











ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 24

COMPLETE

THE PORCELLANIDAE  
(CRUSTACEA ANOMURA)  
OF THE EASTERN PACIFIC

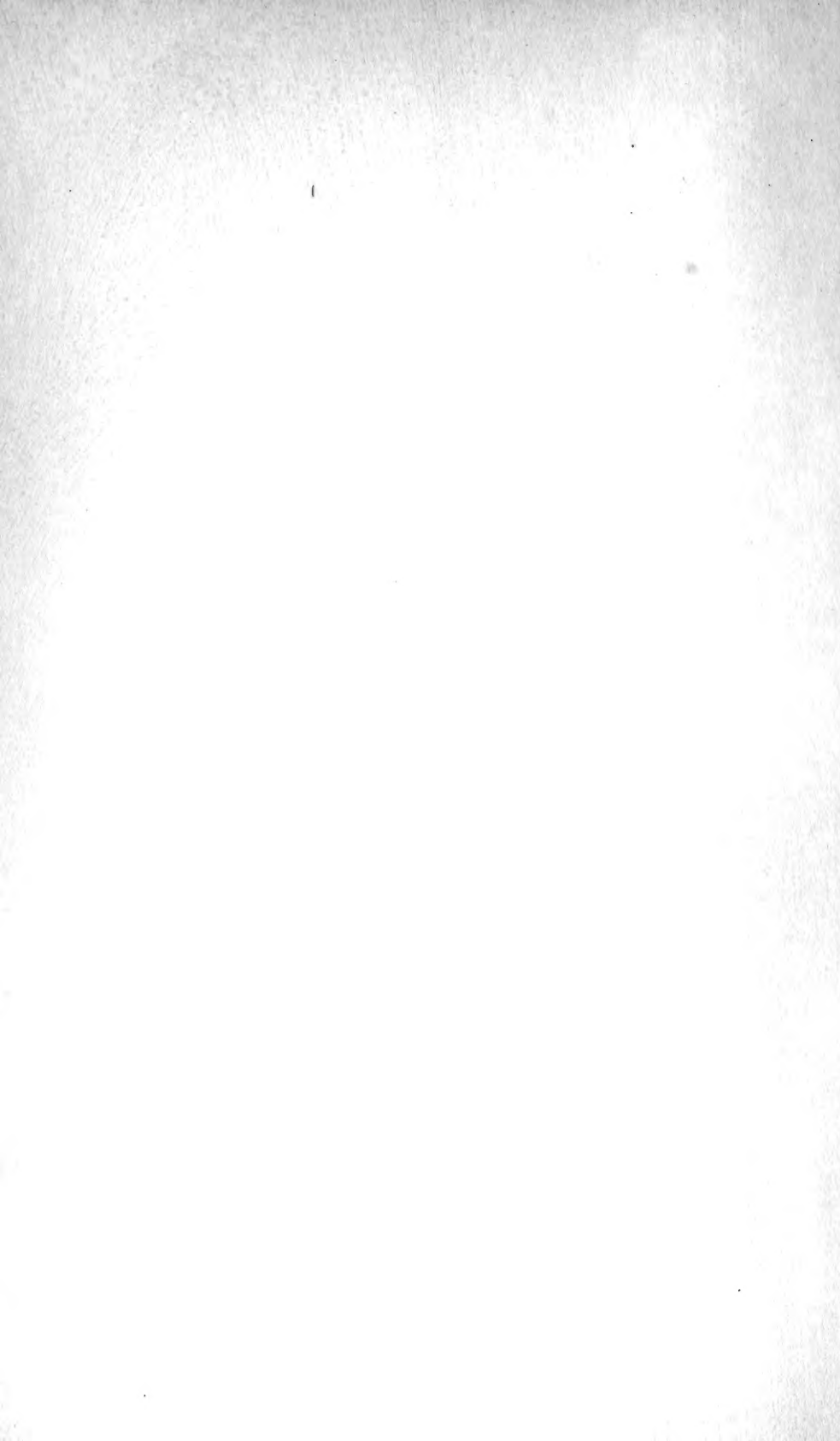
BY

JANET HAIG



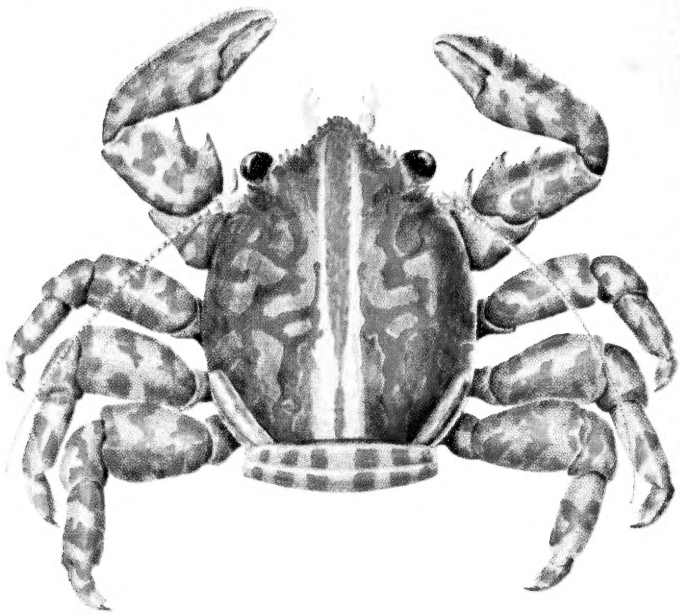
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1960









*Liopetrolisthes mitra* (Dana)

Water color painting by Anker Petersen of a juvenile specimen, 2 mm in length, from Bahía de la Independencia, Peru.

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ALLAN HANCOCK FOUNDATION  
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## Introduction<sup>1</sup>

In January, 1823, the corvette *Coquille*, on a voyage around the world under the sponsorship of the French government, visited the port of Concepción in Chile. During their stay at Concepción members of the expedition collected specimens on Península de Talcahuano, including a porcellanid crab to which Guérin (1831) gave the name *Porcellana violacea*. This was the first porcellanid to be reported from western America.

The advent of the *Coquille* marks the beginning of a long history of porcellanid collecting in the eastern Pacific. Since that time many expeditions and individual collectors have combed the west American coasts and their outlying island groups, assembling a vast amount of material that has found its way into museums in America and Europe. As a result of studies on portions of this material, a large body of literature on eastern Pacific porcellanids has accumulated.

Prior to the present study, however, the porcellanid fauna of the eastern Pacific had not been studied as a unit and was not at all well known. Many species, including some that have since proved to be common, were undescribed. Many existing descriptions were inadequate, and others, while more detailed, lacked illustrations. As a result, specimens (particularly those from areas in which the family had received less attention) were often difficult to place, even after a successful search through scattered literature for whatever information might be available.

This study was prompted by a desire to learn more about the composition of the eastern Pacific porcellanid fauna and the distribution and interrelationships of the various species. It is intended as a contribution toward a much-needed revision of the family, and may also serve as an aid to ecologists, natural history students, and others who frequently encounter porcellanids among collections from the littoral and sublittoral.

---

<sup>1</sup>This study was supported by a grant from the National Science Foundation.

## Acknowledgment

This study would not have been possible without the generous assistance of many persons, whose aid it is a pleasure to acknowledge. The following extended many courtesies to the writer while she was visiting their respective institutions, and gave permission to study and report on the collections in their care: Fenner A. Chace, Jr., U. S. National Museum; Elisabeth Deichmann, Museum of Comparative Zoology, Harvard University; Dorothy E. Bliss, American Museum of Natural History; Frederick A. Aldrich and Ruth Patrick, Academy of Natural Sciences of Philadelphia; Jack L. Littlepage, Natural History Museum, San Diego; and Allyn Smith, California Academy of Sciences, San Francisco. Material was received on loan from Drs. Chace, Deichmann, and Bliss, and from Jocelyn Crane, New York Zoological Society; L. Pardi, Istituto e Museo di Zoologia, Università di Torino; Albert Panning, Zoologisches Museum, Hamburg; Hans Brattström, Zoologisk Museum, Bergen; and Nils Knaben, Universitetets Zoologisk Museum, Oslo. Material in their institutions was examined for the writer and information on it provided by Dr. Panning and by Jacques Forest, Muséum National d'Histoire Naturelle, Paris, and Isabella Gordon, British Museum (Natural History). Information on specimens and locality records was tendered by Dr. Aldrich and by Mrs. G. C. Carl, Victoria, British Columbia; L. R. Richardson, Victoria University College, Wellington, New Zealand; and M. Woodbridge Williams, Bethesda, Maryland. Valuable suggestions on nomenclatural problems were offered by Dr. Chace and by W. I. Follett, California Academy of Sciences. Permission to retain material for the Hancock Foundation collections was given by Miss Crane and Drs. Bliss and Panning. Professor Richardson and J. C. Yaldwyn, Victoria University College, Wellington, kindly sent comparative material of New Zealand species, and R. Zariquiey Alvarez, Barcelona, made a loan of European forms. The photographs were taken by Francis Munger, Whittier, California. The writer wishes to thank the administration of the Allan Hancock Foundation for permission to use its facilities and study its collections. Finally, she acknowledges her indebtedness to members of the Hancock Foundation staff who followed and assisted the progress of this work from the beginning: Dorothy M. Halmos and Mary Ellen Pippin, librarians, who helped locate many an obscure reference, and John S. Garth, who read the manuscript and offered encouragement and advice throughout.

## Source of Materials

*Allan Hancock Foundation:* The major portion of the material on which this study is based was derived from the cruises of the research vessels *Velero III* and *Velero IV* under the command of Captain Allan Hancock. Beginning in 1932 and continuing until 1941, the *Velero III* obtained porcellanids in an area bounded on the north by San Miguel Island and the California mainland near Santa Barbara, and on the south by Bahía de San Juan, Peru, and including all the major offshore island groups with the exception of Guadalupe and Clipperton. In addition to dredging operations from the ship, shore collecting, diving, and cracking from coral heads all yielded specimens, with J. S. Garth, F. C. Ziesenhenne, and W. L. Schmitt as principal collectors. Especially rich, and undoubtedly the finest ever made in those areas, are collections from the Gulf of California and the Galapagos Islands.

The *Velero IV*, which began operations in 1948, has confined its endeavors largely to dredging off southern California and the Santa Barbara Islands, although three cruises were made to the west coast of Baja California and one each to the Gulf of California, Isla Guadalupe, and the southern Mexican mainland and offshore islands.

The Northern Hemisphere cold-temperate region, in which the *Veleros* have scarcely operated and from which they obtained no porcellanids, is well represented by the contributions of individual collectors. A few porcellanids were taken at Vancouver Island and at San Juan Island, Washington, by G. E. and N. MacGinitie, and in Washington by H. G. Coffin. In the summer of 1942, F. C. Ziesenhenne and C. Wade made extensive collections in Oregon, an area from which the family has never been reported in the literature. Within the last few years specimens were obtained in Mendocino County, California, by W. K. Emerson and J. L. Barnard; in Sonoma County by L. O. Miles and W. K. Emerson; in Sonoma and Marin Counties by R. J. Menzies; in San Mateo County by F. E. Christensen; in Monterey County by J. L. Barnard and J. Worden; and in San Luis Obispo County by J. S. Garth and J. L. Mohr.

Supplementing the southern California *Velero* collections are specimens taken in 1912 by the *Anton Dohrn*, research vessel of the Hancock Foundation's predecessor, the Venice Marine Laboratory; specimens collected in 1913 by J. R. Beck and P. S. Barnhart of the same institution; and material contributed during the past twenty years by Hancock Foundation field parties and by T. A. Burch, N. MacGinitie, E. Y. Daw-

son, F. E. Durham, J. L. Mohr, J. S. Garth, C. L. Hubbs, B. C. Walton, M. E. Pippin, J. Haig, and J. W. Knudsen.

Specimens from the west coast of Baja California were collected by E. Y. Dawson and F. E. Durham in 1946, by a Hancock Foundation field party in 1947, and by L. O. Miles in 1950. Material from the Gulf of California came from E. Y. Dawson and F. E. Durham in 1946; B. W. Halstead in 1949; C. Limbaugh in 1950; E. Y. Dawson in 1951 and 1952; R. J. Menzies and G. Ewing in 1953; a Hancock Foundation field party in 1954; J. W. Knudsen, participating in a California Fish and Game cruise, in 1955; and R. Hardy in 1956. Collections from the southern Mexican mainland were made by C. L. Hubbs in 1946 and by E. Y. Dawson in 1946-47. A cruise sponsored by Patrick A. Doheny, with J. W. Knudsen as carcinological collector, obtained specimens in the Gulf of California and Mexican offshore islands in 1956. Porcellanids collected at Clipperton Island in 1954 by the Scripps Institution of Oceanography Expedition (Hertlein and Emerson, 1957) are housed in the Hancock Foundation, as are most of those from dredge stations occupied by the *Zaca* during the New York Zoological Society's 1937-38 expedition to Central America.

*Other institutions:* In addition to the large and varied material available for study at the Hancock Foundation, a number of collections belonging to other institutions were examined; data on these specimens appear in the Tables, Appendix I. Of particular value to the study were specimens derived from areas in which the *Velero* porcellanids are less well represented, notably southern Mexico and Central America; and specimens from Chile, which lies beyond the southern limit of Hancock Foundation explorations. The porcellanids of the *Askoy* Expedition to Panama, Colombia, and Ecuador, 1941, and the Lund University Chile Expedition, 1948-49, were previously studied by the writer (Haig, 1957b, 1955) and have aided materially in the preparation of the present report.

An interesting find from the historical standpoint was a series of about 1,160 specimens, divided among 15 species, obtained by J. Xantus at Cabo San Lucas, Baja California, at the mouth of the Gulf of California. These specimens are housed in the Museum of Comparative Zoology, Harvard University. In 1862 and 1871 Stimpson described many new species of Crustacea from Xantus's Cabo San Lucas collections, but did not study the Porcellanidae. Had he done so, many more west American crustacean species would now have Cabo San Lucas as

their type locality; for when he worked up the *Xantus* material only one of the 15 porcellanids represented, *Petrolisthes edwardsii* (Sausure), had been described.<sup>1</sup>

### Method of Study

Of the 85 eastern Pacific species here considered valid, 69 had been described prior to the present study. Types (either holotypes, syntypes, neotypes, or paratypes) of 54 nominal forms, representing 49 of these valid species, were personally examined by the writer; Jacques Forest of the Paris Museum provided information on types of two others. In this way the status of several poorly defined species could be definitely established. Of the 18 valid species for which no types (nor types of their synonyms) were seen, all but one have been well characterized in the literature. The status of *Polyonyx nitidus* Lockington, described from a single specimen no longer in existence, remains questionable.

The carcinological collections of Lockington were destroyed in the San Francisco earthquake and fire of 1906. It has been generally supposed that this material included all his porcellanid types; therefore it was of great interest to discover that duplicate types of four Lockington species are housed in the Paris Museum. Lectotypes are selected for these species, and will be discussed under the appropriate accounts. According to J. Forest (personal communication), each of the four lots bears the notation "Californie—Lockington 6-99 (Type)" in the handwriting of E. L. Bouvier. Mr. Forest believes "6-99" to be the date on which the specimens were entered in the Museum register. "Californie" for Lockington's "Lower California" is an error of a sort that has often appeared in scientific literature. The importance of distinguishing between California and Lower California cannot be over-emphasized, particularly when the latter designation refers to localities inside the Gulf, which supports a fauna very different from the Californian one.

Steve A. Glassell, who made many important contributions to the knowledge of eastern Pacific Porcellanidae, had further studies under way at the time of his death in 1948. The Hancock Foundation's porcellanid collection contains a number of lots with notations in Mr. Glassell's handwriting, indicating forms he had intended to describe as new.

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<sup>1</sup>Madden (1949, pp. 108-110) has shown that, contrary to the opinion of certain writers, *Xantus* must have made all his collections in the general vicinity of Cabo San Lucas during his residence there in 1859-61, and that this locality designation may therefore be accepted in all cases as reasonably accurate.

These notations have served as a useful guide in delimiting several species described in this report. One manuscript name proposed by Glassell is adopted herein.

The writer has seen representatives of every species treated; in most cases long series were available for examination. Many of the earlier descriptions did not contain enough detail to identify a species readily or to distinguish it from its closest relatives; for this reason a detailed description has been written for each species (with the exception of the problematical *Polyonyx nitidus*, which is represented by a diagnosis only), using material examined during this study.

In most cases length-width ratios proved to be of less value taxonomically than other characters, and detailed proportional measurements were not taken. The length-width ratio of the carpus is a useful taxonomic character in members of the genus *Petrolisthes*, as are several such ratios in *Polyonyx*. Proportional measurements may prove to be useful in comparative studies of populations of identical or very closely related species from different oceans. For the present study, however, measurements have been largely confined to carapace length, except in the case of the two genera just mentioned; the size range has been noted for males, non-ovigerous females, and ovigerous females within each species. Carapace and other lengths were measured along the mid-line; widths at the broadest point, excluding spines and lobes. Measurements were made with dial calipers and are expressed in millimeters.

## Method of Treatment

In each species account, information appears under the following headings:

*Synonymy*: For species restricted to the eastern Pacific, every known reference is cited. In the case of the few forms occurring in the Atlantic as well, Atlantic references are omitted except those involving original descriptions, designations of type localities, and new combinations of names.

*Previous records*: Under this heading are listed all Pacific locality records, followed in each case by the collector, if known, and by the author of the reference in parentheses. Localities are arranged in geographical sequence from north to south under several main headings. North-temperate localities are listed under the headings "Alaska," "British Columbia," "Washington," and "California." "Baja California" refers only to localities on the west side of that isthmus; "Gulf of Cali-



fornia" to localities inside the Gulf; and "Mexico" to Mexican localities south of a line drawn between Cabo San Lucas and Mazatlán. "Clipperton Island" and "Galapagos Islands" are listed separately. In all other cases the name of a country forms the main heading.

For consistency, Latin American localities are cited in the form given in *Index to Map of Hispanic America* ("Millionth Map") (U. S. Government Printing Office, 1945). The few place names not appearing in that work are cited according to the Allan Hancock Pacific Expeditions station list (Fraser, 1943).

*Diagnosis:* Under this heading appear the characters most useful in separating the species from its congeners.

*Description:* A full description of the species, except that characters common to all members of the genus and included in the generic description are not repeated.

*Variations:* Under this heading appears additional descriptive information, often referring to atypical specimens.

*Material examined:* When no more than four lots of specimens were examined, pertinent data are listed here. In all other cases reference is made to the appropriate table in Appendix I.

*Measurements:* These include carapace lengths of the largest and smallest males, non-ovigerous females, and ovigerous females examined, and reference to measurements of other specimens.

*Color:* Color notes on living material of several species, prepared by Anker Petersen, formerly staff artist of the Allan Hancock Foundation, are published for the first time. The color terminology adopted by Mr. Petersen is from Ridgway, *Color Standards and Color Nomenclature* (Washington, D. C., 1912). Other color notes have been extracted from the literature.

*Ecology:* Under this heading are included such data as bathymetric range, substrates, commensalism, and months in which ovigerous females were encountered, as determined from the present study and from the literature.

*Relationships:* A discussion of the affinities of the species with closely related forms.

*Remarks:* Any pertinent information not included under the above headings.

*Range:* A brief summary of the complete range of the species insofar as known, as determined from the present study and from previous records.

## Summary of Additions and Changes

The genus *Liopetrolisthes* is proposed for *Petrolisthes mitra* (Dana). The genus *Neopisosoma* is proposed for *Pachycheles mexicanus* Streets, *Pisosoma angustifrons* Benedict, *P. curacaoense* Schmitt, and two species described herein. The genus *Clastoecus* is proposed for *Petrolisthes diffractus* Haig, *P. vanderhorsti* Schmitt, and *P. nodosus* Streets. The genus *Allopetrolisthes* is proposed for *Petrolisthes angulosus* (Guérin), *P. punctatus* (Guérin), and *P. spinifrons* (H. Milne Edwards). The neglected genus *Pisidia* Leach is resurrected to include those species of *Porcellana* having lateral spines on the carapace posterior to the cervical groove and fingers twisted out of plane with the manus.

The following species are described as new: *Petrolisthes nobilii*, *P. galapagensis*, *P. tonsorius*, *P. platymerus*, *P. cocoensis*, *P. artifrons*, *Neopisosoma bicapillatum*, *N. dohenyi*, *Pachycheles calculus*, *P. velerae*, *P. trichotus*, *P. subsetosus*, *P. crinimanus*, *Porcellana corbicola*, *Megalobrachium peruvianum*, and *Polyonyx confinis*. *Petrolisthes gracilis* var. *brachycarpus* Sivertsen is elevated to a full species, *P. brachycarpus* Sivertsen.

The following subspecies is described as new: *Petrolisthes lewisi austrinus*.

Lectotypes are selected for the following species: *Petrolisthes hirtipes* Lockington, *Petrolisthes (Pisosoma) setimanus* Lockington (now known as *Pachycheles setimanus*), *Porcellana transversilineata* Lockington (now known as *Euceramus transversilineatus*), and *Petrolisthes (Pisosoma) sinuimanus* Lockington (now known as *Megalobrachium sinuimanus*).

The following species are reduced to synonymy for the first time: *Petrolisthes acanthophorus* (H. Milne Edwards and Lucas), a synonym of *P. desmarestii* (Guérin); *Pisosoma flagraciliata* Glassell, a synonym of *Petrolisthes hians* Nobili; and *Petrolisthes (Pisosoma) gibbosicarpus* Lockington, a synonym of *Pachycheles biocellatus* (Lockington).

The following previously described species are illustrated or adequately illustrated for the first time: *Petrolisthes sanfelipensis* Glassell, *P. hirtispinosus* Lockington, *P. tiburonensis* Glassell, *P. holotrichus* Nobili, *P. schmitti* Glassell, *P. brachycarpus* Sivertsen, *P. crenulatus* Lockington, *P. ortmanni* Nobili, *P. lewisi* (Glassell), *Neopisosoma mexicanum* (Streets), *Pachycheles setimanus* (Lockington), *P. crassus* (A. Milne Edwards), *P. vicarius* Nobili, *P. marcortezensis* Glassell, *Porcellana hancocki* Glassell, *P. cancrisocialis* Glassell, *P. paguriconviva* Glassell,

*Megalobrachium smithi* (Glassell), *M. erosum* (Glassell), *M. festai* (Nobili), and *Polyonyx nitidus* Lockington.

The ranges of nearly all previously described species are extended on the basis of heretofore unpublished records.

### Recorded Specimens *incertae sedis*

Specimens unidentifiable in our present state of knowledge of porcellanid larval stages:

*Porcellana longicornis* (megalops stage). Coventry, 1944, p. 537.

Isla María Madre, Islas Las Tres Marías, Mexico, two specimens. The megalopa are in the Academy of Natural Sciences of Philadelphia. The identification with *Porcellana longicornis*, an eastern Atlantic species, is obviously in error.

Specimens not located:

*Petrolisthes* species. Schmitt, 1939, pp. 25, 26.

Isla Narborough and Isla Albemarle, Galapagos Islands. [Probably *Petrolisthes brachycarpus* Siversten, *P. galapagensis*, new species, and/or *P. tonsorius*, new species.]

*Pachycheles* sp. undetermined. Steinbeck and Ricketts, 1941, p. 456.

"Minute porcellanids from Pulmo Reef, associated with the red coral crabs *Trapezia*." [Perhaps *Neopisosoma dohenyi*, new species, which reaches the mouth of the Gulf of California.]

*Petrolisthes* sp., Glassell MSS. Steinbeck and Ricketts, 1941, p. 457.

"With *gracilis* at Port San Carlos (Sonora)."

Undetermined porcellanids. Steinbeck and Ricketts, 1941, p. 458.

"An indeterminable porcellanid juvenile was taken in a worm tube at Cape San Lucas." [*Polyonyx*?]

"We took also an unnamed porcellanid with *Mithrax*, etc. at Pulmo Reef."

## Systematic Discussion

### Family PORCELLANIDAE

- Porcellaniens H. Milne Edwards, 1837, p. 246 (part; not *Aeglea*, *Megalops*, *Monolepis*) (tribe). A. Milne Edwards and Bouvier, 1894, p. 245 (tribe).
- Porcellaniadae Randall, 1839, p. 136 (family).
- Porcellanidae White, 1847, p. 62 (family). Henderson, 1888, p. 104 (family). Ortmann, 1892, p. 245 (family).
- Porcellanidea de Haan, 1849, pp. xxii, 197, 199 (family). Dana, 1852, p. 400 (subtribe).
- Porcellanodea Henderson, 1888, p. 103 (section).
- Porcellaninea Holmes, 1900, p. 106 (legion).

General form crablike. Carapace well calcified, depressed, regions usually not well defined. Front often prominent, but never with a rostrum greatly projecting beyond the eyes. Eyes pigmented. Antennae inserted external to eyes, with three movable segments and a flagellum. Basal segments of antennules broad, frequently touching on midline, their anterior margins or faces often armed with spines or other projections; remaining antennular segments short. Outer maxillipeds too large to be contained in buccal cavity; ischium broad and flattened, merus broad, flattened, with a prominent inner lobe, distal articles fringed with long plumose hairs. Chelipeds moderately elongate, usually broad and depressed; merus short, carpus usually elongate; nearly always a sharp bend at articulation of carpus and manus, with latter directed inward. Three well-developed pairs of walking legs; following pair feeble, reduced in size, inflexed, and resting on the carapace. Abdomen broad, symmetrical, composed of seven segments, bent under and closely adpressed to thorax. Tail fan well developed, formed of the telson (segment 7) and the uropods of segment 6. Telson composed of five or seven well-calcified pieces. Males with a pair of pleopods on segment 2; these pleopods sometimes rudimentary or absent. Females with a pair of pleopods on segments 3, 4, and 5; those on segment 3 sometimes reduced or absent.

*Remarks:* The limits of this well-defined taxon continue to be clear-cut with increase in knowledge of the group. Its place in the general scheme of crustacean classification and the rank to be accorded it were matters of varying opinion among early workers; A. Milne Edwards and Bouvier (1894) summarized the early history of its classification.

Today the group is accepted as a distinct family in the Galatheidea, having its closest affinities with the family Galatheididae.

Porcellanids are distributed throughout the tropical and temperate regions of all the oceans, and are typically littoral or sublittoral; in number of species they are by far the most abundant in the Pacific. Chace (1951) estimated the total number of species as about 225. A great deal of systematic work still remains to be done on the family as a whole.

#### KEY TO THE EASTERN PACIFIC GENERA

- 1a. Chelipeds normally held more or less straight out in front of carapace; carapace nearly one and a half times as long as broad, lateral margins with a series of about 12-15 minute, close-set spinules. . . . . *Orthochela*
- 1b. Chelipeds normally bent sharply at articulation of carpus and manus, with manus directed inward. . . . . 2
- 2a. Carapace at least one and a half times as long as broad; a large orbitlike concavity on hepatic margin, its outer angle marked by a tooth. . . . . *Euceramus*
- 2b. Carapace never as much as one and a half times as long as broad; no large orbitlike concavity on hepatic margin as in 2a. 3
- 3a. Basal segment of antenna short, not strongly produced forward to meet anterior margin of carapace; movable segments with free access to orbit (rarely, basal segment in contact with outer orbital angle, narrowly excluding movable segments from orbit). . . . . 4
- 3b. Basal segment of antenna produced forward and broadly in contact with anterior margin of carapace; movable segments far removed from orbit. . . . . 9
- 4a. Posterior portion of side walls of carapace consisting of one or more pieces separated by membranous interspaces. . . . . 5
- 4b. Posterior portion of side walls of carapace without separated pieces. . . . . 6
- 5a. Chelipeds thick, robust, one distinctly larger than the other; front not prominent, usually transversely sinuate or rounded in dorsal view. . . . . *Pachycheles*
- 5b. Chelipeds somewhat flattened, subequal; front strongly produced, distinctly trilobate in dorsal view. . . . . *Glastotoechus*

- 6a. Chelipeds thick, robust, one distinctly larger than the other; side walls of carapace incomplete, the portion posterior to epibranchial or mesobranchial area occupied by membrane only . . . . . *Neopisosoma*
- 6b. Chelipeds subequal, usually not robust; side walls of carapace entire . . . . . 7
- 7a. Basal segment of antennule not laterally expanded; basal segment of antenna either not produced inward, or with a distinct inward projection forming a partial suborbital margin; front triangular or trilobate, usually rather prominent; telson almost invariably 7-plated. . . . . *Petrolisthes*
- 7b. Basal segment of antennule laterally expanded; basal segment of antenna strongly produced inward and, with the outer side of basal antennular segment, forming a complete or nearly complete suborbital margin; front tridentate or distinctly trilobate; telson 5-plated. . . . . 8
- 8a. Front tridentate, strongly produced beyond eyes; basal segment of antenna not at all produced forward; anterior margin of carpus with narrow spines. . . . . *Liopetrolisthes*
- 8b. Front trilobate, two supplementary lobes sometimes present; basal segment of antenna produced forward and in contact with outer orbital angle, narrowly excluding movable segments from orbit; anterior margin of carpus with a broad lobe. . . . . *Allopetrolisthes*
- 9a. Dactylus of walking legs ending in two or more large, strong, fixed spines; carapace markedly broader than long; front nearly transverse in dorsal view. . . . . *Polyonyx*
- 9b. Dactylus of walking legs ending in a single spine, usually with accessory movable spinules on posterior margin. . . . . 10
- 10a. Movable segments of antenna minute and flagellum rudimentary, their total length less than or scarcely exceeding width of eye; carapace about  $1\frac{1}{3}$  times as long as broad; front strongly tridentate in dorsal view. . . . *Minyocerus*
- 10b. Movable segments of antenna normal. . . . . 11
- 11a. Front prominent, strongly tridentate or trilobate in dorsal view. . . . . 12
- 11b. Front deflexed, appearing rounded or faintly trilobate in dorsal view . . . . . 13

- 12a. Lateral margins of carapace entire posterior to epibranchial angle; fingers not twisted. . . . . *Porcellana*
- 12b. Lateral margins of carapace with spinules posterior to epibranchial angle; fingers on one or both chelipeds twisted out of plane with palm. . . . . *Pisidia*
- 13a. Carapace about as broad as long; front trilobate to strongly tridentate in frontal view; basal segment of antennules very small, recessed behind front, latter projecting over them like a shelf. . . . . *Megalobrachium*
- 13b. Carapace longer than broad; front with a broad, rectangular rostral process, visible only in frontal view; basal segment of antennules large, produced anteriorly to fill notches between rostral process and inner orbital angles. . . . *Ulloaia*

#### ORTHOCHELA Glassell 1936

*Orthochela* Glassell, 1936, p. 296 (type species *Orthochela pumila* Glassell, 1936, by original designation).

Carapace longer than broad; lateral margins subparallel, armed with a series of short, forward-pointing spines posterior to cervical groove. Front nearly as broad as carapace, trilobate; lateral lobes directed outward, their inner margins lying horizontal, front thus appearing truncate on either side of median lobe, latter directed forward, strongly projecting. Orbits directed laterally; eyestalks large, short, retractile.

Basal segment of antenna not produced forward to meet anterior margin of carapace; with a long, narrow inward projection, forming a partial suborbital margin. First movable segment nearly concealed behind outer orbital angle.

Basal segment of antennule broad, anterior face truncate.

Chelipeds large, heavy, subcylindrical; manus normally held more or less straight out in front of carapace, instead of bent sharply at articulation with carpus and directed inward; fingers very short in relation to manus, opening vertically.

Walking legs slender, somewhat flattened; propodus with a single movable spinule at distal end of posterior margin; dactylus ending in a simple spine, with several movable accessory spinules on posterior margin.

Telson of abdomen composed of seven plates.

Contains a single species.

*Orthochela pumila* Glassell

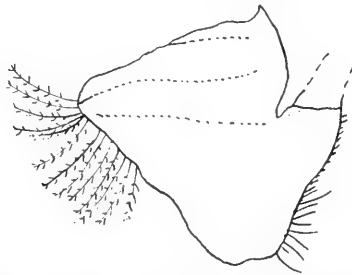
Plate 18, fig. 1; text-fig. 1

*Orthochela pumila* Glassell, 1936, p. 296, pl. 21, fig. 1 (type locality, Isla Santa Margarita, Bahía de la Magdalena, Baja California, Mexico).

*Previous records:* Baja California. Isla Santa Margarita, Bahía de la Magdalena: S. A. Glassell (Glassell).

*Diagnosis:* Carapace a little less than one and a half times as long as broad; front nearly as broad as carapace, truncate, with strongly projecting median lobe; lateral margins subparallel, with about twelve to fifteen close-set spinules posterior to epibranchial angle; chelipeds subcylindrical, held straight out in front of carapace.

*Description:* Carapace a little less than one and a half times as long as broad, transversely convex, lightly granulate or punctate, regions not distinct; devoid of pubescence. Front very broad, flat, not deflexed; median lobe triangular, truncate and with several minute spinules at tip; lateral lobes a little broader than median lobe, minutely spinulate along their inner (anterior) margins. Orbits broad, deeply concave; outer orbital angle produced into a broad tooth. No epibranchial spine, but epibranchial angle marked by a distinct notch; lateral margin posterior to this notch and cervical groove with about twelve to fifteen close-set spinules, the posterior ones slightly the largest.



Text-fig. 1. Basal segment of right antennule of *Orthochela pumila*, x 56.

Movable segments of antenna more or less smooth; flagellum naked. Outer maxillipeds lightly rugose.

Chelipeds similar in form but one distinctly larger than the other; larger cheliped about two and a half times length of carapace in largest specimens; smooth to lightly granular, devoid of hairs. Merus extending to or beyond tip of median frontal lobe, with a low lobe on its an-



terior margin. Carpus without anterior projections. Manus considerably longer than fingers, latter curved, gaping, crossing at tips; gape with a short pubescence and longer, scattered setae.

Walking legs lightly granular, practically devoid of hairs. Merus with a high crest on anterior margin, ending in an outward-pointing tooth or spine.

*Variations:* With increase in size of the crab, the chelipeds become longer in relation to the size of the carapace; the larger cheliped is about one and a half or two times the carapace length in young specimens, two and a half times in adults. The walking legs, on the other hand, become proportionately shorter with increase in size of the individual.

*Material examined:* See Table 1.

*Measurements:* Males, 1.8 to 4.2 mm; non-ovigerous females, 1.4 to 2.4 mm; ovigerous females, 1.8 to 3.2 mm. Measurements given by Glassell for a male from the type series are 3.6 x 2.8 mm; for a female 3.8 x 3.0 mm.

*Color:* Color in life a rich yellow; lines of red on the hepatic regions. Hands with a few red blotches on outer surface; fingers with red bases and tips. (Glassell) Traces of red blotches remain on the fingers in some of the preserved material.

*Ecology:* This species is commensal with gorgonians (fan corals). The type series was collected by Glassell from gorgonians at a depth of one fathom; he stated that the corals were bright yellow, and that the crabs, as well as isopods and amphipods associated with them, harmonized exactly in color with their host. Hamburg Museum specimens from Bahía de Caráquez, Ecuador, were taken in 4-5 fathoms from gorgonians ("Fächerkorallen"). U. S. National Museum specimens from Isla San Lucas, Costa Rica, were "from dried *Eugorgia nobilis* Verrill." Collecting data were not given for the lots from Mazatlán and Panama, but they were probably taken under similar conditions.

Ovigerous females are recorded for January, June, and December.

*Remarks:* At the beginning of his description, Glassell gave the type locality as "Magdalena Bay, Baja California, Mexico, 1 fathom; December 2, 1931" and designated a holotype and three paratypes. Later in his account he reported the material examined to be a series of 35 specimens, collected at Santa Margarita Island, Magdalena Bay, Baja California, at the same depth and on the same date. Presumably the

types were part of this series of 35 specimens, but the U. S. National Museum holotype and paratype, and the San Diego Museum paratypes, were labelled without the Santa Margarita Island designation. An unidentified lot of 12 specimens in the U. S. National Museum collection is labelled "Magdalena Bay, B. C., 12/4/31, 1 fathom, Margareta Is., S. A. Glassell." It is believed that these specimens may also be a part of Glassell's original series, and that the date December 4 is an error for December 2.

Although the species has not been mentioned in the literature since its description in 1936 from a single locality, the present study shows that it ranges throughout the Panamic Province. Its very small size and restricted habitat probably account for its scarcity in collections.

*Range:* Bahía de la Magdalena, Baja California, and Mazatlán, mouth of the Gulf of California, south to Bahía de Caráquez, Ecuador. Shore to about 5 fathoms.

#### LIOPETROLISTHES, new genus

*Type species:* *Porcellana mitra* Dana, 1852.

Carapace subovate, usually slightly longer than broad. Front strongly produced beyond eyes, trilobate. Eyestalks short and stout, retractile behind supraorbital margin.

Basal segment of antenna not produced forward to meet anterior margin of carapace; with a long, narrow, acute projection, directed inward and, with the outer portion of the basal antennular segment, forming a complete suborbital margin. First movable segment very short, nearly concealed behind hepatic margin.

Basal segment of antennule broad, laterally expanded, with two long, narrow lobes on inner side of anterior face.

Chelipeds small in relation to carapace, weak, flattened; anterior margin of carpus armed with prominent teeth.

Walking legs of moderate length, flattened; propodus with movable spinules on posterior margin; dactylus ending in a simple spine, with small movable accessory spinules on posterior margin.

Telson of abdomen composed of five plates.

Contains a single species.

*Remarks:* *Liopetrolisthes mitra* has most often appeared in the literature as a *Porcellana*. There is a superficial resemblance to typical

members of that genus, especially in the form of the carapace and front; in *Porcellana*, however, the basal antennal segment is broadly in contact with the anterior margin of the carapace. The combination of characters given in the description, above, sets *Liopetrolisthes* apart from all other genera in which the basal antennal article lacks a strong forward projection in contact with the carapace margin.

The generic name is derived from the Greek *λειος*, smooth, and *Petrolisthes*.

***Liopetrolisthes mitra* (Dana), new combination**

Frontispiece; plate 41, fig. 1; text-fig. 2

*Porcellana mitra* Dana, 1852, p. 419 (type locality, San Lorenzo, Peru); 1855, pl. 26, figs. 9a-b. Heller, 1865, p. 74. Cano, 1889, pp. 96, 101, 260. Rathbun, 1910, p. 601. Meredith, 1939, p. 113, col. pl.

*P[orcellana] mitra?*, Stimpson, 1858, p. 229.

*Porcellana spinosa* Philippi, 1860, p. 169 (type locality, Isla Blanca, Chile).

*Porcellana patagonica* Cunningham, 1871, p. 495 (type localities, Estrecho de Magallanes and Port Otway [Puerto Barroso], Chile).

*Porcellana pulchellula* Cano, 1889, p. 260 (type locality, San Lorenzo, Peru). Rathbun, 1910, p. 601.

*Petrolisthes patagonicus*, Lenz, 1902, p. 748, pl. 23, fig. 4. Bouvier, 1906, p. 28. Rathbun, 1910, p. 600. Doflein and Balss, 1912, p. 34. Porter, 1926, p. 190, text-fig. 23; 1936a, p. 255; 1936b, p. 153; 1936c, p. 339.

*Petrolisthes mitra*, Haig, 1955, pp. 43, 52.

*Previous records:*

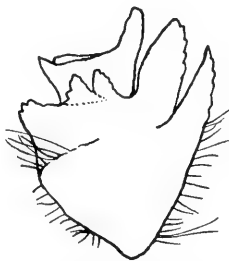
Peru. San Lorenzo: U. S. Expl. Exped. (Dana); *Vettor Pisani* (Cano). Bahía de la Independencia: *Velero III* (Meredith). Mollendo: R. Paessler (Haig).

Chile. Pisagua: Kophamel (Haig). Iquique: L. H. Plate (Lenz); F. Ringe (Doflein and Balss; Haig). Cavancha; Tocopilla: Lund Univ. Chile Exped. (Haig). Isla Blanca: R. A. Philippi (Philippi). Caldera: R. Paessler (Haig). Península Coquimbo: Lund Univ. Chile Exped. (Haig). Montemar: F. Riveros-Zuñiga (Haig). Valparaíso: C. E. Porter (Bouvier; Porter 1926). Curaumilla: C. E. Porter (Bouvier; Porter 1936a). Golfo de Arauco: Lund Univ.

Chile Exped. (Haig). Corral: P. Krefft (Haig). Seno Reloncaví; Golfo de Ancud: Lund Univ. Chile Exped. (Haig). Puerto San Pedro, Isla Chiloe: *Hassler* (Haig). Islas Guaitecas: Lund Univ. Chile Exped. (Haig). Port Otway [Puerto Barroso]; Estrecho de Magallanes: *Nassau* (Cunningham).

*Diagnosis:* Carapace smooth; front strongly produced beyond eyes, spinulate on margin, trilobate, the median lobe broad, triangular, lateral lobes very narrow, scarcely projecting; chelipeds weak, scarcely longer than walking legs, carpus armed on anterior margin with two or three narrow, wide-set teeth; dactylus of walking legs with a thick tuft of hairs on posterior margin, other segments naked or with a few scattered hairs.

*Description:* Carapace usually a little longer than broad; smooth, except for light plications on posterolateral area; regions scarcely marked. Front trilobate, median lobe broad, triangular, strongly produced beyond lateral lobes, the latter very narrow, scarcely projecting in young specimens and some adults. Orbits shallow, straight or slightly concave, sharply oblique, outer orbital angle slightly or not at all produced, the supraorbital margin forming a nearly straight line with the hepatic margin to anterior limit of epibranchial region, this limit marked by a minute marginal notch but no cervical groove. Frontal, orbital, and hepatic margins beset with small, strongly projecting granules or minute spinules.



Text-fig. 2. Basal segment of right antennule of *Liopetrolisthes mitra*, x 20.

First movable segment of antenna granular or somewhat nodular; second granular, with a distal anterior nodule; third somewhat granular; flagellum with very short hairs visible only under magnification. Outer maxillipeds smooth, ischium elongate.

Chelipeds scarcely longer than walking legs, covered with small granules. Merus with a strongly projecting, distally directed tooth on

anterior margin. Carpus armed on anterior margin with three narrow, wide-set teeth, proximal one the largest, distal not always developed; posterodistal angle usually produced into a small spine. Manus narrow, sometimes more so than carpus, granules more projecting toward outer margin; fingers long and slender, fitting together for their entire length, gape without pubescence.

Walking legs lightly granular or punctate. Merus, carpus, and propodus naked or with a few scattered hairs; dactylus with a thick, short tuft of hairs on posterior margin.

*Variations:* From a survey of the literature and examination of specimens, it appears that in general the two lateral lobes of the front begin to develop when the crab attains a length of between 2.5 and 5.0 mm. In specimens over 5.0 mm long, the lateral lobes are almost invariably present, although they may be very small.

The third carpal spine is usually present in specimens of 6.0 mm and over and absent in those smaller than 6.0 mm; however, one 3.7 mm specimen examined had three distinct spines, and a 6.5 mm specimen had only two. The carpus appears to become considerably longer in proportion to its width with increase in size of the crab.

*Material examined:* See Table 2.

*Measurements:* Of material examined in connection with the present report: males, 3.7 to 6.5 mm; non-ovigerous females, 2.5 to 3.7 mm; ovigerous females, 4.8 to 12.0 mm. Of material examined for an earlier report (Haig, 1955): males, 2.3 to 8.0 mm; non-ovigerous females, 2.0 to 5.3 mm; ovigerous females, 4.3 to 8.7 mm. The only recorded measurements to exceed these are Cano's 11 mm for the male type of *Porcellana pulchellula*, and Lenz's 13 mm for a specimen of unspecified sex. The type of *Porcellana mitra* was recorded as  $2\frac{1}{2}$  lines (5.3 mm); of *P. spinosa*, 3 lines (6.0 mm); and of *P. patagonica*, about 8 mm. During a visit to the British Museum (Natural History) in 1953, the writer examined two specimens of *P. patagonica* from Port Otway, Chile, labelled "Type?"; they were an 8.1 mm male and a 7.8 mm female.

*Color:* *Liopetrolisthes mitra* has two characteristic color patterns, both of which may occur in the same individual; one consists of a broad white longitudinal stripe on the carapace, and the other of marblings and stripings on the carapace, chelipeds, walking legs, and abdomen. These patterns have been mentioned or figured by Dana (1855),

Philippi (1860), Heller (1865), Cano (1889, as *Porcellana mitra*), Meredith (1939), and Haig (1955). The color of preserved specimens has usually been described as either pale violet, reddish, or brown, with white stripe and darker marblings. Meredith's color illustration, made by Anker Petersen from a freshly caught specimen, and reproduced herein (see frontispiece), shows excellently both the natural color and characteristic pattern.

*Ecology:* The species has been taken in the littoral zone under stones, and to a depth of about 7 fathoms. The *Velero III* dredged it on two occasions at 5 fathoms, the substrate being rock in one case and sand in the other.

Bouvier (1906) reported young specimens taken at Valparaiso, Chile, as commensals on a sea star, *Asteracanthion helianthus* [= *Helianaster helianthus* (Lamarck)]. Porter (1926) reported young specimens between the bases of spines of a sea urchin, *Loxechinus albus* (Molina), mentioning that they were found on many of these urchins at Valparaiso. *Velero III* collectors recovered a young specimen from a sea star, *Stichaster aurantiacus* [= *S. striatus* Müller and Troschel] at Bahía de la Independencia, Peru (Meredith, 1939). Haig (1955) reported a specimen collected by Prof. Riveros-Zuñiga at Montemar, Chile, from a sea star, either *Stichaster aurantiacus* [= *S. striatus*] or *Meyenaster gelatinosus* (Meyen). Haig (1955) also reported commensal specimens in the Hamburg Museum collection, taken by R. Paessler from a sea urchin at Mollendo, Peru, and from sea stars at Caldera, Chile. Although Bouvier (1906) thought it probable that commensalism in this species is confined to juveniles, the Mollendo and Caldera specimens examined by the writer included large adults, some of them ovigerous females.

Ovigerous females have been collected in January, February, April, and November.

*Remarks:* The variation, with growth, in conformation of front and number of carpal spines has resulted in the description of this species under several names. Dana's type of *Porcellana mitra* had characters typical of young specimens. Philippi described it as *Porcellana spinosa* from a specimen with a tridentate front, but the number of carpal spines was not specified. Cunningham described it from typical adult examples as *Porcellana patagonica*, a name used (in the combination *Petrolisthes patagonicus*) by several subsequent writers, who failed to recognize its identity with *Porcellana mitra* and who may have been

unaware of Philippi's obscure reference. Cano recognized the similarity of his *Porcellana pulchellula* to *P. mitra*, distinguishing it only by the distinctly trilobate form of the front, three instead of two carpal spines, and the more granular surface of the carpus.

The specimen from the *Novara* Expedition identified by Heller (1865) as *Porcellana mitra* Dana had as its locality "Südsee." This suggests that it might have been collected in the Indo-Pacific region, in which case it would represent an entirely different species. However, many of Heller's locality records are known to be unreliable (cf. Chilton and Bennett, 1929, p. 732), and the specimen could have been collected at Valparaiso, where the *Novara* stayed for some time. Heller's brief description certainly fits the present species.

*Range*: Callao, Peru, south to Estrecho de Magallanes, Chile. Shore to about 7 fathoms.

#### PETROLISTHES Stimpson 1858

*Petrolisthes* Stimpson, 1858, p. 227 (type species *Porcellana violacea* Guérin, 1831, by original designation).

Carapace rounded or subquadrate, usually about as broad as long. Front triangular or trilobate, often rather prominent and produced beyond eyes. Eyestalks short and stout, retractile.

Basal segment of antenna not produced forward to meet anterior margin of carapace; either not produced inward, or with a distinct inward projection forming a partial suborbital margin.

Basal segment of antennule large, broad, in dorsal view sometimes partially visible beyond front; anterior margin occasionally sinuate, but more often armed with spines, lobes, or other projections.

Chelipeds large, subequal in size; carpus variable, from about one and a half to over three times as long as wide; manus broad and flattened, its dorsal surface occasionally somewhat swollen.

Walking legs of moderate length, somewhat flattened; propodus with movable spinules on posterior margin; dactylus ending in a simple spine, with small movable accessory spinules on posterior margin.

Telson of abdomen almost invariably composed of seven plates.

The genus is worldwide in distribution, and contains numerous species.

*Remarks:* A few of the more aberrant eastern Pacific species formerly included in *Petrolisthes* are assigned in this report to three new genera, *Liopetrolisthes*, *Allopetrolisthes*, and *Clastotoechus*. *Petrocheles* Miers, 1876, which contains one species each from New Zealand and southern Australia, was originally described as a subgenus of *Petrolisthes* but is usually considered to be a full genus. Glassell (1945, p. 229) noted that the western Atlantic species *Petrolisthes tortugensis* Glassell, 1945, resembles *Petrocheles* in some respects; however, the present writer, who has compared specimens of *Petrolisthes tortugensis* and *Petrocheles spinosus* (Miers), 1876, considers Glassell's species generically distinct from both *Petrolisthes* and *Petrocheles*.

With the above forms excluded, the genus is composed of perhaps 75 or more species, with 39 recognized from the eastern Pacific alone. The species tend to fall into several natural groups, some of which were discussed by Ortmann (1897, p. 275 *et seq.*). The interrelationships of the species are not at all clear, however, and it seems inadvisable to attempt any splitting of the genus until it can be studied on a worldwide basis.

One large group of species is characterized by the presence of teeth or spines on the anterior margin of the carpus, and one or two posterodistal spines on the merus of walking leg 1; in addition there may be any or all of the following: epibranchial and supraorbital spines; a row of spines on the outer margin of the manus and on the anterior margin of the walking legs; and spines on the frontal, orbital, and lateral margins of the carapace. The anterior margin of the basal antennular article usually bears two or more spines. Many of these species have transverse piliferous striations on the carapace. This group, which corresponds to the divisions called "Gruppe des *Petrolisthes galathinus*" and "Gruppe des *Petrolisthes lamarckii*" by Ortmann (1897), contains a dozen eastern Pacific species. Related forms are *Petrolisthes politus* (Gray), 1831, and *P. amoenus* (Guérin), 1855, from the western Atlantic; *P. cessacii* (A. Milne Edwards), 1878, and *P. monodi* Chace, 1956, from the eastern Atlantic; and a number of Indo-Pacific species, among them *P. lamarckii* and *P. asiaticus* (Leach), 1820, *P. militaris* (Heller), 1862, *P. coccineus* (Owen), 1839, and *P. decacanthus* Ortmann, 1897.

*Petrolisthes hirtipes* Lockington and *P. nigrunguiculatus* Glassell, which are almost entirely restricted to the Gulf of California, are not closely related to any other species. They are characterized by the



presence of conical tubercles on the anterior margin of the carpus and a thick fringe of hairs on the outer margin of the manus, and by the shape of the fingers, which differs markedly in the two chelipeds. The basal segment of the antennule is much like that of some members of the *P. violaceus* group of species, discussed below.

A well-marked group ("Gruppe des *Petrolisthes tuberculatus*" of Ortmann) contains two species confined to Peru and Chile, *Petrolisthes tuberculatus* (Guérin) and *P. tuberculosus* (H. Milne Edwards). They are characterized by the strongly trilobate front; two narrow, strongly projecting lobes on the basal segment of the antennule (see text-fig. 3); and a row of uneven, serrate teeth on the anterior margin of the carpus. These two species are particularly distinctive, and together should probably form a separate genus or subgenus.

One large group consists of species in which the carpus of the cheliped is not armed with teeth or spines (except for minute spinules in the young of some forms), and in which there are no spines on the carapace and walking legs. The basal antennular article is variable. The type species of the genus, *Petrolisthes violaceus* (Guérin), belongs here but is somewhat aberrant in that the orbits are nearly straight instead of concave. Other aberrant forms are *P. rathbunae* Schmitt, which has piliferous striations on the carapace, and the posterodistal angle of the merus of walking leg 1 very slightly produced into a spine; and *P. tiburonensis* Glassell, which is sexually dimorphic and has rows of nodulate tubercles along the anterior margins of the walking legs. This group is almost entirely confined to the eastern Pacific, where it is represented by 17 tropical and temperate species; *P. quadratus* Benedict, 1901, occurs in the western Atlantic. In another group of species closely allied to these, there is a single tooth or small lobe at the proximal end of the anterior margin of the carpus; included are *P. elongatus* (H. Milne Edwards), 1837, from New Zealand and southern Australia, and such Indo-Pacific forms as *P. unilobatus* Henderson, 1888, *P. japonicus* (de Haan), 1849, and *P. inermis* Haswell, 1882.

The final natural division among eastern Pacific *Petrolisthes* consists of species in which the hepatic and protogastric lobes are usually strongly accentuated; the front is trilobate and usually sharply deflexed; the carpus is usually short and stout; and the carpus and manus usually bear longitudinal crests and grooves. Nobili (1901, pp. 17-18) recognized and discussed the relationship of the forms known to him. Included are a western Atlantic species, *Petrolisthes jugosus*

Streets, 1872, and several from the eastern Pacific, including *P. crenulatus* Lockington, *P. ortmanni* Nobili, *P. lewisi* (Glassell), *P. hians* Nobili, and two species described herein.

Several species not treated in this report, including *Petrolisthes novaezelandiae* Filhol, 1885, *P. penicillatus* (Heller), 1862, and *P. tomentosus* (Dana), 1852, do not fit into any of the categories outlined above.

#### KEY TO THE EASTERN PACIFIC SPECIES

- 1a. Epibranchial spine present (rarely obsolescent, its position distinctly marked at epibranchial angle); anterior margin of merus of walking legs spined. . . . . 2
- 1b. No epibranchial spine; anterior margin of merus of walking legs without spines (in *P. hirtipes*, 1 or 2 minute spinules occasionally present on dorsal surface near epibranchial angle; anterodistal angle of merus of walking legs sometimes spine-tipped). . . . . 13
- 2a. Carapace with distinct, transverse, piliferous striations, interrupted only at grooves defining the various regions. . . . . 3
- 2b. Carapace smooth to rough, but never with transverse striations as in 2a. . . . . 8
- 3a. Carapace with groups of spines on hepatic, protogastric, and epibranchial regions, and a row of marginal mesobranchial spines, in addition to the usual epibranchial spine. . . . .  
. . . . . *sanfelipensis*
- 3b. No spines on dorsal surface of carapace; no marginal mesobranchial spines. . . . . 4
- 4a. A single epibranchial spine. . . . . 5
- 4b. Two epibranchial spines. . . . . *glasselli*
- 5a. Carpus with 3 low, wide-set teeth on anterior margin. . . . . 6
- 5b. Carpus with 4 or 5 broad, close-set teeth on anterior margin. . . . . 7
- 6a. Carpus about twice as long as wide, covered with large flattened tubercles; striations of carapace interrupted at metabranchial regions. . . . . *edwardsii*
- 6b. Carpus about 3 times as long as wide, with 3 longitudinal rows of rugae; striations of carapace continuing across metabranchial regions. . . . . *agassizii*

- 7a. Front narrow, strongly produced; carpus about twice as long as wide, surface with oblique striations; merus of walking legs with a row of anterior spines, that of legs 1 and 2 with a posterodistal spine. . . . . *galathinus*
- 7b. Front broad, not strongly produced; carpus about  $1\frac{1}{2}$  times as long as wide, surface with short, flattened rugae; merus of walking legs with 1 or 2 anterior spines, a posterodistal spine on the merus of leg 1 only. . . . . *polymitus*
- 8a. Anterior margin of carpus with 4-6 broad, close-set teeth. . . . . 9
- 8b. Anterior margin of carpus with 2-3 (occasionally 4) low, wide-set teeth. . . . . 11
- 9a. Manus covered with small flattened tubercles; adults very large, length of carapace to 30 mm or over. . . . . *desmarestii*
- 9b. Manus not covered with flattened tubercles; adults small, length of carapace not exceeding about 13 mm. . . . . 10
- 10a. No strong supraocular spine, but 1 or 2 supraocular spinules occasionally present; carpus less than twice as long as wide, anterior margin with 4 (rarely 5 or 6) teeth. . . . . *marginatus*
- 10b. A strong supraocular spine; carpus a little over twice as long as wide, anterior margin with 5 or 6 (rarely 4) teeth. . . . .  
. . . . . *hirtispinosus*
- 11a. Anterior margin of carpus with 2 teeth; merus of walking legs with 1 or 2 anterior spines. . . . . *robsonae*
- 11b. Anterior margin of carpus with 3 (occasionally 4) teeth; merus of walking legs with 2-6 anterior spines . . . . . 12
- 12a. Carapace nearly as wide across mid-branchial regions as posteriorly; epibranchial spine distinct; no short pubescence on outer margin of ventral surface of manus. . . . . *armatus*
- 12b. Carapace widest posterior to mid-branchial regions; epibranchial spine usually absent or vestigial, rarely distinct; ventral surface of manus with a narrow band of short pubescence along outer margin. . . . . *nobilii*
- 13a. Merus of walking legs nodulate on anterior margin. . . . .  
. . . . . *tiburoniensis*
- 13b. Anterior margin of merus of walking legs unarmed. . . . . 14

- 14a. Carpus armed on anterior margin with strong teeth or tubercles. . . . . 15
- 14b. Carpus not armed with strong teeth or tubercles. . . . . 23
- 15a. Carpus with wide-set conical tubercles on anterior margin; manus with a thick fringe of hairs on outer margin; fingers dissimilar in the two chelipeds. . . . . 16
- 15b. Carpus with strong teeth on anterior margin; manus without a thick fringe of hairs; fingers not distinctly dissimilar. . . . . 17
- 16a. Carapace covered with short transverse plications; front with a fringe of hairs; posterior margin of merus of walking legs 1 and 2 with 2 or 3 distal spines. . . . . *hirtipes*
- 16b. Carapace nearly smooth; no fringe of hair on front; posterior margin of merus of walking legs without spines. . . . .  
. . . . . *nigrunguiculatus*
- 17a. Front not strongly deflexed; carapace covered with pubescence, with large tubercles anteriorly; carpus at least twice as long as wide (south-temperate species). . . . . 18
- 17b. Front usually strongly deflexed; carapace not covered with pubescence, without anterior tubercles, but anterior regions and grooves defining them strongly accentuated; carpus not more than  $1\frac{1}{2}$  times as long as wide (tropical species). . . . . 19
- 18a. Lobes of front about equal in breadth; about proximal  $\frac{2}{3}$  of anterior margin of carpus produced into a strongly projecting lobe, its edge cut into about 8 uneven, serrate-edged teeth; gape of fingers naked. . . . . *tuberculatus*
- 18b. Median lobe of front much broader than lateral lobes; carpus with 2 or 3 strong, uneven, serrate teeth on anterior margin followed by a number of denticles; gape of fingers with a short pubescence. . . . . *tuberculosis*
- 19a. Telson of abdomen with 5 plates; outer orbital angle produced into a distinct tooth. . . . . *hians*
- 19b. Telson of abdomen with 7 plates; postorbital angle not strongly produced. . . . . 20
- 20a. Manus with 2 longitudinal crests on dorsal surface and a heavy, rounded crest along outer margin. . . . . 21

- 20b. Manus without dorsal crests, no heavy rounded crest along outer margin. . . . . 22
- 21a. Carpus with 3 or 4 narrow, strongly projecting conical teeth confined to proximal  $\frac{2}{3}$  of margin. . . . *lewisii lewisii*
- 21b. Proximal 2 or 3 teeth of carpal margin partly or wholly coalesced to form a broad tooth, this followed by a smaller tooth. . . . . *lewisii austrinus*
- 22a. Carapace covered with granules and short plications, long plumose hairs anteriorly; carpus about  $1\frac{1}{2}$  times as long as wide, covered with long plumose hairs. . . . *crenulatus*
- 22b. Carapace nearly smooth, with traces of hair on front; carpus less than  $1\frac{1}{2}$  times as long as wide, naked or with traces of hair. . . . . *ortmanni*
- 23a. Carpus about  $1\frac{1}{2}$  times as long as wide; manus with 2 or 3 crests on dorsal surface. . . . . 24
- 23b. Carpus usually more than  $1\frac{1}{2}$  times as long as wide; manus without crest or with a single crest on dorsal surface. . . . 25
- 24a. Front narrow, trilobate in dorsal view; orbits concave; proximal  $\frac{2}{3}$  of anterior margin of carpus with a broad, strongly projecting lobe, its edge obscurely subdivided into 3; crests on dorsal surface of manus low, separated by indistinct grooves. . . . . *artifrons*
- 24b. Front broad, triangular or rounded in dorsal view; orbits very shallow, in dorsal view nearly straight; anterior margin of carpus with a strong proximal lobe, anterior and posterior margins converging distally from its highest point; crests on dorsal surface of manus strong, separated by deep, broad grooves. . . . . *cocoensis*
- 25a. Orbits without a concavity, forming a nearly straight line with front to outer orbital angle; front broadly triangular, without a median groove; gape naked. . . . . *violaceus*
- 25b. Orbits concave; front with at least a faint median groove; gape with at least traces of pubescence. . . . . 26
- 26a. Carpus over twice as long as wide. . . . . 27
- 26b. Carpus twice as long as wide, or less. . . . . 29

- 27a. Carapace covered with short transverse piliferous striations and large flattened tubercles; carpus about  $2\frac{1}{2}$  times as long as wide, margins subparallel. . . . . *rathbunae*
- 27b. Carapace smooth or granular, never with piliferous striations. 28
- 28a. Carapace nearly smooth posteriorly, often granular anteriorly; front with a deep median groove; carpus a little over twice to nearly 3 times as long as wide; merus of walking legs with a fringe of hair on anterior margin (California and western Baja California). . . . . *manimaculis*
- 28b. Carapace nearly smooth anteriorly as well as posteriorly; median groove of front usually faint; carpus  $2\frac{1}{2}$  to 3 times as long as wide; merus of walking legs naked or with traces of hair (Gulf of California). . . . . *gracilis*
- 29a. Carapace subquadrate, the lateral margins nearly parallel posterior to epibranchial angle; fingers often short and stubby. 30
- 29b. Carapace subovate, the lateral margins not parallel; fingers not short and stubby. . . . . 31
- 30a. Anterior and posterior margins of carpus subparallel, unarmed; merus of walking leg 3 not inflated. . . . . *galapagensis*
- 30b. Proximal  $\frac{2}{3}$  of anterior margin of carpus lobed, distal third subparallel with posterior margin; merus of walking leg 3 inflated. . . . . *tonsorius*
- 31a. Front triangular, the inner orbital angle not produced. . 32
- 31b. Front sinuously triangular to tridentate, the inner orbital angle produced. . . . . 36
- 32a. Carpus without a lobe on anterior margin, anterior and posterior margins subparallel. . . . . *erionerus*
- 32b. Carpus lobed on anterior margin. . . . . 33
- 33a. Carpal lobe occupying proximal  $\frac{1}{4}$  of anterior margin, anterior and posterior margins otherwise subparallel; merus of walking leg 3 not inflated. . . . . *cabrilloi*
- 33b. Carpal lobe not confined to proximal  $\frac{1}{4}$  of anterior margin, anterior and posterior margins converging distally from its highest point; merus of leg 3 inflated. . . . . 34

- 34a. Outer orbital angle not produced; pubescence in gape of fingers produced into a short tuft; merus of walking legs naked  
 . . . . . *cinctipes*
- 34b. Outer orbital angle produced; pubescence in gape of fingers not produced into a tuft; merus of walking legs with a fringe of plumose hairs. . . . . 35
- 35a. Carapace nearly smooth; front with a shallow median sulcus; flagellum with long hairs; outer half of dorsal surface of manus with a short pubescence. . . . . *laevigatus*
- 35b. Carapace with distinct granulations, some of them transversely elongate; front with a deep median groove; flagellum naked or with vestigial hairs; outer half of dorsal surface of manus naked. . . . . *granulosus*
- 36a. Front distinctly trilobate; manus not swollen, its outer edge thin; gape of fingers without a thick tuft of pubescence. . 37
- 36b. Front sinuously triangular; manus somewhat swollen on dorsal surface, its outer margin with a crest; gape of fingers with pubescence produced into a thick tuft. . . . . 38
- 37a. Carapace and chelipeds naked or with traces of pubescence; lateral lobes of front narrower than median lobe; carpus unarmed, its margins slightly converging distally. *tridentatus*
- 37b. Entire crab covered with a short, fine tomentum, produced into a long fringe on outer margin of manus; frontal lobes about equal in breadth; anterior margin of carpus with a strong proximal lobe, anterior and posterior margins converging distally from its highest point. . . . . *holotrichus*
- 38a. Entire carapace rough and uneven; carpus unarmed; merus of walking leg 3 broad, inflated. . . . . *platymerus*
- 38b. Carapace nearly smooth anteriorly; anterior margin of carpus with enlarged granules or spinules; merus of leg 3 not inflated. . . . . 39
- 39a. Entire carapace finely and evenly granulate; crest on outer margin of manus defined by a distinct groove. . *schmitti*
- 39b. Carapace with low, large, rough granules posterior to cervical groove, nearly smooth anteriorly; crest on outer margin of manus not defined by a distinct groove. . *brachycarpus*

***Petrolisthes sanfelipensis* Glassell**

Plate 20, fig. 3

*Petrolisthes sanfelipensis* Glassell, 1936, p. 281 (type locality, San Felipe, Gulf of California); 1938a, p. 443.

*Petrolisthes felipensis*, Glassell, 1937, p. 82.

*Previous records:* Gulf of California. Punta Peñasco, Sonora; San Felipe: S. A. Glassell (Glassell 1936).

*Diagnosis:* Carapace with distinct, transverse, piliferous striations, not continuing across metabranchial regions; groups of spines on hepatic, protogastric, and epibranchial regions, and a row of marginal mesobranchial spines, in addition to the usual epibranchial spine; front triangular, denticulate on margin; carpus about twice as long as wide (longer in some large specimens), anterior margin with three or four low, wide-set, serrate-edged teeth, and surface with short, rough rugae sometimes produced into spinules; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description:* Carapace covered with distinct, transverse, piliferous striations, scarcely interrupted at grooves separating the various regions, latter distinct; striations absent only on metabranchial regions, latter areas nearly smooth. Front triangular, denticulate on margin, with a deep median groove extending between protogastric lobes; a distinct supraocular spine, and a row of denticles on orbital margin. Postorbital angle with a strong spine. Upper surface of carapace with groups of spines on hepatic, protogastric, and epibranchial regions, partially obsolescent in large specimens; margins with an epibranchial spine and a row of mesobranchial spines.

First movable segment of antenna with a strong lamellar lobe, bearing a row of spinules; second with two spinules; third nearly smooth; flagellum naked. Outer maxillipeds rugose.

Merus of chelipeds rugose, with a large serrate-edged tooth on anterior margin. Carpus about twice as long as wide, longer in some large specimens; armed on anterior margin with three or four low, wide-set teeth, denticulate on their margins, some of them often semi-divided into smaller teeth; surface with short, rough rugae, granulate on their margins and often produced in the form of spinules, those rugae along center more elongate and forming a low longitudinal crest; posterior margin with a row of spines. Manus long and slender, covered with small groups of rough granules, often produced into spinules as in



carpus; outer margin with a row of spines and a fringe of scattered plumose hairs. Fingers with granules similar to those of manus; outer margins of both pollex and dactylus with a row of spines; gape with a short, thick pubescence.

Walking legs rugose; all segments thickly covered with setae; anterior margin of merus of leg 1 with five to seven spines, of leg 2 with three to six, of leg 3 with two to four; merus of legs 1 and 2 with a posterodistal spine.

Ventral surface of chelipeds and walking legs rugose; abdomen smooth to very lightly rugose.

*Material examined:* See Table 3.

*Measurements:* Males, 3.1 to 11.1 mm; non-ovigerous females, 3.1 to 7.9 mm; ovigerous females, 7.6 to 7.9 mm. The male holotype measures 8.7 mm in length, 9.0 mm in breadth.

*Color:* Live specimens with a faint pinkish tint; when freshly preserved in alcohol, beautifully colored with rich reds and purple. (Glassell, 1936)

*Ecology:* Taken at mean low tide level and below, from among sponges and gorgonians (Glassell). Most of the *Velero III* and *Velero IV* specimens were dredged in 3 to 25 fathoms, with recorded bottoms of rock; sand; shell and mud; and mud, sand, and shell.

Ovigerous females were recovered in March by the *Velero III* and in June by S. A. Glassell.

*Relationships:* This species is not closely related to any of the other eastern Pacific *Petrolisthes* forms with striated carapace; it is the only one from that area with groups of spines on the carapace surface.

*Remarks:* Glassell (1937, p. 82) stated that a bifid-tipped dactylus is characteristic of both this species and *Petrolisthes polymitus* Glassell. In the latter species a single forward-pointing spine is always present near the tip of the dactylus; however, examination of a number of specimens showed that in *P. sanfelipensis* the row of spines along the outer margin of the dactylus extends to its distal end only in occasional individuals.

Previously recorded only from the northern end of the Gulf of California, *Petrolisthes sanfelipensis* is now known to occur as far south as Guaymas and also on the west side of the Baja California peninsula. It does not appear to be abundant anywhere.

*Range:* Bahía de San Juanico and Bahía de la Magdalena, Baja California; Gulf of California, from Punta Peñasco south to Guaymas. Shore to 25 fathoms.

***Petrolisthes agassizii* Faxon**

Plate 20, fig. 4

*Petrolisthes agassizii* Faxon, 1893, p. 174 (type locality, Panama [City?]); 1895, p. 69, pl. 15, figs. 1, 1a.

*Petrolisthes edwardsii*, Boone, 1931, p. 152, text-fig. 7. Not *P. edwardsii* (Saussure).

*Petrolisthes agassizi*, Haig, 1957b, p. 12.

*Previous records:*

Panama. "Panama" [City?]: *Albatross* (Faxon). Isla Saboga, Islas de las Perlas: Mrs. S. D. Sturgis and W. G. Van Name (Boone); *Askoy* (Haig).

Colombia. Bahía Utría: *Askoy* (Haig).

*Diagnosis:* Carapace with distinct, transverse, piliferous striations, continuing across metabranchial regions; a single epibranchial spine; front triangular; carpus three times as long as wide, anterior margin with three low, wide-set, serrate-edged teeth, and surface with three longitudinal rows of rugae; manus with small groups of flattened, scalelike tubercles; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description:* Carapace covered with distinct, transverse, piliferous striations, scarcely interrupted at the grooves separating the various regions, the latter well marked; striations uninterrupted posterior to cardiac region. Front triangular, with a deep median groove extending between protogastric lobes; a small supraocular spine, scarcely produced in larger specimens. Postorbital angle produced into a low denticulate tooth. A single epibranchial spine.

First movable segment of antenna with a broad lamellar lobe, its margin serrate; second granular; third nearly smooth; flagellum naked. Outer maxillipeds rugose.

Merus of chelipeds rugose, with a strong serrate lobe or tooth on anterior margin. Carpus about three times as long as wide; armed on anterior margin with three low, wide-set, spine-tipped teeth, denticulate on margins; piliferous striations of dorsal surface broken up into three longitudinal rows of rugae. Manus long and slender, covered with small groups of flattened, scalelike tubercles scattered evenly over dor-

sal surface; tubercles often produced into spinules along outer margin. Fingers covered with flattened tubercles similar to those on manus; gape with pubescence produced into a long tuft on proximal half of fingers.

Walking legs rugose; merus and carpus with a fringe of plumose hairs on anterior margin, all segments covered with long, non-plumose setae; anterior margin of merus of leg 1 with six to eight spines, of leg 2 with six to eight, of leg 3 with three to seven; merus of legs 1 and 2 with one or two posterodistal spines.

Ventral surface of chelipeds and walking legs rugose; abdomen rugose.

*Material examined:* See Table 4.

*Measurements:* Males, 2.9 to 9.9 mm; non-ovigerous females, 6.1 and 6.5 mm; ovigerous females, 5.5 to 8.3 mm. The male holotype measures 5 mm in length, according to Faxon (1893). The present writer, who examined the type specimen, recorded a measurement of 9.9 mm.

*Color:* Color in alcohol reddish, lighter below, the pigment assuming the form of spots on the basal parts of the abdomen; a large blood-red spot on the propodite of the outer maxillipeds. (Faxon, 1895)

*Ecology:* This species has been found under stones in the littoral zone, usually at low tide. It was taken by the *Askoy* Expedition from coral dredged at 2 fathoms.

Ovigerous females have been collected in January, March, and May.

*Remarks:* The range of *Petrolisthes agassizii* is here extended from Panama northward to Mazatlán at the mouth of the Gulf of California. The species apparently does not occur inside the Gulf.

*Range:* Mazatlán, Gulf of California, south to Bahía Utría, Colombia. Shore to 2 fathoms.

### ***Petrolisthes edwardsii* (Saussure)**

#### Plate 21

*Porcellana edwardsii* Saussure, 1853, p. 366, pl. 12, fig. 3 (type locality, Mazatlán, Gulf of California). Stimpson, 1857b, p. 480.

*Petrolisthes edwardsii*, Stimpson, 1858, p. 227. Rathbun, 1910, p. 600. Schmitt, 1924a, p. 170. Boone, 1932, p. 39, text-fig. 10. Glassell, 1938a, p. 443. Steinbeck and Ricketts, 1941, p. 456, pl. 22, fig. 2. Not Boone, 1931, p. 152, text-fig. 7.

*Petrolisthes edwardsi*, Ortmann, 1897, pp. 283, 284. Haig, 1957b, p. 11.

*Petrolistes edwardsii*, Nobili, 1901b, p. 11.

*Petrolisthes galathinus*, Boone, 1931, p. 155 (part). Not *P. galathinus* (Bosc).

Not *Petrolisthes edwardsius*, Lockington, 1878, pp. 396, 400.

*Previous records:*

Gulf of California. Cabo San Lucas: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Mazatlán: Verreaux (Saussure).

Panama. Isla Flamenco: E. Festa (Nobili). Isla Saboga, Islas de las Perlas: *Askoy* (Haig). Isla del Rey, Islas de las Perlas: W. G. Van Name (Boone 1931). Guayabo Chiquito: *Askoy* (Haig).

Colombia. Bahía Utría; Isla Gorgona: *Askoy* (Haig).

Ecuador. Isla La Plata: *Askoy* (Haig).

Galapagos Islands. Isla Edén off Isla Indefatigable: Williams Galapagos Exped. (Schmitt). Off Isla Hood: W. Beebe on *Arcturus* (Boone 1932).

*Diagnosis:* Carapace with strong, transverse, piliferous striations, not continuing across metabranchial regions, and distinctly interrupted at grooves separating the various regions; a single epibranchial spine; front triangular; carpus about twice as long as wide, anterior margin with three low, wide-set, serrate-edged teeth, and surface with large flattened tubercles; manus with similar but more rounded tubercles; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description:* Carapace covered with strong, transverse, piliferous striations, interrupted at the grooves separating the various regions, the latter well marked; metabranchial regions without striations, but punctate. Front triangular, with a deep median groove extending between protogastric lobes; supraocular spine present or absent, but at least its position clearly marked by a small lobe. Postorbital angle scarcely produced, not spined. A single epibranchial spine.

First movable segment of antenna with a strongly projecting lamellar lobe, granular on its margin and bearing one or two spinules; second granular, with a small conical projection at the distal end of its anterior margin; third nearly smooth; flagellum naked. Outer maxillipeds lightly rugose.

Merus of chelipeds rugose, with a large serrate-edged tooth on anterior margin. Carpus about twice as long as wide, armed on anterior margin with three low, wide-set teeth, spine-tipped and denticulate on

their margins; anterior margin usually with a few smaller denticles between these teeth; surface with large, flattened tubercles, median ones largest and forming an irregular longitudinal row; some of those along posterior margin produced into spines, and posterodistal angle with a long spine-tipped extension. Manus broad, flattened, covered with tubercles similar to those of carpus, but usually more rounded; a few of the proximal ones along outer margin usually produced into spines. Fingers with tubercles similar to those of manus; gape with a short, thick pubescence, confined to dactylus and extending nearly to tip of latter.

Walking legs with small, flattened tubercles; anterior margin of merus and carpus with a fringe of plumose hairs, all segments covered with long, non-plumose setae; anterior margin of merus of leg 1 with nine to eleven spines, of leg 2 with ten to twelve, of leg 3 with five to eleven; one or two (rarely three) posterodistal spines on merus of legs 1 and 2.

Ventral surface of chelipeds and walking legs, and abdomen, without distinct striations.

*Material examined:* See Table 5.

*Measurements:* Males, 3.8 to 15.9 mm; non-ovigerous females, 3.3 to 12.3 mm; ovigerous females, 4.7 to 14.7 mm. Measurements of the type were given as 7 by 7 lines (about 16 mm).

*Color:* In alcohol the striations of the carapace show red stripes, which may be broken up into spots. The tubercles of the chelipeds are red, the carpus and propodus of the walking legs are broadly striped with red, and the abdomen is spotted. The palp of the outer maxillipeds is bright blue.

*Ecology:* *Petrolisthes edwardsii* occurs in the intertidal zone under stones, and in coral heads to a depth of about 6 fathoms. It has also been dredged in depths to about 20 fathoms; the *Velero III* took it on hard substrates such as sand and shell, gravel, corallines, rock, and nullipores. Hancock Foundation collectors recovered it on one occasion from a sponge dredged by the *Velero IV* in 1-4 fathoms. A specimen in the Hancock Foundation collections was taken from the stomach of a tuna, *Neothunnus macropterus*, captured off Mazatlán, Gulf of California.

Ovigerous females have been collected in every month from December through May, and in September.

*Remarks:* Spence Bate (1866, p. 277) reported *Porcellana edwardsii* from Esquimault Harbor, Vancouver Island, an obviously erroneous record. As noted by S. I. Smith (1880, p. 209, footnote), the listing by Spence Bate of a number of tropical and subtropical crabs from Vancouver Island must have been due to an admixture of collections.

Specimens from the Gulf of California questionably referred by Lockington (1878) to this species (as *Petrolisthes edwardsius*) were *Petrolisthes hirtispinosus* Lockington. The first substantiated record since the original description is that of Nobili (1901b), based on a specimen collected by Enrico Festa at Isla Flamenco, Panama (not Ecuador). This record was evidently the basis for the range "Gulf of California to Ecuador" given by Rathbun (1910).

Two specimens from Islas de las Perlas, Panama, reported by Boone (1931) as *Petrolisthes galathinus* (Bosc), were examined by the writer. One proved to be *P. edwardsii*, the other *P. marginatus* Stimpson. The specimen identified with *P. edwardsii* by Boone in the same paper should be referred to *P. agassizii* Faxon.

Schmitt (1924a), reporting *Petrolisthes edwardsii* for the first time from the Galapagos Islands, called it the "scarlet tissue crab."

*Range:* Bahía de Santa María and Bahía de la Magdalena, Baja California; Los Frailes near the mouth of the Gulf of California south to Isla La Plata, Ecuador; Isabel, Tres Marías, Revillagigedo, and Galapagos Islands. Shore to about 20 fathoms.

### ***Petrolisthes galathinus* (Bosc)**

Plate 19, fig. 4

Restricted synonymy:

*Porcellana galathina* Bosc, 1801 (or 1802), p. 233, pl. 6, fig. 2 (type locality unknown). Latreille, 1802 (or 1803), p. 76 (type locality restricted to Antilles). Not Say, 1818, p. 458.

*Porcellata sexspinosus* Gibbes, 1850, p. 190 (type locality, Key West, Florida).

*Porcellana danae* Gibbes, 1854, p. 11 [new name for *Porcellana boscii* of Dana, 1852, p. 421; 1855, pl. 26, fig. 11; not *Petrolisthes boscii* (Audouin)]. Not *P. danae* Heller, 1865, p. 74.

*Porcellana egregia* Guérin, 1855, pl. 2, fig. 1 (type locality, Cuba).

*Petrolisthes sexspinosus*, Stimpson, 1858, p. 227.

*Petrolisthes occidentalis* Stimpson, 1858, p. 227 (listed only; type locality, Panama); 1859, p. 73 (description). Streets, 1871b, p. 240. Lockington, 1878, pp. 395, 399. Faxon, 1893, p. 75; 1895, p. 69.

*Petrolisthes brasiliensis* S. I. Smith, 1869, p. 38 (new name for *Porcellana bosicii* of Dana; see reference above).

*Petrolisthes danae*, Kingsley, 1880, p. 405, footnote.

*Petrolisthes galathinus*, Nobili, 1897, p. 4. Ortmann, 1897, p. 283. Rathbun, 1910, p. 600. Schmitt, 1935, p. 186. Not Boone, 1931, p. 155, text-fig. 9; 1932, p. 45; probably not Hult, 1938, p. 10.

*Previous Pacific records*: Pacific Panama. "Panama": Sternbergh and Rowell (Stimpson 1859). "Panama" [City?]: *Albatross* (Faxon). Isthmus of Panama: J. A. McNeil (Streets). Isla Taboguilla: (Schmitt).

*Diagnosis*: Carapace with strong, transverse, piliferous striations, not continuing across metabranchial regions; a single epibranchial spine; front triangular; carpus about twice as long as wide, anterior margin with four broad, serrate-edged teeth, and surface with oblique striations; manus with oblique striations; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description*: Carapace covered with strong, transverse, piliferous striations, scarcely interrupted at the grooves separating the various regions, the latter well marked; frontal region granulate, metabranchial regions finely plicate. Front triangular, truncate at tip, with a deep median sulcus usually filled with a short pubescence; supraocular spine present, not distinct in large specimens. Postorbital angle produced into a small spine-tipped tooth. A single strong epibranchial spine.

First movable segment of antenna with a spine-tipped, lamellar lobe; second and third lightly rugose; flagellum naked. Outer maxillipeds rugose.

Chelipeds covered with strong piliferous striations, continuing obliquely and almost unbroken across carpus and manus, broken up into series of shorter rugae on fingers. Merus with a strong rugose lobe on anterior margin, having the form of a serrate-edged tooth in small specimens. Carpus about twice as long as wide, anterior margin with four broad, strong, serrate-edged teeth; no median longitudinal crest; a row of spines on posterior margin. Manus broad, flattened, rugae on outer margin produced into spines in smaller specimens; outer margin often fringed with plumose hairs. Gape of fingers with a thick pubescence, somewhat elongated to form a short tuft.

Walking legs rugose; anterior margin of merus with a fringe of plumose hairs, all segments covered with long, non-plumose setae; anterior margin of merus of leg 1 with six to nine spines, of leg 2 with

six to nine, of leg 3 with five to seven; merus of legs 1 and 2 with a posterodistal spine.

Sternum, sternal plastron, abdomen, and ventral surface of chelipeds and walking legs covered with strong striations.

*Material examined:* See Table 6.

*Measurements:* Males, 6.9 to 17.4 mm; non-ovigerous females, 6.1 to 11.1 mm; ovigerous females, 7.3 to 13.2 mm.

*Color:* In recent alcoholic specimens the transverse ridges and squamiform tubercles of the carapace are dark red, the intervening spaces yellowish. Lower surface, including abdomen, deep madder. (Faxon)

*Ecology:* In the Atlantic the species has been reported to a depth of 27 fathoms, and in the littoral under stones and associated with sponges, corals, and anemones. Collection data for Pacific specimens, much of which are incomplete, do not indicate any commensal associations. The *Velero III* dredged specimens in 4 and 10 fathoms, from bottoms of sand and of sand and shell, respectively. Other examined material was probably shore collected.

Ovigerous females are reported from January, February, and March.

*Remarks:* *Petrolisthes galathinus*, which had already been collected many times in the Atlantic and described under several names, was first reported from the Pacific coast by Stimpson (1858, 1859) as *P. occidentalis* on the basis of specimens collected by Sternbergh and Rowell in Panama. A number of specimens taken by those collectors and labelled "Panama" were seen in the Museum of Comparative Zoology, but of these only a male and three females collected by R. Rowell are labelled as types. The designation "Panama" probably refers to Panama City.

The species was also reported as *Petrolisthes occidentalis* by Streets (1871b) from specimens collected by J. A. McNeil, and by Faxon (1893, 1895) from the collections of the *Albatross*. These lots of specimens were also seen by the writer, the first in the Academy of Natural Sciences of Philadelphia and the second in the U. S. National Museum.

Ortmann (1897) was the first to regard *Petrolisthes occidentalis* identical with *P. galathinus*. Under the latter name it was reported from the Pacific coast by Schmitt (1935), Boone (1931, 1932), and Hult (1938). The Boone and Hult records, however, refer to another species.



A survey of unreported collections, chiefly from the U. S. National Museum, revealed many more Pacific records for *Petrolisthes galathinus*. On the Atlantic coast this species is very common and ranges from Cape Hatteras, North Carolina, to Rio de Janeiro, Brazil, throughout the Caribbean area, and on the Brazilian island of Ilha Trindade, about 700 miles from the mainland. In the Pacific, on the other hand, nearly all the known specimens have come from a relatively small area in the vicinity of Panama City. Despite extensive collecting along the Pacific coast over a period of many years, the only known examples of *P. galathinus* from outside this area are three specimens from Isla San Lucas, Costa Rica, collected in 1930, and three taken off La Libertad, Ecuador, in 1933. It seems strange that the species has apparently remained almost entirely concentrated in a very limited area in the Pacific, particularly since it is unusually wide-ranging on the Atlantic coast.

***Petrolisthes glasselli* Haig**

Plate 20, fig. 2

*Petrolisthes amoenus*, Boone, 1932, p. 41, text-figs. 11-12. Not *P. amoenus* (Guérin).

*Petrolisthes glasselli* Haig, 1957a, p. 33, pl. 8, figs. 1-3 (type locality, Bahía Octavia, Colombia); 1957b, p. 13.

*Previous records:*

Mexico. Islas Las Tres Marías: (Haig 1957a).

Panama. Isla Saboga, Islas de las Perlas: *Askoy* (Haig 1957b).

Colombia. Bahía Octavia: *Velero III* (Haig 1957a). Isla Gorgona: *Askoy* (Haig 1957b).

Galapagos Islands. Bahía de Gardner, Isla Hood: W. Beebe on *Arcturus* (Boone).

*Diagnosis:* Carapace with distinct, transverse, piliferous striations, not continuing across metabranchial regions; two epibranchial spines; front triangular; carpus less than twice as long as wide, anterior margin with four or five broad, serrate-edged teeth, and surface with oblique striations; manus with oblique striations; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description:* Carapace covered with distinct, transverse, piliferous striations, interrupted at cervical and branchial grooves; frontal region granulate and metabranchial regions punctate, these regions lacking

striations. Front triangular, truncate at tip, with a deep median sulcus extending to protogastric lobes; a small supraocular spine, scarcely distinct in larger specimens. Postorbital angle produced into a small spine. An epibranchial spine at cervical groove, followed by a second spine on epibranchial region between cervical and mesobranchial grooves.

First movable segment of antenna with a small, spine-tipped, lamellar lobe; second and third nearly smooth; flagellum naked. Outer maxillipeds rugose.

Chelipeds covered with piliferous striations, granulate on their margins. Merus with a large serrate-edged tooth on anterior margin. Carpus less than twice as long as wide, anterior margin with a row of four or five broad, serrate-edged teeth; striations continuing obliquely and unbroken across dorsal surface. Manus broad, flattened, striations continuing obliquely and unbroken across dorsal surface except on margins, there breaking up into flattened tubercles; outer half of manus often with a fringe of hairs. Gape of fingers nearly smooth, devoid of pubescence.

Walking legs faintly rugose; merus with a fringe of plumose hairs on anterior margin, all segments covered with long, non-plumose setae; anterior margin of merus of leg 1 with seven or eight spines, of leg 2 with eight to ten, of leg 3 with six or seven; merus of legs 1 and 2 with a posterodistal spine, a second occasionally present.

Ventral surface of chelipeds striate; abdomen and ventral surface of walking legs nearly smooth.

*Material examined:* See Table 7.

*Measurements:* Males, 3.9 to 11.0 mm; non-ovigerous females, 4.0 to 10.2 mm; ovigerous females, 4.7 to 9.2 mm. The male holotype measures 11.0 mm in length, 10.1 mm in breadth.

*Color:* In alcohol most specimens are strikingly marked, with a strong stripe of deep purplish-red along each striation of the carapace, and stripes across the metabranchial and frontal regions. The chelipeds are similarly striped, and the walking legs and abdomen are striped or spotted. (Haig, 1957a) The ventral surface of the chelipeds and walking legs is usually solid dark purplish-red.

*Ecology:* *Petrolisthes glasselli* is usually associated with corals; it has been recorded from *Pocillopora* and *Pavona* in the littoral and to about 4 fathoms. It has been taken a very few times under stones, but probably always remains close to corals.

Ovigerous females have been collected in every month from January through May.

*Relationships:* This species is closely related to *Petrolisthes galathinus* (Bosc), but is easily distinguished from the latter form by the absence of any pubescence in the gape of the fingers, and the presence of two marginal epibranchial spines.

*Remarks:* *Petrolisthes glasselli* was first reported by Boone (1932), who identified it as *Petrolisthes amoenus* (Guérin), 1855, an Atlantic form. Boone's description and accompanying illustration leave no doubt that her specimens should be referred to the present species.

In the original description of the species, the holotype was inadvertently given an Allan Hancock Foundation catalog number. This type is housed in the U. S. National Museum where it bears catalog number 102402.

*Range:* Cabo San Lucas at the mouth of the Gulf of California, south to Isla Gorgona, Colombia; Isabel, Tres Marias, Revillagigedo, and Galapagos Islands. Shore to 4 fathoms.

### ***Petrolisthes polymitus* Glassell**

Plate 22, fig. 1

*Petrolisthes polymitus* Glassell, 1937, p. 81, pl. 1, fig. 1 (type locality, off Arena Bank, Gulf of California); 1938a, p. 443.

*Previous records:* Gulf of California. Off Arena Bank: W. Beebe on *Zaca* (Glassell 1937).

*Diagnosis:* Carapace with distinct, transverse, piliferous striations, continuing across metabranchial regions; a single epibranchial spine; front broad, sinuously triangular; carpus about one and a half times as long as wide, anterior margin with four or five broad, serrate-edged teeth, and surface with short flattened rugae; manus with similar rugae and large flattened granules; merus of walking legs with one or two distal spines on anterior margin, that of leg 1 spined at posterodistal angle.

*Description:* Carapace covered with distinct, transverse, piliferous striations, not interrupted at grooves separating the various regions, latter not distinct; absent only on frontal region, this area granulate. Front broadly, sinuously triangular, its margin minutely denticulate, and with a median sulcus extending between protogastric lobes; a small supraocular spine. Postorbital angle scarcely produced. A single epibranchial spine.

First movable segment of antenna with a lamellar lobe, finely denticulate on its margin and bearing a single spine; second granulate; third nearly smooth; flagellum naked. Outer maxillipeds rugose.

Merus of chelipeds rugose, armed on anterior margin with a large spine-tipped tooth. Carpus about one and a half times as long as wide, armed on anterior margin with four or five broad teeth, denticulate on their margins; surface covered with short, flattened rugae forming oblique longitudinal rows; no median longitudinal crest. Manus and fingers with similar rugae tending to break up into flattened granules on outer half of manus, and extending obliquely on inner half; outer margin of manus with a row of spines and with scattered plumose and non-plumose hairs. Outer margin of pollex with a row of rough granules; dactylus with a forward-pointing distal spine on outer margin, giving it a bifid-tipped appearance; gape with a short thick pubescence.

Walking legs rugose, all segments with setae; anterior margin of merus with one or two distal spines; merus of leg 1 with a posterodistal spine, that of leg 2 unspined at posterodistal angle.

Abdomen and ventral surface of chelipeds and walking legs without distinct striations.

*Material examined:* See Table 8.

*Measurements:* Males, 2.2 to 6.0 mm; non-ovigerous females, 2.7 to 4.5 mm; ovigerous females, 2.8 to 5.8 mm. The male holotype measures 5.0 mm in length, 4.8 mm in breadth.

*Color:* "[In alcohol] this beautiful little crab has the appearance of being embroidered in colored silks, somewhat similar in effect to the Peking stitch; the plications are an orange-red, laterally merging into a yellow on the median line; the subcardiac whorls, protogastric and frontal ridges are a deep red. The under side of the chelipeds is a brilliant carmine, mottled with white. The propodi of the ambulatories are distally banded with mottled carmine. The median line of the abdomen is paralleled with red chromatophores, blending into orange. The hands give the impression of being banded with orange and white." (Glasell, 1937)

*Ecology:* *Petrolisthes polymitus* has been taken in the littoral under stones, and in corals to a depth of 2.5 fathoms. It was dredged on one occasion by the *Velero III* from a sand bottom in 4 fathoms, and taken in abundance from sponge dredged at 1-4 fathoms.

Ovigerous females have been collected in December, January, February, and March.

*Remarks:* Formerly known from a single specimen taken in the southern part of the Gulf of California, *Petrolisthes polymitus* is now shown to extend along the mainland as far south as Ecuador and also to be common in the Galapagos Islands.

*Range:* Isla Espiritu Santo, Gulf of California, south to La Libertad, Ecuador; Tres Mariás and Galapagos Islands. Shore to 4 fathoms.

### *Petrolisthes desmarestii* (Guérin)

Plate 19, fig. 3

*Porcellana desmarestii* Guérin, 1835, p. 115 (type locality, Chile); 1838b, p. 7, pl. VII 26, fig. 1 (type locality restricted to Valparaiso); 1839, p. 175, pl. 52, fig. 1. Nicolet, 1849, p. 198. Not White, 1847, p. 62.

*Porcellana acanthophora* H. Milne Edwards and Lucas, 1844, p. 33, pl. 16, fig. 2 (type locality, Valparaiso, Chile). Nicolet, 1849, p. 196.

*Porcellana dubia* Kinahan, 1857, p. 348, pl. 14, fig. 4 (type locality, Callao, Peru).

*Petrolisthes acanthophorus*, Stimpson, 1858, p. 228. Cano, 1889, pp. 96, 100, 258. Rathbun, 1910, p. 600. Porter, 1925, p. 320; 1936b, p. 153; 1936c, p. 339. Haig, 1955, p. 54, text-fig. 13.

[*Petrolisthes*] *desmarestii*?, Stimpson, 1858, p. 228.

*Petrolisthes* (?) *desmarestii*, Rathbun, 1910, p. 600.

*Petrolisthes desmaresti*, Haig, 1955, p. 54.

#### *Previous records:*

Peru. Callao: J. R. Kinahan (Kinahan); *Vettor Pisani* (Cano).

Chile. "Chile": (Guérin 1835). Pisagua; Iquique; Coloso near Antofagasta: R. Paessler (Haig). Bahía de Taltal: A. Capdeville (Porter 1925). Taltal: R. Paessler (Haig). Valparaiso: *Favorite* (Guérin 1838b); A. d'Orbigny (H. Milne Edwards and Lucas). Bahía de Talcahuano: (Porter 1936b, 1936c). Coronel: R. Paessler (Haig).

W coast of South America [probably Chile]: Rehberg (Haig).

*Diagnosis:* Carapace covered with fine plications; a single epibranchial spine; front triangular; carpus about twice as long as wide, anterior margin with four or five broad, serrate-edged teeth; manus covered with small flattened tubercles; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at postero-distal angle.

*Description:* Carapace with fine transverse plications, cardiac and metabranchial regions punctate; covered with a fine pubescence. Front triangular, with a deep median sulcus; a strong supraocular spine. Outer orbital angle produced into a small spine. A single small epibranchial spine.

First movable segment of antenna with a large, spine-tipped tooth on anterior margin; second rugose, anterior margin granular; third nearly smooth; flagellum naked. Outer maxillipeds rugose.

Merus of chelipeds rugose, with a large, serrate-edged tooth on anterior margin. Carpus finely pubescent, about twice as long as wide; anterior margin armed with four or five broad, serrate-edged teeth similar to meral tooth; surface granulate, with a median longitudinal crest formed of large, obliquely elongate, flattened tubercles; posterior margin with a row of rugae produced into spines. Manus finely pubescent, broad, flattened, covered with small flattened tubercles usually produced into spinules on outer margin. Fingers covered with similar tubercles; gape with a short, thick pubescence.

Walking legs rugose; anterior margins of merus and carpus with a fringe of plumose hairs, all segments covered with tufts of non-plumose setae; anterior margin of merus of leg 1 with six to ten spines, of leg 2 with six to eight, of leg 3 with one to six; merus of legs 1 and 2 with one or two posterodistal spines.

Ventral surface of chelipeds and walking legs with rugae and flattened granules; abdomen smooth.

*Material examined:* Peru; November 17, 1866; H. Edwards, collector; two males (Museum of Comparative Zoology Cat. No. 7971).

Valparaiso, Chile; April, 1941; one male, one female (U. S. National Museum Cat. No. 81902).

Coronel, Chile, 8-9 fms.; December 30, 1915; R. Paessler, collector; one male, one female (Allan Hancock Foundation, gift of Hamburg Museum).

*Measurements:* Males, 5.3 to 30.3 mm; non-ovigerous females, 17.9 to 33.0 mm; ovigerous females, 21.9 and 26.2 mm. These measurements include specimens in the Hamburg Museum collection previously examined by the writer. The largest specimen seen, a 33 mm female from Valparaiso in the collection of the U. S. National Museum, agrees with the measurement of 33 mm length, 35 mm breadth given by H. Milne Edwards and Lucas (1844) for the type of *Porcellana acanthophora* from the same locality.

*Color:* Cherry red, dotted with rounded white and bluish dots and rings, chelae cherry red, the tubercles showing as white dots. (Kinahan) Carapace, external maxillipeds, sternal plastron, abdomen, and legs red spotted with yellow. (H. Milne Edwards and Lucas)

*Ecology:* This species has been taken in the littoral on rocky reefs and dredged in about 8-20 fathoms, with the substrate not recorded. An ovigerous female in the Hamburg Museum collection was recovered in December.

*Remarks:* In her report on the anomuran crabs of Chile (Haig, 1955), the writer suggested that the species inadequately described by Guérin (1835) as *Porcellana desmarestii* Eydoux and Gervais might be identical with *Petrolisthes acanthophorus* (H. Milne Edwards and Lucas). It is now believed that this is definitely the case, and *Porcellana acanthophora* H. Milne Edwards and Lucas is therefore placed in the synonymy of *Petrolisthes desmarestii*. Furthermore, the name *desmarestii* is attributed to Guérin, rather than to Eydoux and Gervais as was done previously. Where it is clearly stated in a work written by one author that the description of a taxon named therein was prepared exclusively by some other person or persons, the name of that taxon is to be attributed solely to that other person or persons (Bull. Zool. Nomen., vol. 4, p. 566, Concl. 49 (1) (b); Copenhagen Decisions Zool. Nomen., p. 59, par. 103 (2)). However, in this case there is no indication that the description was prepared by Eydoux and Gervais; only the name was attributed to them, for no apparent reason, by Guérin (1835, 1838b, 1839).

The species seems to have been rarely collected, in spite of its extraordinary size. It is probably more abundant in deeper water.

*Range:* Callao, Peru, south to Coronel, Chile. Known from shore to about 20 fathoms.

### *Petrolisthes hirtispinosus* Lockington

Plate 19, fig. 1

*Petrolisthes edwardsius*, Lockington, 1878, pp. 396, 400. Not *P. edwardsii* (Saussure).

*Petrolisthes hirtispinosus* Lockington, 1878, p. 400 (type locality, Bahía Mulegé, Gulf of California). Glassell, 1937, p. 80; 1938a, p. 444. Steinbeck and Ricketts, 1941, p. 457.

*Petrolisthes hirtispinosus?*, Schmitt, 1924b, p. 384.

*Previous records:* Gulf of California. Bahía de Tepoca, Sonora: F. Baker (Schmitt). Bahía San Pedro, Sonora: S. A. Glassell (Glassell 1937). Bahía Mulegé: (Lockington). Bahía Concepción: S. A. Glassell (Glassell 1937). Isla Coronados; Punta Lobos, Isla Espíritu Santo: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Off Arena Bank: W. Beebe on *Zaca* (Glassell 1937).

*Diagnosis:* Carapace nearly smooth, laterally plicate; a single epi-branchial spine and a distinct supraocular spine; front sinuously triangular; carpus a little over twice as long as wide, anterior margin with five or six (rarely four) serrate-edged teeth; manus with a longitudinal crest of large flattened granules; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description:* Carapace nearly smooth except for light plications on posterolateral regions; covered with a fine pubescence, longer in young specimens. Front sinuously triangular, rounded at tip, with a deep median groove; a strong supraocular spine, distinct even in the largest specimens. Outer orbital angle produced into a spine. A single epi-branchial spine.

First movable segment of antenna with an anterior lamellar lobe, granular on its margin and bearing a spine; second granular; third nearly smooth; flagellum naked. Outer maxillipeds rugose.

Merus of chelipeds roughly granular; anterior margin with a large, serrate-edged, spine-tipped tooth. Carpus pubescent, a little over twice as long as wide; armed on anterior margin with five or six (rarely four) serrate, spine-tipped teeth similar to meral tooth; a median longitudinal row of large flattened tubercles, and a row of spines on posterior margin. Manus granular, with a longitudinal crest of larger, flattened granules extending from base of dactylus; surface pubescent, more distinctly so to the outside of this crest; outer margin with a row of enlarged granules, produced into spines in all but the largest specimens; outer margin usually fringed with hairs. Dactylus with a row of large flattened granules continuing the row on manus; gape of fingers with a short pubescence.

Walking legs rugose; anterior margin of merus with a fringe of plumose hairs, all segments with long tufts of non-plumose setae; anterior margin of merus of leg 1 with seven to nine spines, of leg 2 with seven to ten, of leg 3 with five or six; merus of legs 1 and 2 with one or two posterodistal spines.



*Material examined*: See Table 9.

*Measurements*: Males, 2.9 to 13.1 mm; non-ovigerous females, 3.0 to 11.1 mm; ovigerous females, 5.5 to 6.6 mm. The size of Lockington's types was not stated. The material examined apparently includes the largest specimens to be recorded.

*Color*: "This species is not nearly as brightly colored in life as it is in alcohol, the preservative intensifying the coloration for a considerable time. In life it is a light red mottled with cream, spines and lobes, yellow to white margined with a deep red; the undersides of the hands are very conspicuous, a bright pink." (Glassell, 1937)

*Ecology*: Unlike its closest relative, *Petrolisthes marginatus*, which occurs most frequently in coral heads, the present species is most often found under stones in the intertidal zone. It has, however, been taken from coral on a few occasions, to a depth of  $2\frac{1}{2}$  fathoms. The *Velero III* once dredged it in 22 fathoms from a coral rock substrate, along with *P. marginatus*; this depth is exceptional for both species.

Females were taken in abundance in January, February, and March. Of all these, only eight out of 72 collected in March were ovigerous. The culmination of the breeding cycle undoubtedly occurs later in the year, when the Gulf of California is rarely visited by collectors.

*Remarks*: *Petrolisthes hirtispinosus* appears to be strictly confined to the Gulf of California, and to be abundant throughout its range.

*Range*: Gulf of California, from Bahía de Tepoca, Sonora, south to Cabo San Lucas. Shore to  $2\frac{1}{2}$  fathoms; exceptionally to 22 fathoms.

### ***Petrolisthes marginatus* Stimpson**

Plate 20, fig. 1

Restricted synonymy:

*Petrolisthes marginatus* Stimpson, 1858, p. 227 (listed only; type locality, Antilles); 1859, p. 74 (description; type locality restricted to Barbados). Schmitt, 1939, p. 16. Haig, 1956a, p. 26; 1957b, p. 10. Hertlein and Emerson, 1957, p. 5.

*Petrolistes marginatus*, Nobili, 1901b, p. 12.

*Petrolisthes galathinus*, Boone, 1931, p. 155 (part), text-fig. 9; 1932, p. 45, text-fig. 13. Not *P. galathinus* (Bosc).

?*Petrolisthes galathinus*, Hult, 1938, p. 10. Not *P. galathinus* (Bosc).

*Previous Pacific records:*

- Clipperton Island: Presidential Cruise of 1938 (Schmitt); Scripps Inst. of Oceanography Exped. (Hertlein and Emerson).
- Costa Rica: *Velero III* (Haig 1956a).
- Panama. "Panama": *Velero III* (Haig 1956a). Isla Flamenco: E. Festa (Nobili). Isla Contadora and Isla Saboga, Islas de las Perlas: *Askoy* (Haig 1957b). Isla del Rey, Islas de las Perlas: W. G. Van Name (Boone 1931). Guayabo Chiquito: *Askoy* (Haig 1957b).
- Colombia. "Colombia": *Velero III* (Haig 1956a). Bahía Humboldt; Bahía Utría; Isla Gorgona: *Askoy* (Haig 1957b).
- Ecuador. Isla La Plata: *Askoy* (Haig 1957b). Bahía de Santa Elena: E. Festa (Nobili).
- Galapagos Islands. "Galapagos Islands": *Velero III* (Haig 1956a). ? Bahía de la Academia, Isla Indefatigable: R. Blomberg (Hult). Bahía de Gardner off Isla Hood: W. Beebe on *Arcturus* (Boone 1932).

*Diagnosis:* Carapace nearly smooth, laterally plicate; a single epibranchial spine; no strong supraocular spine, but one or two supraocular spinules sometimes present; front sinuously triangular; carpus less than twice as long as wide, anterior margin with four (rarely five or six) serrate-edged teeth; manus with a longitudinal crest of large flattened granules; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description:* Carapace nearly smooth except for plications on posterolateral regions; covered with a fine pubescence, latter very short on adult specimens, longer in young. Front sinuously triangular, rounded at tip, with a deep median groove; no strong supraocular spine, but one to three small supraocular spinules often present. Outer orbital angle produced into a spine. A single, strong epibranchial spine.

First movable segment of antenna with an anterior lamellar projection, serrate on its margin and bearing one to three spines; second covered on anterior side with small, projecting granules; third nearly smooth; flagellum naked. Outer maxillipeds rugose.

Merus of chelipeds rugose, with a large serrate-edged tooth on anterior margin. Carpus pubescent, more distinctly so in young specimens; less than twice as long as wide; armed on anterior margin with four serrate-edged, spine-tipped teeth similar to meral tooth, a smaller fifth tooth (and rarely a sixth) sometimes present; surface roughly granulate, the largest granules forming a median longitudinal crest;

posterior margin rugose, some of the rugae produced into spines. Manus granular, with a longitudinal crest of larger, flattened granules extending from base of dactylus; surface pubescent, more distinctly so to the outside of this crest; outer margin with a row of large, well-spaced granules, sometimes developed into spinules; outer margin often with a fringe of hairs. Dactylus with a row of large flattened granules continuing the row on manus; gape of fingers with a short pubescence.

Walking legs rugose; anterior margin of merus and carpus with a fringe of plumose hairs, all segments with long tufts of non-plumose setae; anterior margin of merus of leg 1 with five to seven spines, of leg 2 with four to seven, of leg 3 with four to seven; merus of legs 1 and 2 with one or two posterodistal spines.

*Material examined:* See Table 10.

*Measurements:* Males, 2.9 to 11.9 mm; non-ovigerous females, 2.4 to 6.8 mm; ovigerous females, 3.0 to 12.5 mm. Stimpson (1859) gave the length as about  $\frac{1}{2}$  inch (13 mm).

*Color:* In specimens preserved for only a few years in alcohol, the ground color is yellow, overlaid on the carapace with dark red spots and broken marblings. All granules on the chelipeds are dark red, and the same color appears on the walking legs in the form of small spots on the merus and broad stripes on the carpus and propodus. The outer maxillipeds and the ventral surface of the manus and fingers are also dark red. Traces of this coloration remain, particularly on the granules of the chelipeds, in many specimens which have been a long time in preservative.

*Ecology:* *Petrolisthes marginatus* commonly inhabits interstices of *Pocillopora* coral, in depths to about 6 fathoms. Much less frequently it occurs under stones in the intertidal zone, or on hard substrates in depths not exceeding about 4 fathoms; it was once dredged by the *Velero III* from a coral bottom at 22 fathoms, a depth that must be considered exceptional. It was once taken by Hancock Foundation collectors from sponge dredged in 1-4 fathoms.

Ovigerous females have been taken in October and in every month from December through May.

*Relationships:* On the Pacific coast, *Petrolisthes marginatus* has its closest affinities with *P. hirtispinosus* Lockington, which like it has a crest formed of enlarged granules on the dorsal surface of the manus. *P. marginatus* differs mainly in the shorter carpus, (average) smaller number of carpal teeth, and lack of a strong supraocular spine. *P.*

*cessacii* (A. Milne Edwards) and *P. monodi* Chace from west Africa, and *P. amoenus* (Guérin) from eastern America, are closely related Atlantic forms.

*Remarks:* *Petrolisthes marginatus* was first reported from the Pacific coast by Nobili (1901b), on the basis of material collected by Enrico Festa at Isla Flamenco, Panama, and Bahía de Santa Elena, Ecuador. Subsequent study has shown it to be one of the most widely distributed and abundant west American species. In the Atlantic it is known from but few records. Pacific and Atlantic populations have not been critically compared, but the comparatively few Atlantic specimens seen by the writer do not appear to differ from Pacific examples.

As earlier noted by the writer (Haig, 1956a, pp. 26-27), Galapagos Islands specimens identified by Boone (1932) as *Petrolisthes galathinus* (Bosc) are actually *P. marginatus*, as probably is the record by Hult (1938) of *P. galathinus* from the Galapagos. The presence of *P. marginatus* in the Galapagos Islands has been amply confirmed, while there are no substantiated records of *P. galathinus* from that area.

Although very common south of the Gulf of California, *P. marginatus* does not appear to be well established in the Gulf, where it is largely replaced by *P. hirtispinosus*.

*Range:* Bahía de Guaymas, Gulf of California, south to Bahía de Santa Elena, Ecuador; Clipperton, Isabel, Tres Mariás, Revillagigedo, and Galapagos Islands. Shore to about 6 fathoms; exceptionally to 22 fathoms. Also known in the Atlantic from the eastern Caribbean area.

### ***Petrolisthes armatus* (Gibbes)**

Plate 19, fig. 2

Restricted synonymy:

*Porcellana armata* Gibbes, 1850, p. 190 (type locality, Florida). Not

*P. armata* Dana, 1852, p. 426.

*Porcellana gundlachii* Guérin, 1855, pl. 2, fig. 6 (type locality, Cuba).

*Petrolisthes armatus*, Stimpson, 1858, p. 227; 1859, p. 73. Streets, 1871b, p. 240. Lockington, 1878, pp. 396, 399. Bouvier, 1895, p. 8. Ortmann, 1897, p. 280. Rathbun, 1910, pp. 558, 599, pl. 41, fig. 3. Boone, 1931, p. 151, text-fig. 6 (part); 1932, p. 35, text-fig. 9. Glassell, 1938a, p. 444. Steinbeck and Ricketts, 1941, p. 456. Holthuis, 1954a, p. 15; 1954b, p. 161. Bott, 1955, p. 52. Garth and Haig, 1956, p. 4. Haig, 1957b, p. 9. Not Hildebrand, 1939, p. 23.

- Porcellana leporina* Heller, 1862, p. 523 (type locality, Rio de Janeiro, Brazil).
- Petrolisthes leporinus*, S. I. Smith, 1869, p. 38.
- Petrolisthes armatus*, S. I. Smith, 1871, p. 92.
- Petrolisthes similis* Henderson, 1888, p. 108 (*vide* Faxon, 1895, p. 70, footnote).
- Petrolisthes iheringi* Ortmann, 1897, p. 286, pl. 17, fig. 3 (type locality, Sao Sebastião, Brazil).
- Petrolisthes lamarcki* var. *asiaticus*, Borradaile, 1898, p. 464 (part).  
Not *P. lamarckii* (Leach) nor *P. asiaticus* (Leach).
- Petrolisthes armatus*, Nobili, 1901b, p. 11.
- Petrolisthes armatus* var. *pallidus* Verrill, 1908, p. 291 (type locality, Bermuda).

*Previous Pacific records:*

- Gulf of California. "Lower California" [probably Gulf]: Diguët (Bouvier). Bahía Mulegé: (Lockington). Bahía Concepción; El Mogote: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). El Salvador. Puerto El Triunfo: H. Peters (Bott). Near La Unión, Bahía de la Unión: M. Boeseman (Holthuis).
- Honduras [probably]. Golfo de Fonseca: J. A. McNeil (Smith 1871).
- Panama. "Panama" [probably Pacific side]: Sternbergh and Rowell (Stimpson 1859). Isthmus of Panama: J. A. McNeil (Streets). Bellavista, Panama City: *Askoy* (Haig). Punta Patillo; Fortified Island; ?Isla Taboga: W. G. Van Name (Boone 1931). Isla Flamenco: E. Festa (Nobili).
- Colombia. Buenaventura: H. Brattström and E. Dahl (Garth and Haig).
- Ecuador. 01°07'N x 79°53'W: *Askoy* (Haig). Bahía and Punta Santa Elena: E. Festa (Nobili).
- Galapagos Islands. Isla Edén: Harrison Williams Exped. (Boone 1932).
- Peru. Matapalo and Las Vacas near Capon: R. E. Coker (Rathbun).

*Diagnosis:* Carapace granulate and plicate; a single epibranchial spine present, occasionally obsolescent; front sinuously triangular; carpus two to two and a half times as long as wide, anterior margin with three low, wide-set teeth, a fourth occasionally present; manus rather long and slender; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description:* Carapace naked or pubescent, covered with granules and short, rough plications; about as broad in mid-branchial regions as posteriorly. Front broadly, sinuously triangular, with a deep median sulcus; no supraocular spine. Outer orbital angle not produced. A single epibranchial spine, occasionally obsolescent.

First movable segment of antenna with a strongly projecting, lamellar lobe, usually spine-tipped; second with a large projecting tubercle; third nearly smooth; flagellum naked. Outer maxillipeds rugose.

Merus of chelipeds rugose, armed on anterior margin with a large lobe, usually spine-tipped. Carpus two to two and a half times as long as wide, naked or pubescent; covered with large granules tending to form a median longitudinal crest, especially in young specimens; anterior margin armed with three low, wide-set, spine-tipped teeth, a fourth occasionally present; posterior margin with a row of large flattened granules, with one to four produced into spines, and ending distally in a large bifid spine. Manus narrow, naked or pubescent, covered with scattered granules similar to those of carpus; outer margin sometimes with a row of spines and a fringe of hairs, particularly in young specimens. Gape of fingers with a short pubescence.

Walking legs rugose; anterior margin of merus and carpus with plumose hairs, all segments with long, non-plumose setae; anterior margin of merus of leg 1 with two to five spines, of leg 2 with two to six, of leg 3 with none or one to three; merus of legs 1 and 2 with one or two posterodistal spines, one occasionally present on leg 3 also.

*Variations:* *Petrolisthes armatus* is subject to considerable intra-specific variation. Chace (1956, p. 20) concluded that recognition of subspecies is not warranted, although some individuals in the west American and west African populations differ markedly from typical east American specimens. Examination of an extensive series during preparation of the present report showed that variations within the Pacific coast population cannot be correlated with geography.

*Material examined:* See Table 11.

*Measurements:* Males, 4.0 to 14.7 mm; non-ovigerous females, 4.0 to 10.9 mm; ovigerous females, 4.6 to 11.5 mm.

*Color:* Carapace cream buff with regular designs of rich dark brown. Eyes blackish brown. Antennule glaucous blue with bright orange tips. Antenna orange. Chela cream buff, ridges dark garnet brown. A distinct blue narrow band on inside of merus and a strong greenish tinge on dorsal side of carpus, hand and fingers. Teeth in-

side fingers light garnet brown. Ambulatory legs cream buff with two light brown bands on each segment, except dactyl where there is only one. Nail of dactyl orange red. Ventral side light buff except maxillipeds which are light cream color on outside and brilliant blue on inner side. (Petersen, of a live specimen from the Gulf of California)

Dark olive and bottle green speckled and mottled with sage green and pea green, propodi of ambulatory legs with band of whitish pea green at either end, carpus with fleck of same on middle of upper side, likewise dactyl just above corneous claw, inner base of movable finger of chela with brilliant spot of orange chrome not visible when chela is closed. (W. L. Schmitt, of live specimens from Ecuador)

*Ecology:* *Petrolisthes armatus* occurs in the intertidal zone in almost any situation where it can obtain shelter: under stones, in oyster and mussel beds, around mangroves, in corals and sponges, and on pilings. In West Africa, it has been taken at depths to 25 or 30 meters, or about 14 to 16½ fathoms (Chace, 1956); the greatest depth attained by specimens examined for this report was 10 fathoms. The dredged material was taken on bottoms of rock and of sand and shell.

Among the material examined are ovigerous specimens taken in every month of the year.

*Remarks:* As shown by the extensive synonymy above, *Petrolisthes armatus* has been described under several different names. This is due partly to its wide range, which includes both tropical American coasts and the west coast of Africa, and partly to its intraspecific variability. The first record of the species from the Pacific coast was that of Stimpson (1859), who reported it from "Panama" (probably Panama City); subsequent Pacific coast records are numerous. Specimens reported by Streets (1871b), Smith (1871), Nobili (1901b), Rathbun (1910), and Boone (1931) were examined in connection with the present study.

In his discussion of an Atlantic porcellanid, Henderson (1888) mentioned *Petrolisthes similis*, a name which had not occurred elsewhere in the literature. The explanation is given by Faxon (1895, p. 70, footnote): "Dr. Stimpson, when labelling the Crustacea in the Smithsonian Institution and Museum of Comparative Zoölogy, separated the Panama specimens of *Petrolisthes armatus* under the name of *Petrolisthes similis*, sp. nov., and specimens so labelled were afterward sent to the Jardin des Plantes, Paris. These were seen by Professor Henderson, and are referred to in his report on the 'Challenger' Anomura, p. 109, as *P. similis* Stimps. But Stimpson, in publication, referred these speci-

mens to *P. armatus* . . . and never, so far as I can learn, published his *P. similis*."

The single record of *P. armatus* from the Galapagos Islands (Boone, 1932) may have been due to accidental introduction of the species in that area. On the whole, it appears to be conspicuously absent from the Pacific American offshore islands.

The local Peruvian name for the species is "Salamandra" according to R. E. Coker (Rathbun, 1910).

Borradaile (1898, pp. 464-467) believed the Indo-Pacific species *Petrolisthes asiaticus* (Leach), 1820, and *P. rufescens* (Heller), 1861, to be but varieties of *P. lamarckii* (Leach), 1820, and created another variety of the latter, *fibriatus*. Under "*P. lamarcki* var. *asiaticus*" he listed an extensive synonymy which included the American species *P. marginatus* Stimpson and *P. armatus* (Gibbes). Miyake (1942, 1943) considered *P. asiaticus*, *P. fibriatus*, and *P. lamarckii* to be distinct species, retaining *P. rufescens* as a variety of the latter. All these Indo-Pacific forms have been examined; *P. asiaticus*, which is the most closely related to *P. armatus*, lacks pubescence in the gape of the fingers and has fewer spines on the anterior margin of the merus of the walking legs. *P. marginatus* is only remotely allied to the Indo-Pacific species.

Ortmann (1897) extended the range of *Petrolisthes armatus* to the Indo-Pacific region on the basis of specimens examined by him in the Academy of Natural Sciences of Philadelphia. The present writer examined part of this material and found none of it to pertain to *P. armatus*; undoubtedly the remainder, which cannot now be located, refers to one or another of the Indo-Pacific species mentioned above.

The synonymies of *P. armatus* in the western and eastern Atlantic were recently listed by Haig (1956a) and Chace (1956), respectively.

*Range*: Eastern Pacific: Puerto Peñasco and San Felipe, Gulf of California, south to Bahía de la Independencia, Peru; Galapagos Islands (extralimital). Western Atlantic: Connecticut (extralimital); Gulf coast of Florida to Santa Catharina, Brazil; Bermudas. Eastern Atlantic: ?Gibraltar; Senegal to Angola; Ascension Island.



***Petrolisthes nobilii*, new species**

Plate 1; plate 18, fig. 3

?*Petrolisthes politus*, Nobili, 1897, p. 4. Rathbun, 1910, p. 600. Not *P. politus* (Gray).

*Petrolisthes armatus*, Boone, 1931, p. 151 (part). Not *P. armatus* (Gibbes).

*Previous records*: Panama. "Panama" [City?]: E. Festa (Nobili). Isla Taboguilla; Isla Pacheca and Isla Saboga, Islas de las Perlas: W. G. Van Name (Boone).

*Types*: Holotype, male, U. S. National Museum Cat. No. 99654, from Isla Taboguilla, Panama, shore; October 31, 1904; collected by the *Albatross*. Paratypes: 158 specimens from the same and 15 other stations (see Table 12). Museum of Comparative Zoology specimens from Cabo San Lucas and Islas de las Perlas, and American Museum of Natural History specimens from Isla Taboguilla and Islas de las Perlas, were not critically examined during the drawing up of the description and therefore are not designated paratypes.

*Diagnosis*: Carapace granulate and plicate; epibranchial spine absent or vestigial, but its position marked by a distinct notch; front sinuously triangular; carpus about two and a half times as long as wide, anterior margin with three low, wide-set teeth, a fourth rarely present; manus broad, outer margin curved; merus of walking legs with a row of spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description*: Carapace about as broad as long, or slightly broader; broadest posteriorly, the lateral margins sharply diverging posterior to the epibranchial angle. Gastric, frontal, and orbital regions covered with small flattened granules; epibranchial regions with rough transverse plications or large granules, continuing onto the posterolateral margins; posterior portion of carapace otherwise smooth or punctate. Front strongly produced, sinuously triangular, with a deep median sulcus; no supraocular spine. Orbits strongly oblique; outer orbital angle not produced. Epibranchial angle with a distinct notch, but spine absent or vestigial; rarely present. Carapace naked or lightly pubescent.

First movable segment of antenna with a strongly projecting, rounded, spine-tipped lamellar lobe; second granular, with a conical projection at the proximal end of the anterior margin; third nearly

smooth; flagellum naked. Outer maxillipeds rugose; inner lobe of the ischium usually ending in a sharp tooth.

Chelipeds subequal, naked or lightly pubescent. Merus rugose dorsally, more faintly so ventrally; armed on anterior margin with a rugose, strongly projecting lobe, usually rounded at tip. Carpus covered with flattened granules dorsally, faintly rugose to nearly smooth ventrally; about two and a half times as long as wide; armed on anterior margin with three low, wide-set, spine-tipped teeth, a fourth rarely present; granules along posterior margin enlarged and roughened, forming a low crest ending distally in a bifid spine, proximad to it another small spine. Manus evenly granular dorsally and ventrally; flat and broad, curved on outer margin which is unspined; a narrow band of short pubescence on ventral surface along outer margin. Fingers broad, granular as in manus, meeting for their entire length or slightly gaping in one cheliped; gape with a short pubescence.

Walking legs long and slender, lightly rugose dorsally, nearly smooth ventrally. Merus with a fringe of plumose hair on anterior margin, all segments with scattered plumose hairs and tufts of non-plumose setae; anterior margin of merus of leg 1 with three to eight (usually three to five) spines, of leg 2 with four to six, of leg 3 with one to seven (usually two to four); merus of leg 1 with two posterodistal spines, of leg 2 with one (rarely two), of leg 3 usually spineless, rarely with one spine.

*Measurements:* Male holotype: length 9.5 mm (width not recorded). Paratypes: males, 3.8 to 10.4 mm; non-ovigerous females, 4.6 to 8.8 mm; ovigerous females, 4.1 to 8.7 mm.

*Color:* Nearly all the material examined had lost its color in alcohol; a few specimens retain small red spots on the carapace.

*Ecology:* Intertidal zone, under stones. Ovigerous females have been collected in January, February, March, September, and October.

*Relationships:* *Petrolisthes nobilii* is very closely related to *P. politus* (Gray), 1831, of the western Atlantic; the two species may be considered analogues. They resemble each other in having the carapace broadest posteriorly, and in lacking an epibranchial spine. *P. politus* has a smoother carapace; it lacks the narrow line of pubescence on the under side of the manus which is characteristic of *P. nobilii*; there are three or four spines on the posterior margin of the carpus proximad to the posterodistal spine; and the gape of the fingers is usually without pubescence or is pubescent in one cheliped only.

The new species is also close to *Petrolisthes armatus* (Gibbes); the two occupy much of the same range. *P. nobilii* is most easily distinguished by the following characters: carapace triangular and broadest posteriorly, instead of being nearly as wide across the midbranchial regions as posteriorly; front somewhat narrower and more triangular; manus broader, its outer margin more strongly curved; a narrow band of short pubescence on ventral surface of manus along its outer margin, this pubescence lacking in *P. armatus*; a single spine on posterior margin of carpus proximad to the double posterodistal spine, while in *P. armatus* the number of these spines is variable, but usually two or three.

*Remarks:* Nobili (1897) reported a specimen of *Petrolisthes politus* (Gray) from "Panama"; by this he probably meant Panama City, in which case the specimen was undoubtedly *P. nobilii*. Apparently Nobili's record was the source of Rathbun's (1910) listing of "Panama" for *P. politus* in her checklist of Pacific coast crabs occurring from Panama to Isla Chiloe.

Boone (1931) reported *Petrolisthes armatus* (Gibbes) from several western Panamanian localities. This material was examined by the writer in the American Museum of Natural History; a portion of it proved to be *P. nobilii*.

This new species is named in honor of Giuseppe Nobili, in recognition of his contributions to west American carcinology.

*Range:* Cabeza Ballena, mouth of the Gulf of California, south to Punta Brava, Bahía de Santa Elena, Ecuador; Isla Isabel off the Mexican coast.

### *Petrolisthes robsonae* Glassell

Plate 18, fig. 2

*Petrolisthes armatus*, Hildebrand, 1939, p. 23. Not *P. armatus* (Gibbes).

*Petrolisthes robsonae* Glassell, 1945, p. 227, text-fig. 3 (type locality, Miraflores Locks, Panama Canal, Canal Zone). Haig, 1957b, p. 10.

*Previous records:* Panama. Miraflores Locks, Panama Canal, Canal Zone: S. F. Hildebrand (Hildebrand); Elinor D. Robson (Glassell). Bellavista, Panama City: Askoy (Haig).

*Diagnosis:* Carapace finely rugose; a single small epibranchial spine; front sinuously triangular; carpus a little over twice as long as

wide, anterior margin with two low, wide-set teeth; merus of walking legs with one or two spines on anterior margin, that of legs 1 and 2 spined at posterodistal angle.

*Description:* Carapace naked or lightly pubescent, finely and evenly rugose. Front sinuously triangular, with a shallow median sulcus; no supraocular spine. Outer orbital angle not produced. A single small epibranchial spine.

First movable segment of antenna with a spine-tipped lamellar lobe on anterior margin; second granular, with a proximal nodular projection on anterior margin; third nearly smooth; flagellum naked. Outer maillipeds rugose.

Chelipeds rugose. Merus armed on anterior margin with a small lobe, blunt or spine-tipped. Carpus a little over twice as long as wide, armed on anterior margin with two low, wide-set teeth, one submedian and the other at proximal end; surface with a longitudinal crest, strong in some specimens; posterior margin with a crest formed of oblique rugae, one to three of them developed into spines. Manus long and slender, outer margin serrate or with a row of spinules, and with a fringe of long hairs; outer half of lower surface often, but not always, densely covered with hairs to base of pollex. Gape of fingers with pubescence confined to proximal half of fingers, often produced into a long tuft.

Walking legs rugose; merus and carpus covered with plumose hairs and a few long, non-plumose setae, other segments with tufts of setae; anterior margin of merus of leg 1 spineless or with a single spine, of leg 2 with one or two spines, of leg 3 spineless or with one; merus of legs 1 and 2 with a posterodistal spine; carpus of legs 1, 2, and 3 with an anterodistal spine.

*Material examined:* See Table 13.

*Measurements:* Males, 5.4 to 8.0 mm; non-ovigerous females, 5.3 to 7.5 mm; ovigerous females, 4.7 to 7.3 mm. The largest specimen on record is the holotype male, which measures 8.6 mm in length, 8.0 mm in breadth.

*Color:* The color in life has not been recorded. Glassell (1945) noted that the carapace in specimens from the type series had a distinct pinkish tone in alcohol, with the pubescence on the carapace dark brown.

*Ecology:* *Petrolisthes robsonae* is remarkable in that it is able to withstand great changes in salinity, a phenomenon almost unique among porcellanids (see also Ecology under account of *Petrolisthes laeviga-*

*tus*). In the type description, Glassell (1945) stated that it was taken inside Miraflores Locks during one of their periodic cleanings, and that the water inside these locks varies greatly in saline content. Hildebrand (1939), who collected zoological specimens (including *P. robsonae*) in Miraflores Locks during the same cleaning period, late March of 1937, reported in more detail on conditions in these locks. When the sea level gates are opened, according to Hildebrand, salinity in the lower chambers is about that of the inner harbor; when water from Gatun Lake enters them, there is about a half and half mixture of harbor and lake water in the lower chambers. Under these adverse conditions many animals live in the lower chambers, among them Crustacea including *P. robsonae*. Hildebrand did not find crabs in the upper chambers of Miraflores Locks, where the water is almost fresh.

Unfortunately, no ecological data accompanied the rest of the known material of *P. robsonae*: four specimens from Mexico (no specific locality), one from Guayaquil, Ecuador, and five from Panama City reported earlier by the writer (Haig, 1957b). It would be of interest to know whether they were taken under conditions similar to those at the type locality.

Ovigerous females from the type series were collected in March.

*Relationships:* *Petrolisthes robsonae* is allied to *P. armatus* (Gibbes), from which it may be distinguished by the presence of two instead of three spines on the carpus of the chelipeds; the reduced number of spines on the merus of the first two pairs of walking legs; and the distinct anterodistal spine on the carpus of the walking legs. The pubescence on the ventral surface of the manus, given by Glassell as a distinguishing character, is indistinct or absent in some specimens.

*Remarks:* Among organisms collected in the Miraflores Locks of the Panama Canal, Hildebrand (1939) listed *Petrolisthes armatus* (Gibbes). These specimens, which were examined by the writer in the U. S. National Museum, proved to belong to *P. robsonae*. All but one of them were collected on the same day as the type series, which was taken by Elinor D. Robson.

Also seen was a female specimen (U. S. National Museum Cat. No. 98493) collected by Hildebrand on February 24, 1935, in the lowest channel of Gatun Locks on the Atlantic side of the Isthmus of Panama. This was probably an accidental introduction, for the species has not been reported elsewhere on the Atlantic coast. Its resistance to

changes in salinity may enable the species to traverse the Canal on the hulls of ships.

*Range:* Mexico (no specific locality reported) south to Guayaquil, Ecuador.

### ***Petrolisthes hirtipes* Lockington**

Plate 24, fig. 3

*Petrolisthes hirtipes* Lockington, 1878, pp. 395, 397 (type localities, Bahía Mulegé and Puerto Escondido, Gulf of California). A. Milne Edwards and Bouvier, 1894, p. 291. Schmitt, 1924b, p. 383. Glassell, 1936, p. 284; 1938a, p. 443. Steinbeck and Ricketts, 1941, p. 457, pl. 29, fig. 3.

*Petrolisthes hispidus*, A. Milne Edwards and Bouvier, 1894, p. 293, footnote.

#### *Previous records:*

Baja California. Bahía de la Magdalena: (Glassell 1936).

Gulf of California. Bahía de Tepoca, Sonora: F. Baker (Schmitt). Puerto Refugio, Isla Angel de la Guarda; Bahía de los Angeles; Bahía de San Carlos: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Bahía Mulegé; Puerto Escondido: (Lockington). Punta Marcial Reef; Bahía San Gabriel, Isla Espíritu Santo: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

*Lectotype:* Ovigerous female, 6.2 mm. in length by 6.4 mm in width, in Paris Museum, labelled "*Petrolisthes hirtipes* Lockington. Californie—Lockington 6-99 (Type)." This specimen is hereby designated lectotype at the request of Mr. Jacques Forest.

*Diagnosis:* Carapace finely plicate and lightly tuberculate; no epibranchial spine, but a tubercle or one or two minute spinules sometimes present at epibranchial angle; front trilobate; carpus about twice as long as wide, anterior margin with a row of strongly projecting, conical tubercles; manus with a thick fringe of hair on outer margin; fingers markedly dissimilar in the two chelipeds; merus of walking legs unarmed on anterior margin (anterodistal angle sometimes spine-tipped), that of legs 1 and 2 spined near distal end of posterior margin.

*Description:* Carapace flattened, covered with fine transverse plications, and with a few scattered tubercles anteriorly; surface covered with a short, velvety pubescence, latter forming a fringe on frontal region. Front trilobate, median lobe slightly broader than lateral lobes

and not strongly projecting beyond them; a deep median groove. Outer orbital angle slightly produced into a small tooth. No epibranchial spine, but usually a small tubercle or one or two minute spinules at epibranchial angle.

First movable segment of antenna with a strongly projecting, truncate, lamellar lobe, its margin granular; second with two or three small tubercles on anterior margin; third nearly smooth; flagellum with short hairs. Outer maxillipeds smooth.

Chelipeds pubescent, covered with scattered, strongly projecting conical tubercles. Merus with a narrow, conical, strongly projecting lobe on anterior margin. Carpus pubescent, about twice as long as wide; a small rounded lobe at proximal end of anterior margin, more in the form of a strongly projecting tooth in young specimens, this lobe and rest of anterior margin lined with a row of strongly projecting conical tubercles; no crest on posterior margin, latter ending distally in a long projection. Manus pubescent, covered with tubercles somewhat larger than those on carpus; outer margin with a broad, thick fringe of soft plumose hairs, continuing to tip of pollex and around "elbow" onto distal fourth of posterior margin of carpus. Dactylus with two longitudinal rows of large pointed tubercles. Fingers in the two chelipeds markedly dissimilar in males, less distinctly so in females and young: in one cheliped, fingers meeting for entire length, and gape with pubescence sometimes produced into a long, heavy tuft covering entire ventral surface of dactylus; in the other cheliped, dactylus and pollex blunt and curved, gaping for entire length, gape with a short pubescence.

Walking legs flattened, thickly covered with pubescence which forms anterior and posterior fringes in all segments; all segments with a few scattered conical granules. Merus without spines on anterior margin, but anterodistal angle sometimes spine-tipped; legs 1 and 2 with two or three spines near distal end of posterior margin, leg 3 without posterior spines, inflated.

*Material examined:* See Table 14.

*Measurements:* Males, 3.1 to 11.1 mm; non-ovigerous females, 3.4 to 11.0 mm; ovigerous females, 5.4 to 10.4 mm. A type specimen was reported to be 7 mm long by 6 mm wide.

*Color:* In alcohol, tubercles of chelipeds tipped with red; bent tip of dactyl bright red. (Lockington) Most of the specimens examined were a pale orange or rust color.

*Ecology:* Commonly found in the littoral under stones; rarely from coral in shallow water. Lockington reported it from 5 fathoms; the *Velero III* dredged it once in 10 fathoms from a sand and rock bottom, and once in 22 fathoms from a coral rock bottom.

Ovigerous females were taken in January, February, and March. Out of a total of 119 female specimens, only 14 were egg-bearing.

*Relationships:* The only species to which *Petrolisthes hirtipes* is at all closely related is *P. nigrunguiculatus* Glassell, which occupies approximately the same range.

*Remarks:* Of the extant syntype in the Paris Museum, here designated lectotype, Mr. J. Forest writes as follows: "Les pièces buccales du côté droit et plusieurs pattes ambulatoires manquent."

A. Milne Edwards and Bouvier (1894, p. 293, footnote) referred to *Petrolisthes hispidus*, apparently a *lapsus* for *P. hirtipes*. The absence of mouthparts on the right-hand side as noted by Forest in the preceding paragraph may be accounted for by the fact that those authors used the type specimen in a study of the structure of "le fouet exopodial des maxillipèdes antérieurs" of various porcellanids (see A. Milne Edwards and Bouvier, 1894, footnote, pp. 292-293).

*Range:* Bahía de la Magdalena, Baja California; entire Gulf of California, from Bahía Cholla south to Cabo San Lucas.

### ***Petrolisthes nigrunguiculatus* Glassell**

Plate 24, fig. 1

*Petrolisthes nigrunguiculatus* Glassell, 1936, p. 282 (type locality, Isla Santa Catalina, Gulf of California); 1938a, p. 443. Steinbeck and Ricketts, 1941, p. 457, pl. 29, fig. 5.

*Previous records:* Gulf of California. Bahía San Francisquito; Bahía de San Carlos; Puerto Escondido: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Isla Santa Catalina: S. A. Glassell (Glassell 1936). Bahía Amortajada; Punta Lobos, Isla Espíritu Santo: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

*Diagnosis:* Carapace nearly smooth; no epibranchial spine; front trilobate; carpus about twice as long as wide, proximal half or two-thirds of anterior margin with about four low, well-separated, roughly granulate lobes; manus with a thick fringe of hair on outer margin; fingers markedly dissimilar in the two chelipeds; merus of walking legs unarmed.



*Description:* Carapace flattened, posterolateral regions plicate, otherwise nearly smooth; faintly pubescent anteriorly. Front trilobate, lateral lobes narrow, pointed, and diverging, median lobe broad, with a deep median sulcus. Outer orbital angle only slightly produced. No epibranchial spine.

First movable segment of antenna with a distinct, truncate lobe; second granular; third nearly smooth; flagellum with short hairs. Outer maxillipeds smooth or punctate.

Chelipeds covered with rough granules. Merus with a large, strongly projecting lobe on anterior margin. Carpus about twice as long as wide, proximal half or two-thirds of anterior margin armed with about four low, well separated, roughly granular lobes; surface with large granules; a low crest on posterior margin, ending distally in a long projection. Manus with rough granules; outer margin with narrow, elongate tubercles, and with a broad, thick fringe of soft plumose hairs extending from proximal end to about half way onto pollex or nearly to tip of latter; surface without pubescence. Fingers in the two chelipeds markedly dissimilar in males, less distinctly so in females and young: in one cheliped, dactylus very narrow, pollex broad and truncate, fingers meeting for entire length, gape without pubescence; in the other cheliped, dactylus broader, hooked, pollex rounded at tip, fingers gaping, gape sometimes with a long, thick tuft of pubescence confined to proximal end of dactylus.

Walking legs flattened, faintly rugose, all segments thickly hairy. Merus without spines, not inflated; carpus with rough granules or spinules on anterior margin.

*Material examined:* See Table 15.

*Measurements:* Males, 3.0 to 9.6 mm; non-ovigerous females, 2.9 to 7.3 mm; ovigerous females, 4.6 to 8.8 mm. The male holotype measures 7.2 mm in length, 7.0 mm in breadth; an ovigerous female paratype, 7.5 by 7.3 mm.

*Color:* In life, thickly mottled with dark brown and red; tips of chelae light red; tomentum and fingers a dirty white. (Glassell, 1936) A characteristic feature of the species is a strong, dark brown or black stripe on the dactylus of the walking legs.

*Ecology:* Under rocks in the littoral, low and half tide levels. The specimen from Colombia was taken from sponge.

Ovigerous females have been collected in February, March, April, and December.

*Remarks:* Except for a single record, *Petrolisthes nigrunguiculatus* has been taken only in the Gulf of California. A specimen in the collections of the Hancock Foundation bears station number 418-35, which refers to Puerto Utría, Colombia. This specimen does not differ in any respect from Gulf of California material. The fact that it was recovered from a sponge suggests that the species should be looked for under similar conditions in intervening territory. On the other hand, there is a possibility that the wrong station number was placed with the specimen; until further material from south of the Gulf of California is recovered, the Colombian record should be accepted with caution.

*Range:* Gulf of California, from Isla Angel de la Guarda south to Cabo San Lucas. Extralimital: Puerto Utría, Colombia.

### ***Petrolisthes tuberculatus* (Guérin)**

Plate 24, fig. 2; text-fig. 3(1)

- Porcellana tuberculata* Guérin, 1835, p. 116 (type locality, Chile); 1838b, p. 7, pl. VII 26, fig. 2 (type locality restricted to Valparaiso); 1839, p. 175, pl. 52, fig. 2. H. Milne Edwards and Lucas, 1844, p. 34. Dana, 1852, p. 422. Cunningham, 1871, p. 495.
- Porcellana lobifrons* H. Milne Edwards, 1837, p. 256 (type locality, shores of Chile).
- Porcellana tuberculifrons*, Nicolet, 1849, p. 193 (error for *tuberculata*).
- Petrolisthes tuberculatus*, Stimpson, 1858, p. 227. Targioni-Tozzetti, 1872a, p. 399; 1872b, p. 471; 1877, p. 216, pl. 13, figs. 3, 3a-f. Cano, 1889, pp. 96, 99, 258. Ortmann, 1897, p. 290. Lenz, 1902, p. 746. Porter, 1903, p. 151. Rathbun, 1910, p. 600. Haig, 1955, pp. 43, 50.

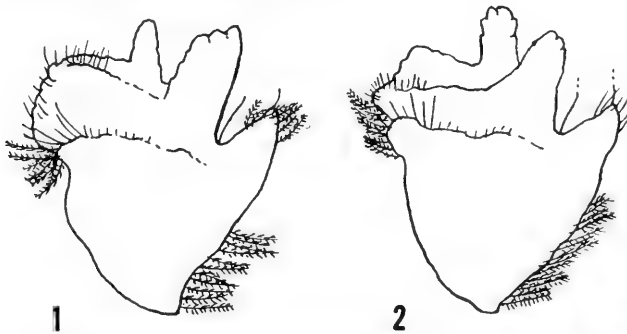
#### *Previous records:*

- Peru. San Lorenzo: U. S. Expl. Exped. (Dana).
- Chile. "Chile": (Guérin 1835); (H. Milne Edwards). Caleta Buena: R. Paessler (Haig). Iquique: F. Beumer (Haig). Iquique; Cavancho; Tocopilla: Lund Univ. Chile Exped. (Haig). Taltal: R. Paessler (Haig). Coquimbo: *Nassau* (Cunningham); L. H. Plate (Lenz). Península Coquimbo; Bahía Herradura de Guayacañ: Lund Univ. Chile Exped. (Haig). Herradura: F. T. Delfin (Porter). Montemar: Lund Univ. Chile Exped. (Haig). Valparaiso: *Favorite* (Guérin 1838b); U. S. Expl. Exped. (Dana); *Magenta* (Targioni-Tozzetti); *Vettor Pisani* (Cano). San An-

tonio: Lund Univ. Chile Exped. (Haig). Tumbes: L. H. Plate (Lenz). Bahía de San Vicente: Lund Univ. Chile Exped. (Haig).

*Diagnosis:* Carapace with a few large tubercles anteriorly, plicate posteriorly; no epibranchial spine; front strongly trilobate, lobes about equal in breadth, rounded at tips; carpus over twice as long as wide, proximal two-thirds of anterior margin produced into a strongly projecting lobe, its edge cut into about eight uneven, serrate-edged teeth; merus of walking legs unarmed.

*Description:* Carapace with a few large tubercles anteriorly, plicate posteriorly, finely pubescent. Front strongly trilobate, lobes about equal in breadth, narrow, rounded at tips, the median one more projecting, lateral ones diverging. Outer orbital angle produced into a strong, narrow tooth. No epibranchial spine.



Text-fig. 3. Basal segment of right antennule of 1, *Petrolisthes tuberculatus*, x 11; 2, *P. tuberculosus*, x 9.

First movable segment of antenna with a strongly projecting, granular lobe on anterior margin; second with scattered rough, projecting granules or small tubercles; third nearly smooth; flagellum naked or with vestigial hairs. Outer maxillipeds punctate or faintly rugose.

Chelipeds granular, finely pubescent. Merus with a strongly projecting pointed lobe on anterior margin. Carpus more than twice as long as wide; about the proximal two-thirds of anterior margin produced into a strongly projecting lamellar lobe, its edge cut into about eight uneven, serrate-edged teeth; surface with a longitudinal crest formed of large granules, flattened in adults and strongly projecting in young; a similar crest on posterior margin, ending distally in a large, strong tooth. Outer margin of manus thin-edged, with a fringe of hairs in young; surface with a longitudinal crest of large granules. Gape of fingers without a trace of pubescence.

Walking legs rugose, all segments with plumose and non-plumose hairs. Merus unarmed, that of leg 3 not inflated.

*Material examined:* See Table 16.

*Measurements:* Males, 4.3 to 20.0 mm; non-ovigerous females, 4.4 to 18.2 mm; ovigerous females, 7.8 to 18.9 mm. Guérin reported the maximum length to be about 20 mm. H. Milne Edwards gave 22.5 mm for the length of *Porcellana lobifrons*, which was based on some of the same specimens from which Guérin described *P. tuberculata*. Targioni-Tozzetti (1877) gave a length of 22 mm for a male specimen.

*Color:* Brownish red with a tinge of purple; prominent surfaces of the carapace blue with a purplish tinge; purplish below. (Dana)

*Ecology:* Taken under stones in the littoral. Lund University Chile Expedition specimens were collected in the lower and middle tidal zone, and (on one occasion) from holdfasts of a brown alga.

Ovigerous females have been collected in January, February, June, August, and November.

*Relationships:* *Petrolisthes tuberculatus* is apparently not closely related to any species except *P. tuberculosus* (H. Milne Edwards).

*Remarks:* Three of Guérin's type specimens from Valparaiso were seen in the Academy of Natural Sciences of Philadelphia, which also houses one specimen from the U. S. Exploring Expedition, labelled "Peru" (probably San Lorenzo).

*Range:* San Lorenzo, Peru, south to Bahía de San Vicente, Chile.

### ***Petrolisthes tuberculosus* (H. Milne Edwards)**

Plate 24, fig. 4; text-fig. 3(2)

*Porcellana affinis* Guérin, 1835, p. 116 (type locality, Chile). Preoccupied by *Porcellana affinis* Gray, 1831.

*Porcellana tuberculosa* H. Milne Edwards, 1837, p. 256 (type locality, shores of Chile). Guérin, 1838b, p. 8; 1839, p. 176. Nicolet, 1849, p. 194.

*Porcellana tuberculifrons* H. Milne Edwards and Lucas, 1843, p. 33 (new name). Dana, 1852, p. 422. Cunningham, 1871, p. 495. Not Nicolet, 1849, p. 193.

*Porcellana desmarestii*, White, 1847, p. 62. Not *Petrolisthes desmarestii* (Guérin).

*Petrolisthes tuberculifrons*, Stimpson, 1858, p. 227.

*Petrolisthes tuberculosus*, Stimpson, 1858, p. 228. Rathbun, 1910, p. 600.

*Petrolisthes affinis*, Ortmann, 1897, p. 290. Nobili, 1901a, p. 7; 1902, p. 235. Lenz, 1902, p. 746. Doflein and Balss, 1912, p. 35. Haig, 1955, pp. 43, 50, text-fig. 12. Not *P. affinis* (Gray).

*Previous records:*

Chile. "Chile": (Guérin 1835); (H. Milne Edwards); *Favorite* (Guérin 1838b); T. Bell (White). Taltal: R. Paessler (Haig). Coquimbo: *Nassau* (Cunningham); L. H. Plate (Lenz). Península Coquimbo; Bahía Herradura de Guayacán; Montemar: Lund Univ. Chile Exped. (Haig). Valparaiso: (H. Milne Edwards and Lucas); (Nicolet); U. S. Expl. Exped. (Dana). Tumbes: L. H. Plate (Lenz). San Vicente: F. Silvestri (Nobili). Bahía de San Vicente: Lund Univ. Chile Exped. (Haig). Chiloe: *Nassau* (Cunningham).

Coast of South America [probably Chile]: R. Paessler (Doflein and Balss).

*Diagnosis:* Carapace with groups of small tubercles anteriorly, rugose posteriorly; no epibranchial spine; front strongly trilobate, median lobe broad, rounded, and concave, lateral lobes narrow and truncate; carpus about twice as long as wide, anterior margin with two or three strong, uneven, serrate teeth followed by a number of denticles; merus of walking legs unarmed.

*Description:* Carapace with groups of small tubercles anteriorly, rugose on posterolateral regions; surface covered with a fine pubescence. Front strongly trilobate, lateral lobes narrow and truncate, median lobe broad, rounded at tip, with a deep concavity flanked on either side by a small tubercle. Outer orbital angle strongly produced into a long, narrow tooth. No epibranchial spine.

First movable segment of antenna with a low granular crest on anterior margin; second granular; third nearly smooth; flagellum naked, other segments pubescent. Outer maxillipeds nearly smooth or punctate.

Chelipeds granular, covered with a fine, short pubescence. Merus with a strongly projecting, pointed lobe on anterior margin. Carpus about twice as long as wide; armed on anterior margin with two or three strong, uneven, serrate-edged teeth, followed by a number of denticles; surface with a strong longitudinal crest, composed of small,

obliquely elongate tubercles; posterior margin with a crest formed of large oblique rugae, and ending distally in a large, strong tooth. Manus with a thin outer margin; gape with a short pubescence, confined to proximal half of fingers.

Walking legs rugose, all segments thickly covered with plumose hairs. Merus unarmed, that of leg 3 slightly inflated.

*Material examined*: Bahía de San Juan, Peru, shore; February 8, 1938; *Velero III* station 828-38; one male.

Península Coquimbo, Chile, shore; June 24, 1949; Lund University Chile Expedition station M127; one male (Allan Hancock Foundation, gift of H. Brattström).

Valparaiso, Chile; date and collector unknown; three dry specimens (Academy of Natural Sciences of Philadelphia Cat. No. 3578).

Talcahuano, Chile; April, 1872; *Hassler* Expedition; 12 males, 15 females (one ovigerous) (Museum of Comparative Zoology Cat. No. 7954).

*Measurements*: Males, 11.5 to 22.9 mm; non-ovigerous females, 11.0 to 25.7 mm; ovigerous females, 13.3 to 16.5 mm. The last measurement was of an ovigerous female collected by the *Hassler*, examined previously but not seen in connection with the present report. In his description of *Porcellana tuberculosa*, H. Milne Edwards gave the length of specimens as about 8 lines (18 mm). A 14 line (29.6 mm) specimen, the largest on record, was taken by the U. S. Exploring Expedition and reported by Dana (1852).

*Color*: Not recorded. Preserved specimens are reddish brown to pale buff.

*Ecology*: In the littoral, under stones. Ovigerous females were collected in April by the *Hassler*.

*Remarks*: The nomenclature of this species has been considerably confused. It was originally described by Guérin (1835) as *Porcellana affinis*, and redescribed two years later by H. Milne Edwards (probably from the same specimens) as *Porcellana tuberculosa*. Guérin (1838b), in his full report on the porcellanids briefly characterized by him in 1835, accepted H. Milne Edwards's name for the species because his own *Porcellana affinis* was preoccupied by *Porcellana affinis* Gray, 1831.

H. Milne Edwards and Lucas (1843) created the new name *Porcellana tuberculifrons* for this species, placing *P. affinis* Guérin in syn-

onymy with it. (At the same time they listed *P. lobifrons* H. Milne Edwards in the synonymy of *P. tuberculifrons*, evidently by error as they also placed the former name in the synonymy of *P. tuberculata* Guérin). Although they did not so state, H. Milne Edwards and Lucas may have intended the name *tuberculifrons* as a substitute for *tuberculosa*, to avoid confusion of the latter name with *tuberculata*. However, in spite of the unfortunate similarity of the names of two closely related species, *tuberculosa* as the oldest available name must stand for the form under consideration.

Nicolet (1849) properly used the name *Porcellana tuberculosa* for the species; however, he created further confusion by citing the related species, *Porcellana tuberculata* Guérin, as "*P. tuberculifrons* Guérin." It is apparent from his account that he attributed the name *tuberculifrons* to Guérin by error for *tuberculata*, and that he was not referring to *Porcellana tuberculifrons* H. Milne Edwards and Lucas = *P. tuberculosus* Guérin.

The name *Porcellana tuberculifrons* was used for the present species by Dana (1852) and Cunningham (1871). Stimpson (1858) listed it as *Petrolisthes tuberculifrons* and also as *Petrolisthes tuberculosus*, having apparently lost sight of the fact that the two are synonymous.

Ortmann (1897) returned to the use of the name *affinis* for the species, arguing that since Gray's *Porcellana affinis* was undefined, Guérin's *Porcellana affinis* is not a homonym. All subsequent writers have followed Ortmann in citing the species as *Petrolisthes affinis* (Guérin). However, Gray's description of *Porcellana affinis* is sufficient to validate it, although so brief that no species can be positively identified with it. (See also under account of *Petrolisthes tridentatus*.) Guérin's *affinis* is therefore not available for the present species.

The specimen collected by the *Velero III* at Bahía de San Juan is the first to be reported from Peru. Rathbun (1910) listed the species from Peru as well as Chile, but the source of her record has not been found.

*Range:* Bahía de San Juan, Peru, south to Chiloe, Chile.

**Petrolisthes tiburonensis** Glassell

Plate 25, figs. 1, 3

*Petrolisthes tiburonensis* Glassell, 1936, p. 284 (type locality, S end of Isla Tiburon, Gulf of California); 1938a, p. 444.

*Previous records:* Gulf of California. Puerto Refugio, Isla Angel de la Guarda; Bahía de los Angeles; S end Isla Tiburón: S. A. Glassell (Glassell 1936).

*Diagnosis:* Carapace with rough granules and plications, raised into rough transverse ridges; no epibranchial spine; front sinuously triangular, with a strong conical tubercle at tip and one on either side; carpus in males over three times as long as wide, anterior margin unarmed, margins subparallel; carpus in females and young about two and a half times as long as wide, anterior margin with a row of spinules, margins slightly converging distally; manus with a broad median longitudinal crest, outer margin unarmed in males, spinulose in females and young; merus of walking legs nodulose on anterior margin, unarmed at posterodistal angle.

*Description:* Carapace covered with rough granules and plications, regions well marked and separated by deep grooves; in females and young, especially, the plications raised into rough transverse ridges. Front sinuously triangular, with a distinct median groove; its margin with three well separated, strong conical tubercles, one at tip and one on either side half way between it and inner orbital angle; these tubercles more distinct and strongly projecting in females and young. Outer orbital angle produced into a small tooth. No epibranchial spine. Carapace naked in males, pubescent in females and young.

First movable segment of antenna with a strongly projecting, nodulate lobe; second and third nodulate, most markedly so in females and young; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose.

Chelipeds covered with fine granules. Merus with a low granular lobe on anterior margin. Carpus in males over three times as long as wide, margins subparallel; anterior margin unarmed; dorsal surface with a low longitudinal crest; posterior margin with a low crest covered with slightly enlarged granules, and ending distally in a small tooth. Carpus in females and young about two and a half times as long as wide, margins slightly converging distally; anterior margin armed



with about five spinules; dorsal crest more distinct than in males; crest on posterior margin similar to that of males. Manus with a broad median longitudinal crest extending to base of dactylus; outer margin with a thin, smooth crest, unarmed in males, in females and young with a row of spinules continuing nearly to end of pollex. Dactylus with a strong ridge on dorsal surface; gape with a thick pubescence, produced along proximal half or more of fingers into a long tuft.

Walking legs covered with small granules. Merus with three longitudinal crests, median one defined by two distinct grooves; anterior margin with a row of small nodules, these crests and nodules more distinct in females and young; not armed with spines; that of leg 3 not inflated. Carpus nodulate at proximal and distal ends of posterior margin; carpus and propodus with a low longitudinal crest. Last three segments with scattered tufts of short setae.

*Variations:* In small males (up to about 8.5 mm in some cases, although some smaller than this show the male characteristics), it was observed that female characters were present, particularly the shorter carpus and spinules on carpus and manus. One large male specimen had a small left cheliped, evidently regenerated, and this cheliped was of the female form although the rest of the specimen exhibited typical adult male characters.

*Material examined:* See Table 17.

*Measurements:* Males, 6.0 to 11.8 mm; non-ovigerous females, 3.8 to 8.3 mm; ovigerous females, 5.8 to 9.3 mm. The female holotype measures 9.2 mm in length, 10 mm in breadth; a male paratype, 10.5 by 10.8 mm.

*Color:* Color in life chocolate brown. (Glassell, 1936)

*Ecology:* Taken under stones in the littoral. The tide level was not noted for Hancock Foundation specimens, but the type series was collected at low tide.

Ovigerous females have been collected in December, January, February, and March.

*Remarks:* This species is remarkable for its strongly nodulated front and walking legs, and its sexual dimorphism.

*Range:* Gulf of California, from San Felipe south to Punta Trinidad.

**Petrolisthes rathbunae** Schmitt

Plate 26, fig. 2

*Petrolisthes rathbunae* Schmitt in Hilton, 1916, p. 72 (listed only), text-fig. 6 (not recognizable to species). Schmitt, 1921, p. 181 (description; type locality, San Clemente Island, California), pl. 32, fig. 3. Glassell, 1938a, p. 443. Hewatt, 1946, pp. 191, 195, 200.

*Previous records:* California. Monterey Bay; Santa Rosa Island: (Schmitt). Scorpion Harbor and between Pelican Bay and Prisoner's Harbor, Santa Cruz Island: W. G. Hewatt and W. Williams (Hewatt). Santa Monica Bay; San Pedro Bay: (Schmitt). Laguna Beach: W. A. Hilton (Hilton). Santa Catalina Island: (Schmitt). San Clemente Island: H. N. Lowe (Schmitt).

*Diagnosis:* Carapace with short, transverse, piliferous striations; no epibranchial spine; front triangular; carpus about two and a half times as long as wide, anterior margin sometimes spinuliferous, margins subparallel; merus of walking legs without spines on anterior margin, that of leg 1 with a very small spine at posterodistal angle.

*Description:* Carapace completely covered with short, transverse, piliferous striations, latter taking the form of large, flattened, imbricate tubercles on epibranchial region and smaller granules on front; regions distinct. Front triangular, with a deep median sulcus; no supraocular spine; inner orbital angle not produced. Outer orbital angle slightly produced. No epibranchial spine.

First movable segment of antenna with a strongly projecting, granular, lamellar lobe, the granules produced into spinules in small specimens; second roughly granular or rugose, armed with a distal spinule on anterior margin in small specimens; third roughly granular; flagellum with short hairs sometimes visible only under magnification. Outer maxillipeds rugose.

Chelipeds lightly pubescent. Merus rugose, armed on anterior margin with a strongly projecting rugose lobe. Carpus about two and a half times as long as wide, margins subparallel, covered with large flattened granules, some of the granules along anterior margin produced into spinules in small specimens; surface with a low median longitudinal crest covered with enlarged granules; posterior margin with an obliquely rugose crest ending distally in a sharp tooth. Manus granular, with a thin outer edge; inner margin with large, oblique, flattened tubercles. Dactylus with a longitudinal median crest composed of imbricate tuber-

cles, and an oblique row along margin forming a continuation with those of inner margin of manus; gape with a thick pubescence produced on proximal half of fingers into a heavy tuft.

Walking legs covered with short rugae from which arise tufts of long setae. Merus with a fringe of plumose hairs on anterior margin; that of leg 1 with a very small posterodistal spine, that of leg 3 not inflated.

Ventral surface of chelipeds and walking legs rugose; abdomen smooth.

*Variations:* In some specimens the hairs arising from the striations of the carapace are rather long, giving the entire carapace a distinctly hairy appearance.

*Material examined:* See Table 18.

*Measurements:* Males, 4.4 to 18.6 mm; non-ovigerous females, 6.6 to 17.2 mm; ovigerous females, 7.7 to 13.0 mm. The male holotype measures 18 mm by 17 mm.

*Color:* Carapace with dotted striations of dark maroon purple on a ground of greenish dark olive buff. Antennae bright maroon and eyes black. Chelae garnet brown, becoming lighter distally. Cutting edge and tips of fingers bright vermilion. Merus of ambulatory legs ochraceous buff dotted with maroon. Carpus and propodus dark garnet brown banded with orange red. Dactyls brilliant scarlet. Fourth ambulatory leg and visible portion of abdomen (in dorsal view) ochraceous buff densely spotted with maroon. Ventral side red orange except pterygostomian area which is garnet brown, and distal portion of maxillipeds bright orange red. (Petersen, of a live specimen from Santa Cruz Island)

"General ground color of salmon, fading out to a paler, more yellowish tint toward posterior edge of carapace, proximal portions of ambulatory legs, and on under parts, becoming bluish white on sternum. Flagella of antennae transparent claret color. Larger scale-like projections of rugae on anterior portion of carapace and chelipeds spotted with brick red, the two to three spots of red to each of the scales on the carapace giving it an apparently tuberculated appearance. Hairs yellowish. A few scattered spots of brick-red occur on the first few abdominal segments." (Schmitt, 1921, of a specimen preserved in formalin)

*Ecology:* This species commonly inhabits the lower intertidal zone, under stones. Ovigerous females are recorded for March, April, June, July, and December.

*Remarks:* Thanks to collecting activities of personnel from the Hancock Foundation's vessel *Velero IV*, the range of *Petrolisthes rathbunae* is extended to Isla Guadalupe, Baja California. Although Isla Guadalupe is known to have a rather high percentage of endemism in its fauna, no differences could be found between specimens of *P. rathbunae* from that island and those from California. This species is the first porcellanid to be reported from Isla Guadalupe.

*Range:* California mainland, from Monterey Bay south to Laguna Beach; Santa Rosa, Santa Cruz, Santa Catalina, San Clemente, and Guadalupe Islands.

### *Petrolisthes eriomerus* Stimpson

Plate 26, fig. 4

?*Porcellana eupicola*, Spence Bate, 1866, p. 277. Not *P. rupicola* Stimpson = *Petrolisthes cincitipes* (Randall).

*Petrolisthes eriomerus* Stimpson, 1871, p. 119 (type locality, Mendocino, California). Lockington, 1878, pp. 395, 397. Holmes, 1900, p. 108, pl. 1, fig. 15. Rathbun, 1904, p. 168. Way, 1917, p. 350, pl. 80, fig. 4. Schmitt, 1921, p. 180 (part), pl. 23, fig. 2; text-fig. 114. Johnson and Snook, 1927, p. 351, text-fig. 299. G. M. Smith, 1928, p. 164. Hart, 1930, p. 105; 1940, p. 89; 1953, p. 140. Clemens, 1933, p. 50. Glassell, 1938a, p. 443; 1945, p. 224. Ricketts and Calvin, 1939, p. 171 (part). Rigg and Miller, 1949, p. 343. Light, 1954, pp. 183, 186. Not Boone, 1931, p. 154, text-fig. 8; 1932, p. 52, text-fig. 16. Probably not Hilton, 1916, p. 72.

?*Petrolisthes rupicolus*, Newcombe, 1893, p. 30 (part).

?*Petrolisthes cincitipes*, Calman, 1898, p. 260. Lenz, 1901, p. 451 (part). Taylor, 1912, pp. 191, 208.

#### *Previous records:*

British Columbia. Langara Island, Queen Charlotte Islands: (Hart 1953). Flamingo Inlet and W side Louscoone Bay, Queen Charlotte Islands: C. M. Fraser (Hart 1940). West coast Vancouver Island: Esperanza Inlet; Nootka Sound; Clayoquot Sound: E. G. Hart (Hart 1940). East coast Vancouver Island: Strait of Georgia; Baynes Sound near Comox: C. F. Newcombe (Newcombe) [probably this species]. Nanaimo: G. W. Taylor (Taylor) [probably this species]. Ross Bay: (Hart 1930). Near Sidney: G. M. Smith (Smith). Victoria: C. F. Newcombe (Newcombe) [probably this species]. Esquimalt Harbor: J. K. Lord (Spence Bate) [prob-

ably this species]. Gonzales Point; Parry Bay; Horswell Point: (Hart 1930). Bare Island between Vancouver Island and the mainland: Schauinsland (Lenz) [probably this species].

Washington. Friday Harbor, San Juan Islands: E. Way (Way). Neah Bay, Juan de Fuca Strait: (Rigg and Miller). Hope Island: G. W. Taylor (Taylor) [probably this species]. Puget Sound: Columbia Univ. Exped. (Calman) [probably this species]. Puget Sound: (Ricketts and Calvin). Seattle: (Schmitt).

California. Humboldt County: (Holmes). Mendocino: A. Agassiz (Stimpson). Point Mendocino: S. J. Holmes (Holmes). San Francisco Bay: (Holmes). Pacific Grove: (Rathbun). San Miguel, Santa Rosa, and Santa Cruz Islands: (Glassell 1945).

*Diagnosis:* Carapace with rough granules and small tubercles anteriorly, nearly smooth posteriorly; no epibranchial spine; front triangular; carpus twice as long as wide, covered with large rough granules and small tubercles, anterior margin unarmed or with a few spinules, margins subparallel; outer margin of manus with a low crest; merus of walking legs unarmed.

*Description:* Carapace covered anteriorly with rough granules, forming small tubercles on protogastric, hepatic, and epibranchial regions, the grooves defining these regions distinct; posterolateral regions plicate. Front broad, triangular, with a deep median sulcus; no supraocular spine; inner orbital angle not produced. Outer orbital angle very slightly produced. No epibranchial spine. Carapace naked or lightly pubescent.

First movable segment of antenna with a strongly projecting lobe on anterior margin; second granular, often with a tubercle near distal end of anterior margin; third granular; flagellum naked or with vestigial hairs. Outer maxillipeds lightly rugose.

Chelipeds covered with scattered large granules. Merus with a strongly projecting, rugose or granular lobe on anterior margin. Carpus twice as long as wide, lightly pubescent, anterior and posterior margins subparallel; in some young specimens, a few granules along anterior margin produced into small spinules; surface covered with large, rough granules and with a low, narrow, median longitudinal crest; posterior margin with a strong, obliquely rugose crest ending distally in a sharp tooth. Manus with a low longitudinal carina from base of dactylus, outer margin bearing a low, smooth, rounded crest. Gape with

a thick pubescence produced on proximal half of fingers into a long tuft.

Walking legs granular; merus unarmed, that of leg 3 not inflated; merus and carpus covered with plumose and non-plumose hairs, propodus and dactylus with long tufts of hairs.

*Material examined:* See Table 19.

*Measurements:* Males, 4.4 to 15.1 mm; non-ovigerous females, 3.8 to 15.0 mm; ovigerous females, 3.9 to 12.6 mm. The size of the type specimen was not recorded.

*Color:* Reddish brown mottled with varying amounts of blue . . . At least part of outer maxilliped and proximal internal angle of dactylus of cheliped a bright porcelain blue. (Hart, 1930)

*Ecology:* In general, *Petrolisthes eriomerus* occurs under stones in the lower part of the tidal zone from the northern part of its range south to San Luis Obispo County, California. It has occasionally been taken from submerged jetties, eelgrass roots, and kelp holdfasts. Way (1917) reported it from 25 fathoms at Friday Harbor, Washington. Glassell's (1945) record for the northern Santa Barbara Islands does not specify depth of capture, but the *Velero III* and *IV* dredged it in that area at a depth of 5 to 30 fathoms, and the *Velero III* took it off Anacapa Island in 45-47 fathoms (substrates of rock, gravel, sand, and shell). The only mainland record south of San Luis Obispo County is La Jolla, where it was collected from kelp beds, probably also at several fathoms' depth. *P. eriomerus* is often found associated with *Pachycheles pubescens* Holmes, which like it characteristically inhabits the intertidal zone from British Columbia to San Luis Obispo County, California, and deeper water off the Channel Islands and the mainland to the south.

*Remarks:* Female and juvenile specimens of *Petrolisthes manimaculis* Glassell, with rough granules on the anterior regions of the carapace and on the carpus of the chelipeds, often resemble *P. eriomerus* very closely. The two species may always be distinguished by the length-width ratio of the carpus. In *P. manimaculis* the length of the carpus is not less than 2.4 times the width; in *P. eriomerus* it seldom exceeds two times the width, and is never as much as 2.4 times.

*Range:* Queen Charlotte Islands, British Columbia, south to La Jolla, California; off Santa Barbara Islands. Shore to 47 fathoms.

**Petrolisthes manimaculis** Glassell

Plate 27, fig. 1

*Petrolisthes eriomerus*, ?Hilton, 1916, p. 72. Schmitt, 1921, p. 180 (part). ?Ricketts and Calvin, 1939, p. 171 (part). Not *P. eriomerus* Stimpson.

*Petrolisthes gracilis*, Schmitt, 1921, p. 181 (part), pl. 32, fig. 4. Not *P. gracilis* Stimpson.

*Petrolisthes manimaculis* Glassell, 1945, p. 223, text-fig. 1 (type locality, Morro Bay, California). Light, 1954, pp. 183, 186.

*Petrolisthes* sp., Hewatt, 1946, p. 200.

*Previous records:*

California. Moss Beach, San Mateo County: R. Fields and E. Benton (Glassell). Half Moon Bay: (Schmitt) [as *P. eriomerus*]. Monterey Bay; Pacific Grove: (Schmitt) [as *P. gracilis*]. Morro Bay: S. A. Glassell (Glassell). Santa Cruz Island: W. G. Hewatt and W. Williams (Hewatt). Newport Bay: (Ricketts and Calvin) [probably this species]. Santa Catalina Island: (Schmitt) [as *P. gracilis*]. Laguna Beach: (Hilton) [probably this species]. Spindrift Beach, La Jolla: S. A. Glassell (Glassell).

Baja California. "Lower California": (Schmitt) [as *P. eriomerus*; probably this species].

*Diagnosis:* Carapace smooth to granulate anteriorly, nearly smooth posteriorly; no epibranchial spine; front triangular; carpus a little over twice to nearly three times as long as wide, anterior margin unarmed, margins subparallel; outer margin of manus with a thin edge; merus of walking legs unarmed.

*Description:* Carapace usually a little broader than long, somewhat granular, sometimes quite roughly so, on anterior regions; nearly smooth posteriorly, posterolateral regions with short, faint plications. Front triangular, with a deep median groove; no supraocular spine; inner orbital angle not produced. Outer orbital angle not produced. No epibranchial spine. Carapace naked, or with a few scattered hairs in some small specimens.

First movable segment of antenna with a thick projecting ridge on anterior margin; second and third nearly smooth to slightly nodulate; flagellum naked. Outer maxillipeds lightly rugose.

Chelipeds in large specimens finely granular, appearing almost smooth; in females and small specimens sometimes rather roughly granular, especially on carpus and proximal part of manus. Merus with a

strongly projecting lobe on anterior margin. Carpus from a little less than two and a half to nearly three times as long as wide, in females and young not exceeding about 2.4 times, margins subparallel; one or two minute spinules near proximal end of anterior margin sometimes present in young; a low, obliquely rugose crest along posterior margin, ending distally in a tooth, the groove defining this crest filled with short plumose hairs. Manus naked, with a thin outer margin. Fingers long and slender; gape with a thick pubescence, usually extending nearly to tips of fingers, and in proximal half of their length produced into a long tuft.

Walking legs smooth to finely granular; merus not inflated, unarmed with spines, all segments covered with scattered tufts of plumose and non-plumose hairs.

*Material examined:* See Table 20.

*Measurements:* Males, 3.4 to 16.2 mm; non-ovigerous females, 4.2 to 12.0 mm; ovigerous females, 5.1 to 11.5 mm. Glassell reported the male holotype to be 15.3 mm in length by 16.0 mm in breadth.

*Color:* "Ground color a rich brown, almost a red-chocolate, with large and small blue dots, giving the effect of blue lines, although they are actually a series of blue dots running together, this same effect being on the carpus and fingers of the hand. Median longitudinal ridge of the palm with a row of turquoise-blue spots. Legs a tan spotted with bluish white. Palp of maxillipeds margined with blue, inner proximal base of dactyl orange." (Glassell, 1945, of a live specimen from color note by Kirk.)

*Ecology:* "This species occupies the lower levels of the intertidal zone. Its vertical range may be assumed not to exceed the mean low-water level. It, like most members of the genus, demands the shelter of rocks and weeds, uninfluenced by drifting sands." (Glassell, 1945)

All Hancock Foundation material was shore collected, with minus tides recorded in three cases. Since the zonation of various species from each collecting station was not critically studied, nothing can be added to Glassell's observations, above.

Ovigerous females are recorded for all months from October through March, and in June.

*Remarks:* Glassell (1945) showed that California specimens referred by Schmitt (1921) to *Petrolisthes gracilis* Stimpson were actually *P. manimaculis*. The reference by Schmitt in the same paper to *P. erio-*



*merus* Stimpson from Half Moon Bay, California, was also based on specimens of *P. manimaculis*, as determined by the present writer who saw the Half Moon Bay material in the U. S. National Museum. Schmitt's reference to "Lower California" as the southern extent of the range of *P. eriomerus* may also be based on *P. manimaculis*, for *P. eriomerus* is not known to occur that far south. It is believed that Hilton's (1916) reference to *P. eriomerus* from Laguna Beach, and Ricketts and Calvin's (1939) to the same species from Newport Bay, may very possibly be based on *P. manimaculis*; although *P. eriomerus* occurs as far south as La Jolla, it appears to be confined to fairly deep water in the southern part of its range.

*Range*: Bodega Bay, California, south to Punta Eugenia, Baja California.

### ***Petrolisthes gracilis* Stimpson**

Plate 27, fig. 2

*Petrolisthes gracilis* Stimpson, 1858, p. 227 (listed only; type locality, Gulf of California); 1859, p. 74 (description; type locality restricted to Guaymas). Lockington, 1878, pp. 395, 396. Rathbun, 1910, p. 599. Schmitt, 1921, p. 181 (part; not pl. 32, fig. 4); 1924b, p. 383. Glassell, 1938a, p. 443. Steinbeck and Ricketts, 1941, p. 456, pl. 29, fig. 4. Not Nobili, 1901b, p. 13.

*Petrolistes gracilis*, Sivertsen, 1933, pl. 3, fig. 31 (not p. 8, pl. 3, fig. 30).

*Previous records*: Gulf of California. Bahía de Tepoca, Sonora: F. Baker (Schmitt 1924b). Bahía de los Angeles: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Bahía de San Carlos: F. Baker (Schmitt 1924b); J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Puerto San Carlos, Sonora: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Guaymas, Sonora: C. M. P. Stone (Stimpson 1859). Bahía San Gabriel, Isla Espíritu Santo: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

*Diagnosis*: Carapace nearly smooth; no epibranchial spine; front sinuously triangular to trilobate; carpus two and a half to three times as long as wide, anterior margin unarmed, margins subparallel; outer margin of manus with a thin edge; merus of walking legs unarmed, naked or nearly so.

*Description*: Carapace smooth, punctate, or very finely and evenly granulate. Front sinuously triangular, median groove not distinct; no

supraocular spine; inner orbital angle broad and rounded, slightly to distinctly produced, the front in the latter case appearing distinctly trilobate. Outer orbital angle only slightly produced. No epibranchial spine. Carapace naked.

First movable segment of antenna with a strongly projecting lobe; second and third nearly smooth; flagellum with short hairs. Outer maxillipeds punctate or lightly rugose.

Chelipeds finely granular, appearing almost smooth, devoid of hairs. Merus with a strongly projecting, distally directed, rounded lobe on anterior margin. Carpus two and a half to three times as long as wide, margins subparallel; a low, obliquely rugose crest on posterior margin, ending distally in a sharp tooth. Manus long and slender, with a thin outer margin. Fingers long, curved; gape with a thick pubescence extending nearly to tips of fingers, not produced into a longer tuft proximally.

Walking legs smooth or punctate; merus not inflated, not armed with spines, naked or with a few scattered setae on margins; other segments covered with long setae.

*Variations:* In some specimens the inner orbital angles appear only very slightly produced; in others they are very strongly produced, so that the front is distinctly trilobate. In long series of specimens it was observed that the inner orbital angles show a gradation between these two extremes.

*Material examined:* See Table 21.

*Measurements:* Males, 2.7 to 10.2 mm; non-ovigerous females, 2.7 to 7.8 mm; ovigerous females, 3.7 to 8.0 mm. The type was reported to be .44 inch in length by .41 inch in breadth (about 11.0 by 10.4 mm).

*Color:* Carapace dull bluish green with evenly placed small white spots. Eyes reddish brown. Antennules yellow green with flame scarlet tips. Antennae dull chrome yellow. Chelae and ambulatory legs same color as carapace but a little lighter. Small scarlet area at the base on inner side of movable finger. Tips of fingers light orange. Dactyls of ambulatory legs dull orange. Ventral side dull bluish green. Inner distal portion of maxillipeds brilliant Matthews blue. (Petersen, of a live specimen from Isla Angel de la Guarda)

In alcohol, some specimens show small orange spots on the chelipeds and walking legs. A characteristic marking, found in some but not all individuals, is a broad black stripe on the propodus of the walking legs;

it is shown in Plate 27, fig. 2 and in the specimen illustrated by Steinbeck and Ricketts (1941, pl. 29, fig. 4).

*Ecology:* *Petrolisthes gracilis* is almost strictly a littoral species; Hancock Foundation collectors took it from under stones at all stations but one, where it was recovered from coral. It was dredged by the *Velero III* on two occasions: in 10 fathoms from a bottom of sand and rock, and in 18-25 fathoms from a sand bottom.

Ovigerous females have been collected in every month from January through June.

*Remarks:* Although Stimpson's description of *Petrolisthes gracilis* was unsatisfactorily brief and his type specimen is no longer extant, the Gulf of California type locality is sufficient to identify the species; no other *Petrolisthes* with which it might be confused occurs in the Gulf. *P. gracilis* is a Gulf of California endemic and, like some other Gulf of California endemic species, is established at the southern end of the outer Baja California coast and on the Tres Mariás Islands. The *Velero III* record from Bahía Tangola-Tangola should be accepted with caution, pending additional recoveries of the species along the Mexican mainland south of the Gulf of California. California specimens identified with *P. gracilis* by Schmitt (1921) belong to a distinct species, *P. manimaculis* Glassell; Nobili's (1901b) Ecuador record was based on *P. tridentatus* Stimpson.

*Range:* Bahía de Santa María, Baja California; Gulf of California, from Punta Peñasco and San Felipe south to La Paz; Islas Las Tres Mariás. Extralimital: Bahía Tangola-Tangola, Mexico. Shore; rarely to 25 fathoms.

### ***Petrolisthes tridentatus* Stimpson**

Plate 25, fig. 4

Restricted synonymy:

?*Porcellana affinis* Gray, 1831, p. 15 (type locality unknown). H. Milne Edwards, 1837, p. 257. White, 1847, p. 63.

*Petrolisthes tridentatus* Stimpson, 1858, p. 227 (listed only; type locality, Antilles); 1859, p. 75, pl. 1, fig. 4 (description; type localities restricted to Barbados and St. Thomas). Schmitt, 1935, pp. 185, 187, text-fig. 47. Haig, 1957b, p. 8.

*Petrolisthes gracilis*, Nobili, 1901b, p. 13. Not *P. gracilis* Stimpson. *Petrolisthes eriomerus*, Boone, 1931, p. 154 (part), text-fig. 8. Not *P. eriomerus* Stimpson.

*Previous Pacific records:*

Panama. Isla Taboguilla: W. G. Van Name (Boone); (Schmitt).

Guayabo Chiquito: *Askoy* (Haig).

Colombia. Bahía Limón, Golfo de Cupica: *Askoy* (Haig).

Ecuador. Bahía de Santa Elena: E. Festa (Nobili).

*Diagnosis:* Carapace nearly smooth; no epibranchial spine; front trilobate, the lateral lobes narrow and diverging; carpus one and a half to two times as long as wide, anterior margin unarmed, margins slightly converging distally; outer margin of manus with a thin edge; merus of walking legs unarmed.

*Description:* Carapace finely and evenly granular or nearly smooth, regions not distinct. Front trilobate, the lateral lobes narrow, diverging, median lobe broad, triangular, with a distinct groove. Outer orbital angle only slightly produced. No epibranchial spine. Carapace naked or with traces of pubescence in small specimens.

First movable segment of antenna with a projecting lamellar lobe; second and third nearly smooth; flagellum with short hairs. Outer maxillipeds lightly rugose.

Chelipeds finely granular, often appearing almost smooth, naked or with slight traces of hairs. Merus with a strongly projecting, distally directed lobe on anterior margin. Carpus one and a half to two times as long as wide, margins very slightly converging distally; anterior margin unarmed; a low, obliquely rugose crest on posterior margin, ending distally in a small sharp tooth. Manus with a thin outer margin. Fingers long and slender, gape with a short pubescence.

Walking legs finely granular; merus not inflated, not armed with spines, all segments covered with long setae.

*Material examined:* See Table 22.

*Measurements:* Males, 2.5 to 6.3 mm; non-ovigerous females, 2.9 to 4.4 mm; ovigerous females, 3.0 to 4.9 mm. Stimpson's type was recorded as 0.20 inch in length, 0.19 inch in breadth (about 5.0 by 4.8 mm).

*Color:* According to Stimpson (1859), the carapace is usually spotted with red, and streaked down the middle with whitish; the chelipeds are dark reddish and legs banded. The examined material was bleached from preservation in alcohol, but some specimens showed faint traces of reddish spots on the carapace.

*Ecology:* *Petrolisthes tridentatus* appears to be a strictly littoral species, and has been taken only under stones. In the Pacific, ovigerous females have been taken in January, February, March, May, October, and December.

*Remarks:* *Petrolisthes tridentatus*, originally described from the western Atlantic, was first reported on the Pacific coast by Schmitt (1935), who mentioned its occurrence at Isla Taboguilla, Panama. The specimens on which this record was presumably based, three males and nine females collected in 1904 by the *Albatross*, were examined by the present writer.

Haig (1957b) reported Pacific coast specimens taken by the *Askoy* in Colombia and Panama, and also identified as this species a specimen from Ecuador referred by Nobili (1901b) to *Petrolisthes gracilis* Stimpson.

Boone (1931) listed seven specimens from Isla Taboguilla, Panama, as *Petrolisthes eriomerus* Stimpson. This material was re-examined by the present writer in the American Museum of Natural History; six of the specimens (including the one figured) proved to belong to *P. tridentatus*, while the seventh is *P. platymerus*, described herein.

Gray (1831) very briefly described *Porcellana affinis* from among British Museum porcellanids without locality data. H. Milne Edwards (1837) repeated Gray's description; White (1847) listed the species, noting that Gray's specimens were three in number. Stimpson (1859, p. 75) suggested that *P. affinis* might be the same as his *Petrolisthes tridentatus*. According to Dr. Isabella Gordon, of whom the present writer requested additional information on *Porcellana affinis*, Gray's three syntypes are still extant in the British Museum, but are dry and in poor condition and unaccompanied by any data. Camera lucida sketches provided by Dr. Gordon show that the front, orbits, chelipeds, and walking legs agree very closely in form with those of *Petrolisthes tridentatus*. However, without evidence that Gray's types came from one of the American coasts, the two species cannot be proved to be identical.

*Range:* Bahía de Salinas, Costa Rica, south to Isla Puná, Ecuador. Also western Atlantic, throughout the Caribbean area.

***Petrolisthes galapagensis*, new species**

Plate 2; plate 25, fig. 2

*Petrolisthes eriomerus*, Boone, 1932, p. 52, text-fig. 16. Not *P. eriomerus* Stimpson.

*Previous records*: Galapagos Islands. Bahía de Gardner, Isla Hood: W. Beebe on *Arcturus* (Boone).

*Types*: Holotype, male, U. S. National Museum Cat. No. 102403, from Black Bight, Isla Albemarle, Galapagos Islands, rocky shore; February 8, 1933; collected during Allan Hancock Pacific Expedition of 1933 at *Velero III* station 62-33. Paratypes: 65 specimens from the same and seven other stations (see Table 23).

*Diagnosis*: Carapace subquadrate, its margins subparallel posterior to epibranchial angle, nearly smooth; no epibranchial spine; front triangular; carpus one and a half to two times as long as wide, anterior margin unarmed, margins subparallel; manus with a low crest on outer margin; fingers blunt, often short and stubby; merus of walking legs unarmed.

*Description*: Carapace about as broad as long, subquadrate, lateral margins nearly parallel behind epibranchial angle; nearly smooth, covered anteriorly with fine granules and posteriorly with light plications; grooves marking the various regions distinct. Frontal region deflexed; front strongly produced, triangular, with a distinct median groove extending to between protogastric lobes; no supraocular spine; inner orbital angle not produced. Orbits rather shallow; outer orbital angle only slightly produced. No epibranchial spine. Carapace naked.

First movable segment of antennae faintly granular, with a low crest on anterior margin; second and third nearly smooth or faintly granular, without anterior projections; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose.

Chelipeds naked, finely granular dorsally, appearing almost smooth; ventral surface smooth. Merus with a broad, low, rounded granular lobe on anterior margin. Carpus one and a half to two times as long as wide, margins subparallel; posterior margin with a low, obscurely rugose crest scarcely produced distally, this crest defined by a narrow, often obsolescent longitudinal groove. Manus flat, its outer edge with a low, smooth crest extending onto pollex. Fingers blunt, curved at tips, cutting edges without teeth; in one cheliped usually short, stubby,

and gaping. Gape with a thick, fine pubescence, extending nearly to tip of fingers, completely filling gape but not produced into a tuft.

Walking legs finely granulate or punctate. Merus unarmed, with long scattered setae near posterior margin and a few on dorsal surface and anterior margin, that of leg 3 not inflated; carpus, propodus and dactylus thickly covered with long and short scattered setae.

*Measurements:* Holotype male: length 10.2 mm, width 10.1 mm. Paratypes: males, 4.0 to 8.9 mm; non-ovigerous females, 3.9 to 7.0 mm; ovigerous females, 4.4 to 7.2 mm. The specimen recorded by Boone (1932) as *Petrolisthes erimerus* was reported to be 13 mm in length.

*Color:* No trace of color remained on any of the specimens examined.

*Ecology:* Hancock Expeditions specimens were taken in the intertidal zone under stones, where they were frequently found with *Petrolisthes tonsorius*, new species. The specimen reported by Boone from the *Arcturus* Expedition was recovered in 2½ fathoms from a coral rock bottom.

Ovigerous females were collected in December, January, and February.

*Remarks:* The specimen reported by Boone (1932) as *Petrolisthes erimerus* Stimpson was not examined by the writer, but may readily be identified with *P. galapagensis* from the accompanying photograph.

*Range:* Known only from the Galapagos Archipelago, at Islas Albe-marle, Bartolomé, James, Indefatigable, Charles, and Hood.

### ***Petrolisthes tonsorius*, new species**

Plate 3; plate 26, fig. 1

*Petrolisthes cincitipes*, Boone, 1932, p. 49, text-fig. 15. Not *P. cincitipes* (Randall).

*Petrolisthes* near *cincitipes*, Schmitt, 1939, p. 11.

#### *Previous records:*

Mexico. Bahía de Braithwaite, Isla Socorro: Presidential Cruise of 1938 (Schmitt).

Galapagos Islands. Bahía de Gardner, Isla Hood: W. Beebe on *Arcturus* (Boone).

*Types:* Holotype, male, U. S. National Museum Cat. No. 102404, from south of Cabo Berkeley, Isla Albemarle, Galapagos Islands, rocky

shore; February 10, 1933; collected during Allan Hancock Pacific Expedition of 1933 at *Velero III* station 68-33. Paratypes: 178 specimens from the same and 16 other stations (see Table 24).

*Diagnosis:* Carapace subquadrate, its margins subparallel posterior to epibranchial angle, nearly smooth; no epibranchial spine; front narrow, triangular; carpus one and a half to two times as long as wide, proximal two-thirds of anterior margin with a strong lobe, distal third subparallel with posterior margin; manus with a low, slightly rounded crest on outer margin; fingers blunt, sometimes short and stubby; merus of walking legs unarmed, that of leg 3 inflated.

*Description:* Carapace about as broad as long, subquadrate, lateral margins nearly parallel behind epibranchial angle; nearly smooth, covered anteriorly with fine granules and posteriorly with light plications; grooves marking the various regions distinct. Frontal region deflexed; front strongly produced, narrow, triangular, with a deep median groove extending to between protogastric lobes; no supraocular spine; inner orbital angle usually not produced, but in some specimens slightly produced, making the front appear sinuously triangular or, in frontal view, somewhat trilobate. Orbits rather shallow; outer orbital angle produced into a small, narrow tooth. No epibranchial spine. Carapace naked.

First movable segment of antenna faintly granular, with a low crest on anterior margin; second and third faintly granular, without anterior projections; flagellum with short, close-set hairs, many long hairs interspersed with them. Outer maxillipeds smooth or lightly punctate.

Chelipeds naked, covered with small flattened granules on dorsal surface, smooth ventrally. Merus with a small granular lobe on anterior margin. Carpus one and a half to two times as long as wide, the granules on its surface often a little larger than those on rest of cheliped; a strong lobe occupying about proximal two-thirds of anterior margin, anterior and posterior margins converging to this point, subparallel in distal third; a broad, shallow longitudinal groove on dorsal surface near posterior margin, defining a low marginal crest, the latter scarcely produced distally; anterior to this groove a faint swelling or crest, often obsolescent. Manus highest near inner side, outer edge thin but slightly rounded into a low, smooth crest extending onto pollex. Fingers blunt, curved at tips, cutting edges without teeth; dactylus a little shorter than pollex; fingers usually meeting for entire length, but in some specimens short, stubby, and gaping in one cheliped. Gape with a short, thick, fine pubescence extending nearly to tips of fingers.



Walking legs finely granular. Merus unarmed, with a short fringe of plumose hairs on anterior margin, that of leg 3 inflated; carpus naked or with traces of setae, and with a longitudinal crest on dorsal surface; propodus and dactylus with tufts of setae.

*Variations:* In some specimens the lobe on the anterior margin of the carpus is less produced than in others, but it always extends for about two-thirds the length of the margin.

As noted above, occasional specimens show a tendency toward a trilobate front. They are not otherwise separable from those in which the inner orbital angles are not produced, and it is not proposed at this time to separate them on this basis alone.

*Measurements:* Holotype male: length 10.2 mm, width 10.2 mm. Paratypes: males, 2.9 to 11.6 mm; non-ovigerous females, 3.5 to 8.8 mm; ovigerous females, 3.8 to 8.7 mm.

*Color:* After more than twenty years in alcohol, a few specimens show a dark blue-violet on the metabranchial regions of the carapace, ringed by a darker line of the same color; this shade of blue is also present on the eyestalks, movable segments of the antennae, walking legs, telson of the abdomen, and palps of the maxillipeds. This suggests that in life the color of *Petrolisthes tonsorius* may resemble that of *P. violaceus* (Guérin). In a few specimens there are faint traces suggesting blotches or stripes on the fingers.

*Ecology:* Most of the material examined was collected under stones in the littoral. William Beebe on the *Arcturus* Expedition recovered it from a coral rock bottom in 2½ fathoms, and the *Velero III* dredged it from a sand and shell bottom in 10 fathoms.

Ovigerous females were collected in January, February, and March.

*Relationships:* *Petrolisthes tonsorius* is extremely close to *P. quadratus* Benedict, 1901, a Caribbean species. *P. quadratus* has been recognized but a few times and has never been thoroughly described, and the types are apparently not extant. From the small sample available to the writer it appears that the outer orbital angle and the front are a little less produced than in *P. tonsorius*. There is a strong possibility, however, that comparison of the two populations from adequate samples of each will show them to be conspecific.

*Remarks:* Six specimens from Isla Hood, Galapagos Islands, were reported by Boone (1932) as *Petrolisthes cinctipes* (Randall); her description and accompanying illustration identify them with the pres-

ent species. "*Petrolisthes* near *cinctipes*" listed by Schmitt (1939) from Isla Socorro is very probably *P. tonsorius* also.

The name *tonsorius* is a manuscript designation of Steve A. Glassell, who first recognized the species as new, and whose untimely death prevented his publishing its description. The scissors-like form of the chela may have suggested to Mr. Glassell this Latin name, which denotes "of, or belonging to, shearing or shaving."

*Range*: Mainland from Cabo San Lucas, Gulf of California, south to Punta Santa Elena, Ecuador; Revillagigedo, Cocos, and Galapagos Islands.

### *Petrolisthes cabrilloi* Glassell

Plate 26, fig. 3

?*Petrolisthes rupicolus*, Lockington, 1878, pp. 395, 396 (part). Not *P. rupicolus* (Stimpson) = *P. cinctipes* (Randall).

?*Petrolisthes cinctipes*, Holmes, 1900, p. 107 (part). Not *P. cinctipes* (Randall).

*Petrolisthes cinctipes*, Baker, 1912, p. 102. Hilton, 1916, p. 72. Not *P. cinctipes* (Randall).

*Petrolisthes cabrilloa* Glassell, 1945, p. 225, text-fig. 4 (type locality, Anaheim Landing, California).

*Petrolisthes* sp., Hewatt, 1946, p. 200.

#### *Previous records:*

California. Morro Bay: S. A. Glassell (Glassell). Santa Cruz Island: W. G. Hewatt and W. Williams (Hewatt). Point Dume; Topanga Canyon; Sesquit Canyon: S. A. Glassell (Glassell). Malaga Cove, Palos Verdes: Olga Hartman (Glassell). Anaheim Landing: W. A. Kirk (Glassell). Corona del Mar: S. A. Glassell (Glassell). Santa Catalina Island: (Holmes) [probably this species]. Laguna Beach: (Baker). San Diego: (Holmes) [probably this species]; P. Rich (Glassell).

Baja California. Approximately to Punta Banda: (Glassell). Isla Asunción: Fisher (Lockington) [probably this species].

*Diagnosis*: Carapace granular to nearly smooth; no epibranchial spine; front triangular; carpus about twice as long as wide, proximal one-fourth of anterior margin with a small lobe, margins otherwise subparallel; outer margin of manus with a thin edge; merus of walking legs unarmed.

*Description:* Carapace covered with plications and fine granules, nearly smooth in some specimens; regions distinct. Front triangular, with a deep median sulcus; no supraocular spine; inner orbital angle not produced. Outer orbital angle not produced. No epibranchial spine. Carapace naked or lightly pubescent, distinctly hairy in some specimens.

First movable segment of antenna lightly granular, with a strongly projecting lobe on anterior margin; second and third lightly granular; flagellum variable, with hairs absent or vestigial in some specimens, rather long in others. Outer maxillipeds lightly rugose.

Chelipeds finely granular. Merus with a strongly projecting granular lobe on anterior margin. Carpus about twice as long as wide; a small lobe at proximal end occupying about one-fourth of anterior margin, anterior and posterior margins otherwise subparallel; a low longitudinal crest on dorsal surface, obsolescent in some specimens; granules along posterior margin enlarged and forming a low crest, ending distally in a sharp tooth; surface covered with short hairs. Manus usually a little smoother than carpus, lightly pubescent in young specimens; outer margin thin. Gape with a thick pubescence, produced into a long tuft at proximal end of fingers.

Walking legs rugose; merus unarmed, that of leg 3 not inflated; merus with plumose and non-plumose hairs, other segments with tufts of setae.

*Material examined:* See Table 25.

*Measurements:* Males, 3.0 to 15.4 mm; non-ovigerous females, 3.9 to 10.8 mm; ovigerous females, 4.8 to 11.3 mm. A-female, the largest of his series, was stated by Glassell to be 12.1 mm in length. The male holotype measures 11.4 by 11.0 mm, the ovigerous female allotype 10.1 by 10.5 mm.

*Color:* "Ground color of carapace dull orange, with striations and numerous spots of very pale greenish white. Margins pale lavender, which becomes darker toward and including the frontal region, where it is dark dusky purple. Antennal peduncles same color as carapace, flagellum ochre with purple edges. Basal segments of maxilliped striated with dull orange and brilliant green; palp brilliant orange. Ground color of carpus green, numerous granulations reddish brown, almost obscuring ground color; hand and finger same color but slightly darker, underside of finger pale, bright, turquoise blue; undersurface of hand much lighter, with green prominent. Merus and carpus of ambulatory

legs with patterns and striations light tan to dark brown, propodus with a broad center band of yellowish tan; dactyl with center band of dark brown, tip bright purple, general appearance dark dusky green. Ventral side pale dull yellow with darker patterns on abdomen." (Glassell, 1945, from notes by Petersen on a live specimen)

*Ecology*: "Occupies the midtidal zone under shelter of rocks and is more tolerant of sand and muddy water than any of the other California species of this genus." (Glassell) It may occasionally be found on wharf pilings or seeking shelter in mussel beds.

Ovigerous females are recorded for February, April, May, October, and November.

*Remarks*: Lockington's (1878) record of *Petrolisthes rupicolus* from Isla Asunción, Baja California, was probably based on material of *P. cabrilloi*; the same is probably true of Holmes's (1900) records of *P. cinctipes* from Santa Catalina Island and San Diego, California. Baker (1912) reported *P. cinctipes* from Laguna Beach, a record repeated by Hilton (1916); specimens on which this record may have been based were seen by the writer in the U. S. National Museum and identified as *P. cabrilloi*.

Glassell's spelling *cabrilloa* is hereby emended to *cabrilloi* to conform with the rules of the International Commission of Zoological Nomenclature for the formation of specific names based on modern surnames.

*Range*: Morro Bay, California, south to Bahía de la Magdalena, Baja California; Santa Cruz and Santa Catalina Islands off the California coast.

### ***Petrolisthes cinctipes* (Randall)**

Plate 28, fig. 3

*Porcellana cinctipes* Randall, 1839, p. 136 (type locality, Sandwich [Hawaiian] Islands, in error for western America).

*Porcellana rupicola* Stimpson, 1857a, p. 85 (type locality, coast of California); 1857b, p. 480, pl. 20 (not pl. 19 as stated in text), fig. 2 (type localities restricted to Farallones, San Luis Obispo, and Monterey, California). Lockington, 1874, p. 383. Boas, 1880, pp. 127, 196, pl. 2, fig. 62; pl. 3, fig. 93.

*Petrolisthes rupicolus*, Stimpson, 1858, p. 227. Lockington, 1878, pp. 395, 396 (part). Newcombe, 1893, p. 30 (part).

[*Petrolisthes*] *cinctipes*?, Stimpson, 1858, p. 228.

*Petrolisthes cincitipes*, Ortmann, 1897, pp. 277, 278. Holmes, 1900, p. 107 (part). Lenz, 1901, p. 451 (part). Rathbun, 1904, p. 168. Schmitt, 1921, p. 179, pl. 32, fig. 1; text-fig. 113. Johnson and Snook, 1927, p. 351. Clemens, 1933, p. 50. MacGinitie, 1935, p. 713. Hewatt, 1935, p. 246; 1937, pp. 186, 187, 189; 1938, p. 286; 1946, pp. 193, 194, 200. Glassell, 1938a, p. 443. Ricketts and Calvin, 1939, pp. 26, 44, 126, pl. 3, fig. 1. Hart, 1940, p. 89. Light, 1954, pp. 183, 186, text-fig. 90f. Not Baker, 1912, p. 102; not Hilton, 1916, p. 72; not Boone, 1932, p. 49, text-fig. 15. Probably not Calman, 1898, p. 260, nor Taylor, 1912, pp. 191, 208.

Probably not *Porcellana eupicola*, Spence Bate, 1866, p. 277.

*Previous records:*

British Columbia. Near Rose Harbor and W side Louscoone Bay, Queen Charlotte Islands: C. M. Fraser (Hart). West coast Vancouver Island: Esperanza Inlet; Nootka Sound; Clayoquot Sound: E. G. Hart (Hart). Clayoquot Sound: C. F. Newcombe (Newcombe).

California. Humboldt County: (Holmes). Tomales Bay: W. N. Lockington (Lockington 1878). Black Point, San Francisco Bay: (Lockington 1874). Sausalito and Richmond, San Francisco Bay: *Albatross* (Schmitt). San Francisco: Lübecker Mus. collection (Lenz). Farallon Islands: Trowbridge (Stimpson 1857b). Elkhorn Slough, Monterey Bay: G. E. MacGinitie (MacGinitie). Pacific Grove: (Schmitt). Cabrillo Point, Monterey Bay: W. G. Hewatt (Hewatt 1935, 1937, 1938). Monterey: Taylor (Stimpson 1857b). San Luis Obispo: Trowbridge (Stimpson 1857b). Santa Barbara: (Holmes). San Miguel Island; Santa Rosa Island: Harford (Lockington 1878). Smuggler's Cove and Pelican Bay, Santa Cruz Island: W. G. Hewatt and W. Williams (Hewatt 1946).

*Diagnosis:* Carapace granular; no epibranchial spine; front triangular; carpus one and a half to two times as long as wide, anterior margin with a distinct proximal lobe, margins converging distally from its highest point; outer margin of manus with a narrow ridge; pubescence in gape of fingers produced into a short tuft; merus of walking legs unarmed, that of leg 3 inflated.

*Description:* Carapace covered with fine granules, latter quite distinct in some specimens, especially anteriorly; posterolateral regions punctate; regions well marked. Frontal region strongly deflexed;

front triangular, strongly produced, with a deep median sulcus; no supraocular spine; inner orbital angle not produced. Outer orbital angle only slightly produced. No epibranchial spine. Carapace naked.

First movable segment of antenna with a granular, lamellar lobe on anterior margin; second roughly granular; third more or less smooth; flagellum with distinct hairs. Outer maxillipeds finely rugose.

Chelipeds covered with small granules, devoid of pubescence. Merus with a strongly projecting granular lobe on anterior margin. Carpus one and a half to two times as long as wide; a strong lobe on anterior margin at proximal end, anterior and posterior margins converging distally from its highest point; posterior margin rugose, the rugae forming a rough, obliquely rugose ridge along posterior margin, ending distally in a strong tooth. Outer margin of manus with a smooth, narrow ridge. Gape with a thick pubescence, produced into a short tuft near proximal end of fingers.

Walking legs rugose and granular like carpus and chelipeds. Merus unarmed, naked or with traces of a short pubescence, that of leg 3 inflated; carpus nearly devoid of hairs; propodus and dactylus covered with tufts of setae.

*Material examined:* See Table 26.

*Measurements:* Males, 4.5 to 21.1 mm; non-ovigerous females, 4.5 to 17.3 mm; ovigerous females, 6.0 to 18.1 mm. Stimpson (1857b) gave the length for a male from the type series of *Porcellana rupicola* as .85 inches (about 21 mm). Hart (1940) reported a female specimen 24 mm in length.

*Color:* The color in live specimens has not been recorded. Randall (1839) gave the color as reddish brown anteriorly, blue posteriorly, walking legs blue and white striped; Stimpson (1857b), for *Porcellana rupicola*, as dark purplish red. These color notes were probably from preserved material. Specimens in the collection of the Allan Hancock Foundation are usually a dark rust color, fading to buff in older material. Some individuals examined had traces of dark stripes on the walking legs.

*Ecology:* This species is almost exclusively littoral; it is very common among rocks, and beneath beds of mussels, sponges, and tunicates (Hewatt). According to Stimpson (1857b) it prefers an open shore with clear water. In British Columbia, it occurs only on the exposed outer coast of Vancouver Island and the Queen Charlotte Islands (Hart). It is common in the high- and mid-tide horizons. In Oregon,

a juvenile specimen was recovered from a sand and mud substrate in 35 fathoms.

Specimens in the Hancock Foundation series include ovigerous females taken in every month except April, May, September, and October; all of those months with the exception of September are accounted for in the literature.

*Remarks:* *Porcellana cincitipes* was originally reported to be from the Sandwich (Hawaiian) Islands, an error evidently due to a confusion of locality data; the collector, T. Nuttall, took specimens at various points in western America as well as in the Islands. The first to recognize the identity of *Porcellana rupicola* with *P. cincitipes* was Ortmann (1897); all subsequent authors have followed him in citing this common species as *Petrolisthes cincitipes*.

An early confusion developed when Lockington (1878) included specimens from Baja California and the Gulf of California under *Petrolisthes rupicolus*. These records were probably based on two species not yet described at that time, *P. cabrilloi* Glassell and *P. schmitti* Glassell, respectively. This erroneous extension of the range of *P. cincitipes* was cited by several subsequent writers. Extensive collecting has revealed that the species apparently ranges no further south than Santa Barbara (probably Point Conception) on the California mainland, and the northern Santa Barbara Islands, San Miguel, Santa Rosa, and Santa Cruz; records from more southern localities can be safely disregarded.

Most early British Columbia and Washington records of *Petrolisthes cincitipes* are probably based on *P. eriomerus* Stimpson, for there are no recent records of *P. cincitipes* from the east coast of Vancouver Island or from Puget Sound (Hart, 1940 and personal communication). These old records, which include Strait of Georgia, Baynes Sound, and Victoria (Newcombe, 1893), Nanaimo and Hope Island (Taylor, 1912), Esquimalt Harbor (Spence Bate, 1866), Bare Island (Lenz, 1901), and Puget Sound (Calman, 1898), are tentatively listed in this report under *P. eriomerus*.

Not only was *Porcellana cincitipes* erroneously attributed to the Hawaiian Islands, but it found its way inadvertently, as *Porcellana rupicola*, into the fauna of New Zealand. Kirk (1878, p. 466) listed it from Lyall Bay, Wellington, New Zealand. The following year (1879, p. 396) he reported further on the specimen on which this record was based, writing as follows: "A single specimen of this species was recently obtained by myself at Lyall Bay, living apparently upon terms

of intimacy with a large family of *Petrolisthes elongatus*. Upon a comparison with the foreign Crustacea in the Colonial Museum, I find it to agree in every particular with a specimen contained in the collection lately received from Prof. Button of the University of California, and labelled as above." Kirk's record was later repeated by Thomson (1899, p. 190) and Bennett (1930, p. 255). Prof. L. R. Richardson, Victoria University College, Wellington, believes (personal communication) that Kirk somehow confused his collections, getting one of the *P. rupicola* received from Prof. Button mixed in with the specimens of *Petrolisthes elongatus* from Lyall Bay.

*Range*: Queen Charlotte Islands, British Columbia, south to Santa Barbara (probably Point Conception), California; San Miguel, Santa Rosa, and Santa Cruz Islands off the California coast.

### ***Petrolisthes granulosus* (Guérin)**

Plate 28, fig. 1

*Porcellana granulosa* Guérin, 1835, p. 115 (type locality, Chile); 1838b, p. 7, pl. VII 25, fig. 1 (type locality restricted to Païta [now Peru]); 1839, p. 175, pl. 51, fig. 1. H. Milne Edwards and Lucas, 1844, p. 34. Nicolet, 1849, p. 197. Dana, 1852, p. 416; 1855, pl. 26, fig. 7. Kinahan, 1857, p. 345.

*Porcellana striata* H. Milne Edwards, 1837, p. 250 (type locality, shores of Chile; apparently based on types of *P. granulosa*). De Haan, 1849, pl. Q.

[*Petrolisthes*] *granulosa*?, Stimpson, 1858, p. 228.

*Petrolisthes validus*, Cano, 1889, p. 100, p. 257 (part). Not *P. validus* (Dana) = *P. laevigatus* (Guérin).

*Petrolisthes granulosus*, Ortmann, 1892, p. 260.

*Petrolisthes laevigatus*, Ortmann, 1897, p. 278 (part). Haig, 1955, p. 45 (part). Not *P. laevigatus* (Guérin).

*Petrolisthes* (?) *laevigatus*, Rathbun, 1910, p. 600 (part). Not *P. laevigatus* (Guérin).

Not *Petrolisthes granulosa*, Boone, 1938, p. 273, pl. 108.

#### *Previous records:*

Peru. Païta: *Favorite* (Guérin 1838b). Ancón: Reiss (Ortmann 1892). Callao: *Vettor Pisani* (Cano). Off North Chincha Island, Islas de Chincha: J. R. Kinahan (Kinahan).

Chile. "Chile": (Guérin 1835); G. Schneider (Ortmann 1892). Iquique: Lund Univ. Chile Exped. (Haig). Antofagasta; Taltal:



R. Paessler (Haig). Península de Coquimbo; Bahía Herradura de Guayacan; Montemar: Lund Univ. Chile Exped. (Haig). Valparaiso: (H. Milne Edwards and Lucas); U. S. Expl. Exped. (Dana). Bahía de San Vicente: Lund Univ. Chile Exped. (Haig).

*Diagnosis:* Carapace with distinct, transversely elongate granules, very strongly convex front to back; no epibranchial spine; front triangular; carpus one and a half to a little less than two times as long as wide, anterior margin slightly produced into a lobe at proximal end, margins slightly converging distally from this point; outer margin of manus with a thin, smooth ridge; merus of walking legs unarmed, that of leg 3 somewhat inflated.

*Description:* Carapace very strongly convex front to back, covered with distinct granulations and plications, the granules somewhat elongate transversely on some specimens, obsolescent on center area. Front broadly triangular, median groove usually deep; no supraocular spine; inner orbital angle not produced, or very slightly produced. Outer orbital angle produced into a strong tooth. No epibranchial spine. Carapace naked or with a faint pubescence on anterior regions.

First movable segment of antenna with a narrow lamellar projection on anterior margin; second and third lightly granular; flagellum naked or with vestigial hairs. Outer maxillipeds rugose.

Chelipeds granular, sometimes quite strongly so, many of the granules slightly elongate as in carapace; devoid of hairs. Merus with a small, strongly projecting, rugose lobe on anterior margin. Carpus one and a half to less than two times as long as wide; anterior margin slightly produced at proximal end, anterior and posterior margins only slightly converging distally from this point; posterior margin with a low, obliquely rugose ridge ending distally in a small tooth. Outer margin of manus with a smooth, narrow ridge. Gape of fingers with a short pubescence, not produced into a tuft.

Walking legs rugose or roughly granular. Merus unarmed, anterior margin with a fringe of plumose hairs, that of leg 3 somewhat dilated distally; carpus, propodus and dactylus thickly covered with plumose and non-plumose hairs.

*Material examined:* See Table 27.

*Measurements:* Males, 6.1 to 14.5 mm; non-ovigerous females, 3.5 to 9.0 mm; ovigerous females, 5.0 to 12.5 mm. Measurements were not recorded for the types of either *Porcellana granulosa* or of *P. striata*. Nicolet (1849) gave the size as 11 lines (about 20.9 mm), which is

considerably larger than any specimens seen by the writer and is perhaps an error.

*Color:* Dark brownish or bluish black, somewhat lined transversely. (Dana) Reddish-brown, waved and mottled with darker red; paler beneath; tips of maxillipeds bluish-purple. (Kinahan)

*Ecology:* This species usually occurs under stones in the intertidal zone. Kinahan (1857) reported it from a gravelly bottom at a depth of 10 fathoms.

Ovigerous females were taken in January and February by the *Velero III*, in April or May by the *Hassler*, and in June and September by the Lund University Chile Expedition.

*Remarks:* Guérin (1835) briefly characterized *Porcellana granulosa* and *P. laevigata* from Chile. The only distinction made by him in this and subsequent papers was in the degree of roughness of the carapace, chelipeds, and walking legs, which were said to be granulate in *P. granulosa* and smooth in *P. laevigata*. Guérin's (1838b) restriction of the type locality of *P. granulosa* to Paita, Peru, makes it clear that he was dealing with the present species, for the following form does not occur north of central Chile. Since no type locality more specific than "Chile" was given for *P. laevigata*, the identity of that species cannot be established on a geographical basis. The possibility that Guérin might have applied the name to smooth examples of the present species can be ruled out, however; three dry specimens from the Guérin collection labelled "*Porcellana laevigata*" and housed in the Academy of Natural Sciences of Philadelphia confirm its identity with the following form. One of these specimens is labelled "Type" and the other two "Type" with a query.

Ortmann (1892) reported several crabs from Golfo de Ancón, Ecuador, among them *Petrolisthes granulosus*. He later (1897, pp. 279, 296) corrected this locality to Ancón, Peru. On the basis of the 1892 work Rathbun (1910) included Ecuador in the distribution of *Petrolisthes* (?) *laevigatus* (= that species plus *P. granulosus*).

Ortmann (1897) included *Porcellana granulosa* and *P. striata* in the synonymy of *Petrolisthes laevigatus*. The present writer followed Ortmann, in reporting material in the Hamburg Museum and collected by the Lund University Chile Expedition (Haig, 1955). However, after examination of types and other material, and re-evaluation of characters in the light of closely related species, it became evident that *Petrolisthes granulosus* and *P. laevigatus* are distinct and valid forms.

The Lund University Chile Expedition specimens were seen again by the writer, and those in the Hamburg Museum were examined by Dr. A. Panning. On the basis of these re-examinations a part of the material previously recorded as *P. laevigatus* is here transferred to the present species.

It now appears that *Petrolisthes granulatus* finds its southern limit at about 36° 40' S, and *P. laevigatus* its northern limit at about 30° S; the intervening territory is an overlap area in which the two species sometimes occur together.

Specimens of *Petrolisthes granulatus* collected by the *Hassler* at Islas Juan Fernández are the first porcellanids to be reported from those islands.

*Range*: Paita, Peru, south to Bahía de San Vicente, Chile; Islas Juan Fernández.

### ***Petrolisthes laevigatus* (Guérin)**

Plate 28, fig. 2

*Porcellana laevigata* Guérin, 1835, p. 115 (type locality, Chile); 1838b, p. 6; 1839, p. 174. H. Milne Edwards and Lucas, 1844, p. 34. Nicolet, 1849, p. 195.

*Porcellana valida* Dana, 1852, p. 415; 1855, pl. 26, figs. 5a-b (type locality, ?Valparaiso, Chile). Cunningham, 1871, p. 495.

*Petrolisthes validus*, Stimpson, 1858, p. 227. Henderson, 1888, p. 105. Cano, 1889, pp. 96, 99, 257 (part; not Callao record). Murray, 1895, pp. 1120, 1166.

[*Petrolisthes*] *laevigata*?, Stimpson, 1858, p. 228.

*Petrolisthes laevigatus*, Ortmann, 1897, p. 277, p. 278 (part). Porter, 1936b, p. 153; 1936c, p. 339. Haig, 1955, pp. 42, 45 (part).

*Petrolisthes* (?) *laevigatus*, Rathbun, 1910, p. 600 (part).

*Petrolisthes granulosa*, Boone, 1938, p. 273, pl. 108 (not all synonymy).  
Not *P. granulatus* (Guérin).

*Previous records*: Chile. "Chile": *Favorite* (Guérin). Península de Coquimbo: Lund Univ. Chile Exped. (Haig). Valparaiso: (H. Milne Edwards and Lucas); *Challenger* (Henderson). ?Valparaiso: U.S. Expl. Exped. (Dana). San Antonio: Lund Univ. Chile Exped. (Haig). Bahía de Talcahuano: (Nicolet). Bahía de San Vicente; Golfo de Arauco: Lund Univ. Chile Exped. (Haig). Lota: *Nassau* (Cunningham). Seno Reloncaví; Estero Reloncaví; Canal Chacao; Golfo de Ancud; Golfo de Quetalmahué; Bahía de Ancud: Lund Univ. Chile Exped.

(Haig). Chiloé: *Vettor Pisani* (Cano). Ancud, Isla Chiloé: *Nassau* (Cunningham). Isla Clotilde, Archipiélago de Chiloé: *Alva* (Boone). Chonos: *Vettor Pisani* (Cano). Archipiélago de Los Chonos: Lund Univ. Chile Exped. (Haig). Canal Messier: *Challenger* (Henderson).

*Diagnosis:* Carapace nearly smooth, very strongly convex front to back; no epibranchial spine; front triangular; carpus one and a half to a little less than two times as long as wide, anterior margin with a strong proximal lobe, margins converging distally from its highest point; outer margin of manus with a sharp crest, outer half of dorsal surface with a short pubescence; merus of walking legs unarmed, that of leg 3 somewhat inflated.

*Description:* Carapace very strongly convex front to back, nearly smooth or with very fine granules anteriorly, granules not transversely elongate as in *Petrolisthes granulosus*; posterolateral regions with light plications. Front triangular, strongly produced, with a shallow median sulcus; no supraocular spine; inner orbital angle not produced. Orbits shallowly concave; outer orbital angle produced into a narrow, distinct tooth. No epibranchial spine. Carapace naked or with traces of a fine pubescence anteriorly.

First movable segment of antenna granular, with a narrow lamellar projection on anterior margin; second and third granular; flagellum with long hairs. Outer maxillipeds lightly rugose or punctate.

Chelipeds covered with small granules, appearing nearly smooth. Merus with a strongly projecting granular lobe on anterior margin. Carpus one and a half to less than two times as long as wide, lightly pubescent; a strong lobe at proximal end of anterior margin, anterior and posterior margins converging distally from its highest point; posterior margin with a low, obliquely rugose ridge ending distally in a small tooth. Outer half of dorsal surface of manus with a short, thick pubescence, continuing for a short distance onto pollex; outer margin with a smooth, sharp crest. Gape of fingers with a short pubescence, not produced into a tuft.

Walking legs nearly smooth to lightly granular. Merus unarmed, with a short fringe of plumose hairs on anterior margin, that of leg 3 somewhat inflated. Carpus, propodus, and dactylus with scattered short tufts of setae.

*Material examined:* See Table 28.

*Measurements:* Males, 5.1 to 23.9 mm; non-ovigerous females, 7.6 to 17.6 mm; ovigerous females, 8.8 to 16.7 mm. All these measurements

are from Lund University Chile Expedition specimens, previously examined by the writer. A type specimen of *Porcellana laevigata*, Academy of Natural Sciences of Philadelphia Cat. No. 648, measures 17.6 mm in length.

*Color:* Dark brown with interrupted lines of brown and yellow. (Dana) Reddish. (Nicolet) Specimens examined were light red or purple.

*Ecology:* The species occurs among and under stones in the intertidal zone; specimens were encountered at all tide levels by the Lund University Chile Expedition. Murray (1895) reported it as *Petrolisthes validus* from fresh water in Canal Messier. Specimens collected by the Lund University Chile Expedition at Canal Moraleda were from "boulders with fresh water running between them."

Ovigerous females have been reported in January, April, June, and November.

*Remarks:* Nicolet (1849) evidently recognized *Petrolisthes laevigatus* as a more southern form than *P. granulatus*, for he mentioned that it occurs in the southern provinces of Chile; however, he gave no distinguishing characters other than those cited by Guérin. Dana (1852) characterized *P. laevigatus* adequately for the first time, as *Porcellana valida*, new species. He noted the rostrum without strong median groove, the hairy antennae, and the hairs on the outer half of the dorsal surface of the manus, all of which distinguish it from *Petrolisthes granulatus*.

Cano's (1889) record of *Petrolisthes validus* from Callao, Peru, is believed to be based on *P. granulatus* because Callao is well outside the range of the present species. By the same reasoning, Boone's (1938) *Petrolisthes granulosa* from Archipiélago de Chiloé is here referred to *P. laevigatus*.

*Range:* Restricted to southern Chile, from Península de Coquimbo south to Canal Messier.

### *Petrolisthes violaceus* (Guérin)

Plate 28, fig. 4

*Porcellana violacea* Guérin, 1831, pl. 3, figs. 2, 2A; 1835, p. 115 (type locality, Chile); 1838a, p. 33 (type locality restricted to peninsula of Talcahuana [Talcahuano]); 1838b, p. 6, pl. VII 25, fig. 2; 1839, p. 174, pl. 51, fig. 2. H. Milne Edwards, 1837, p. 250. H. Milne Edwards and Lucas, 1844, p. 34. White, 1847, p. 62. Nicolet, 1849, p. 196. Dana, 1852, p. 416; 1855, pl. 26, figs. 6a-b. Kinahan, 1857, p. 346.

*Porcellana macrocheles*, Poeppig, 1836, p. 142, pl. 4, fig. 1 (type locality, Bahía de San Vicente, Chile).

*Petrolisthes violaceus*, Stimpson, 1858, p. 227. Targioni-Tozzetti, 1872a, p. 398; 1872b, p. 470; 1877, p. 219, pl. 13, figs. 2, 2a-h. Henderson, 1888, p. 105. Cano, 1889, pp. 96, 99, 100, 257. Ortman, 1892, p. 259; 1897, p. 277. Murray, 1895, p. 1120. Lenz, 1902, p. 745. Porter, 1903, p. 150; 1906, p. 132; 1917, p. 97; 1925, p. 320; 1936b, p. 153; 1936c, p. 339; 1940a, p. 147; 1940b, p. 313; 1941, p. 460. Rathbun, 1910, p. 599. Doflein and Balss, 1912, p. 34. Haig, 1955, pp. 42, 44.

*Previous records:*

Peru. Callao: J. R. Kinahan (Kinahan); *Vettor Pisani* (Cano). San Lorenzo; Ancón: *Vettor Pisani* (Cano). Islas de Chincha: J. R. Kinahan (Kinahan). Middle Chincha Island: J. Steevens (Kinahan).

Chile. "Chile": (Guérin 1835); (H. Milne Edwards); (H. Milne Edwards and Lucas); T. Bell (White); Ackermann (Ortmann 1892). Iquique: J. Bermúdez (Porter 1903). Cavancha: L. H. Plate (Lenz). Province of Antofagasta: J. Herrera (Porter 1940a). Bahía de Taltal: A. Capdeville (Porter 1925). Caldera: E. Gigoux (Porter 1940a). Península Coquimbo: Lund Univ. Chile Exped. (Haig). Coquimbo: F. T. Delfin (Porter 1903). Bahía Herradura de Guayacán: Lund Univ. Chile Exped. (Haig). Herradura: F. T. Delfin (Porter 1903). Los Vilos: J. N. Thomas (Porter 1906). Bahía de Valparaíso: U. S. Expl. Exped. (Dana). Valparaíso: *Magenta* (Targioni-Tozzetti); *Challenger* (Henderson); *Vettor Pisani* (Cano); Guérin collection (Ortmann 1897). San Antonio: Lund Univ. Chile Exped. (Haig). Province of Concepción: (Nicolet). Tumbes: L. H. Plate (Lenz). Talcahuano: *Coquille* (Guérin 1838a); L. H. Plate (Lenz); F. T. Delfin (Porter 1903). Bahía de San Vicente: E. Poeppig (Poeppig); Lund Univ. Chile Exped. (Haig). Puerto Montt; Isla Tenglo: F. Lau (Doflein and Balss). Chiloé; Chonos: *Vettor Pisani* (Cano). Taitao: Mus. Nac. Chile Exped. (Porter 1917).

*Diagnosis:* Carapace smooth, very strongly convex front to back; no epibranchial spine; front broadly triangular; orbits without a concavity, forming a nearly straight line with front to outer orbital angle; carpus one and a half to less than two times as long as wide, anterior margin with a proximal lobe, margins converging distally from its

highest point; outer margin of manus with a thick crest; merus of walking legs unarmed, that of leg 3 inflated.

*Description:* Carapace smooth or lightly punctate, regions not distinct; very strongly convex front to back, especially strongly deflexed in front of epibranchial region. Front broadly triangular, without median groove or sulcus; orbits straight, without a concavity, forming a nearly straight line with front to outer orbital angle, the latter not produced. No epibranchial spine. Carapace naked, front sometimes faintly pubescent.

Movable segments of antenna roughened, without projections; flagellum thick, naked or with very short hairs. Outer maxillipeds smooth or punctate.

Chelipeds smooth or lightly granular, faintly pubescent. Merus with a strongly projecting lobe on anterior margin. Carpus one and a half to less than two times as long as wide; a lobe at proximal end of anterior margin, anterior and posterior margins converging distally from its highest point; posterior margin with a smooth crest, ending distally in a small tooth. Outer margin of manus with a thick, smooth crest. Gape of fingers devoid of pubescence.

Walking legs smooth or punctate; merus unarmed, that of leg 3 inflated at distal end; propodus and dactylus with short tufts of setae.

*Material examined:* See Table 29.

*Measurements:* Males, 6.6 to 25.8 mm; non-ovigerous females, 6.2 to 22.9 mm; ovigerous females, 6.7 to 20.3 mm.

In the type description, Guérin (1838a) stated "largest specimens nearly 2.5 dm." This was undoubtedly a misprint for "cm", for 2.5 cm or 25 mm is close to the largest size actually attained by the species. H. Milne Edwards' "about one pouce" (= ca. 27 mm) was probably based on some of Guérin's type series.

*Color:* Ground color of carapace light caerulean blue overcast with a light jade green on frontal, gastric and cardiac areas. Blue shows brightly in several places, especially on cardiac region. Lateral areas light blue striated with bluish white. Margin of carapace grenadine red. Intestinal a tone lighter. Eyestalk brown and eye dark green. Antenna light pansy purple. Chela lavender overcast with dark green. Merus of ambulatory legs caerulean blue, grenadine red near articulation with carpus. Carpus caerulean blue. Propodus and dactyl light orange buff broadly striped with dark brown. Abdomen caerulean

blue, segments margined with grenadine red. Ventral side light caerulean blue. (Petersen, of a live specimen from Peru)

Purple patches irregularly arranged on a yellowish-red ground. Chelipeds purple, the segments and borders of the fingers and hands edged with a narrow salmon-red border. Walking legs prettily banded with purple and yellowish-red; under parts much lighter in color. (Kinahan, of a specimen preserved but a few years)

After long preservation in alcohol, many specimens retain a brownish-red color on the carapace and distinct stripes on the propodus and dactylus of the walking legs. Some retain a deep blue or violet color on the metabranchial regions, even when all other color has entirely disappeared.

*Ecology:* This species is apparently restricted to an under-rock habitat in the intertidal zone, where it is one of the commonest crustacean species of the Peruvian faunal province. Oviparous females are reported for December, January, February, and June.

*Remarks:* Among the dry collection in the Academy of Natural Sciences of Philadelphia is a specimen of *Petrolisthes violaceus* which, according to the label, is questionably a type and was collected by the *Coquille* at Valparaíso. Talcahuano was the only locality mentioned by Guérin for this species from the *Coquille* collection.

Two dry specimens in the Academy of Natural Sciences of Philadelphia are labelled "Galapagos Islands," as previously noted by Ortmann (1897). This locality is in all probability in error, for the species is not otherwise known from the Galapagos archipelago.

*Range:* Callao, Peru, south to Taitao, Chile.

### ***Petrolisthes holotrichus* Nobili**

Plate 29, fig. 4

*Petrolisthes holotrichus* Nobili, 1901b, p. 14 (type locality, Isla Flamenco, Panama). Rathbun, 1910, p. 599. Haig, 1957b, p. 8.

*Previous records:* Panama. Isla Flamenco: E. Festa (Nobili). Isla Pacheca, Islas de las Perlas: Askoy (Haig).

*Diagnosis:* Carapace nearly smooth, it and rest of body completely covered with a short, fine tomentum; no epibranchial spine; front trilobate; carpus less than twice as long as wide, anterior margin with a strong proximal lobe, margins converging distally from its highest point; outer margin of manus with a thin edge, and with to-



mentum produced into a long fringe; all segments of walking legs with a long fringe of hairs on anterior margin, merus unarmed, that of leg 3 somewhat inflated.

*Description:* Carapace nearly smooth, regions not distinct. Front trilobate, the lobes rounded, about equal in breadth, lateral lobes diverging from median lobe, latter more advanced and with a distinct median groove. Outer orbital angle produced into a spine-tipped tooth. No epibranchial spine. Carapace completely covered with a short, fine tomentum, as are the side walls of the carapace, eyestalks, movable segments of antennae (except flagella), dorsal surface of chelipeds and walking legs, and abdomen (except telson).

First movable segment of antenna with a strongly projecting, lamellar lobe on anterior margin; second and third nearly smooth; flagellum naked. Outer maxillipeds lightly rugose.

Chelipeds finely granular, nearly smooth. Merus with a strongly projecting, broad, pointed tooth on anterior margin. Carpus less than twice as long as wide, anterior margin with a strong proximal lobe, anterior and posterior margins converging distally from its highest point; posterodistal angle produced into a small spine. Manus with a thin outer margin; surface near outer margin with a series of three to six small, low, wide-set, rounded tubercles; on outer margin of manus and pollex a fringe of long plumose hairs, long non-plumose setae interspersed with them. Fingers long and slender; gape with a short tomentum and a few long scattered setae; a few long setae on inner ventral surface of manus and on ventral surface of dactylus.

Walking legs nearly smooth; merus unarmed, that of leg 3 somewhat inflated; tomentum produced into a long fringe on both margins of all segments.

*Material examined:* See Table 30.

*Measurements:* Males, 2.8 to 5.9 mm; non-ovigerous females, 3.3 to 3.8 mm; ovigerous females, 4.0 to 5.4 mm. Nobili recorded one of the syntypes as 5.25 by 5.25 mm. One of the male syntypes examined by the writer was larger than this, measuring 6.3 mm in length.

*Color:* According to Nobili, who studied the type series only a few years after its collection, the color was reddish-rose, the tubercles near the outer margin of the manus reddish-purple. The two syntypes examined by the present writer had lost all their color; the same was true of all other specimens of *Petrolisthes holotrichus* examined.

*Ecology:* All Hancock Foundation material was taken under rocks in the littoral. Oviparous females were taken in January, February, and March.

*Remarks:* Until recently, the species was known only from the three type specimens collected by Enrico Festa at Isla Flamenco, Panama, and reported by Nobili. Haig (1957b) reported one additional specimen from Isla Pacheca, Islas de las Perlas, taken by the *Askoy Expedition* in 1941. Specimens collected in 1934 and 1935 by the *Velero III*, and in 1937 by Woodbridge Williams, show that it is distributed throughout a large part of the Panamic Province.

*Range:* Bahía de Salinas, Costa Rica, south to La Libertad, Ecuador.

### *Petrolisthes schmitti* Glassell

Plate 29, fig. 1

?*Petrolisthes rupicolus*, Lockington, 1878, pp. 395, 396 (part). Not *P. rupicolus* (Stimpson) = *P. cinctipes* (Randall).

*Petrolisthes schmitti* Glassell, 1936, p. 280 (type locality, San Felipe, Gulf of California); 1938a, p. 444.

*Previous records:* Gulf of California. San Felipe: S. A. Glassell (Glassell 1936). Bahía de las Animas; Puerto Escondido: Fisher (Lockington) [probably this species].

*Diagnosis:* Carapace finely granular, regions distinct; no epibranchial spine; front sinuously triangular; carpus less than twice as long as wide, anterior margin with enlarged granules or spinules, margins slightly converging distally; manus somewhat swollen on dorsal surface, outer margin with a crest defined by a distinct groove; merus of walking legs unarmed.

*Description:* Carapace finely and evenly granular, regions distinct. Front sinuously triangular, with a deep median groove extending to between protogastric lobes; no supraocular spine; inner orbital angle produced into a small, narrow, rounded lobe, sometimes quite strongly projecting. Outer orbital angle only slightly produced. No epibranchial spine. Carapace lightly pubescent.

First movable segment of antenna with a strongly projecting, granular lobe on anterior margin; second and third roughly granular; flagellum with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose.

Chelipeds covered with small, rough granules, naked or with a fine pubescence. Merus with a strongly projecting, distally directed, pointed

lobe on anterior margin. Carpus less than twice as long as wide; margins slightly converging distally; proximal third to two-thirds of anterior margin with enlarged, rough granules taking the form of spinules in small specimens, giving margin an irregularly serrate appearance; a low longitudinal crest along anterior third of dorsal surface, another along center, and a third along posterior margin, these crests obsolete in some specimens; posterior crest rough, formed of oblique flattened granules, ending distally in a small sharp tooth. Upper surface of manus somewhat swollen, swollen portion covered with scattered large granules; outer margin with a smooth crest, defined by a distinct, broad groove near outer margin and extending onto pollex. Gape with a short thick tuft of pubescence, sometimes extending nearly to tips of fingers, longer near their proximal end.

Walking legs rugose; merus not inflated, not armed with spines, anterior margin with a fringe of short plumose hairs, surface and posterior margin covered with non-plumose setae; other segments covered with long setae.

*Material examined:* See Table 31.

*Measurements:* Males, 3.3 to 5.7 mm; non-ovigerous females, 2.9 to 5.7 mm; ovigerous females, 4.0 to ca. 6.0 mm. The ovigerous female holotype measures 4.7 mm in length, 4.7 mm in breadth.

*Color:* The color in alcohol, according to Glassell (1936), was red-brown mottled with white. A similar coloration was noted in Allan Hancock Foundation specimens collected in 1954.

*Ecology:* The type series was taken "at low water from under rocks"; all the Hancock Foundation material was collected in the intertidal zone under stones. Ovigerous females were recovered in April and June.

*Remarks:* Specimens collected by Fisher at Puerto Escondido and Bahía de las Animas and referred by Lockington (1878) to *Petrolisthes rupicolus* (Stimpson) [= *P. cinctipes* (Randall)] were probably *P. schmitti*, the only Gulf of California species which might be confused with it.

Extensive intertidal collecting from the *Velero III* failed to recover *Petrolisthes schmitti* anywhere in quantity. On the other hand, a Hancock Foundation field party found it to be the most abundant porcellanid at San Felipe, the type locality.

*Range:* Gulf of California, from San Felipe south to Isla San Francisco.

*Petrolisthes brachycarpus* Sivertsen

Plate 29, fig. 2

*Petrolistes gracilis* var. *brachycarpus* Sivertsen, 1933, p. 8, pl. 3, fig. 30 (type locality, Post Office Bay, Isla Floreana [Charles], Galapagos Islands). Not *Petrolisthes gracilis* Stimpson.

*Previous records:* Galapagos Islands. Post Office Bay, Isla Charles: A. Wollebaek on Norwegian Zool. Exped. to the Galapagos Islands 1925 (Sivertsen).

*Diagnosis:* Carapace with low, enlarged, rough granules posterior to cervical groove, nearly smooth anteriorly, regions distinct; no epibranchial spine; front broad, sinuously triangular to trilobate; carpus one and a half to two times as long as wide, anterior margin with a few enlarged granules or spinules, margins slightly converging distally; manus swollen on dorsal surface, outer margin with a sharp crest not defined by a distinct groove; merus of walking legs unarmed.

*Description:* Carapace covered with low, enlarged, rough granules posterior to cervical groove; hepatic, frontal, and gastric regions nearly smooth; regions distinct. Front broad, sinuously triangular, inner orbital angles produced, sometimes quite distinctly, giving front a trilobate appearance; median portion broad, produced, triangular with rounded tip, and with a deep median groove. Outer orbital angle produced into a small sharp tooth. No epibranchial spine. Carapace covered with a short, sparse pubescence.

First movable segment of antenna with a projecting lamellar lobe on anterior margin; second and third nearly smooth; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose.

Merus of chelipeds lightly rugose, with a strongly projecting, rugose, rounded lobe on anterior margin. Carpus one and a half to two times as long as wide; anterior and posterior margins very slightly converging distally; anterior margin with a few enlarged granules near proximal end, produced into spinules in smaller specimens; a distinct longitudinal crest about center of dorsal surface, and a second strongly, obliquely rugose crest along posterior margin, ending distally in a small incurving spine; between these crests a distinct, broad groove covered with small rough granules; in addition, a faint crest sometimes present near anterior margin; surface with traces of pubescence. Manus rather swollen, highest on inner side, sloping gradually to outer margin, latter bearing a distinct, sharp crest extending onto pollex; surface

finely granular, with traces of pubescence, latter thicker along outer margin where it extends onto ventral surface. Fingers finely granular as in manus; gape with a thick tuft of pubescence.

Walking legs finely granular or punctate. Merus not armed with spines, that of leg 3 not inflated; carpus with a low longitudinal crest on dorsal surface; all segments with scattered long setae.

*Material examined:* See Table 32.

*Measurements:* Males, 2.0 to 5.9 mm; non-ovigerous females, 2.3 to 6.0 mm; ovigerous females, 2.9 to 6.0 mm. An ovigerous female from the type series was reported to be 5.0 mm in length, 4.5 mm in breadth.

*Color:* No color or trace of a pattern remained on any of the specimens examined. A note in the container with specimens from *Velero III* station 24-33 stated: "Some selected specimens with color notes in separate vials." This material was not located; the specimens with color notes may have been other crustacean species from the same station.

*Ecology:* *Velero III* collectors took this species in the intertidal zone under stones in all but three instances. It was twice found associated with coral, and once dredged from a sand bottom in 4-10 fathoms.

Ovigerous females have been collected in every month from December through March, and in September.

*Remarks:* Through the courtesy of Nils Knaben, Universitetets Zoologisk Museum, Oslo, the writer was able to examine most of the type series. *Petrolisthes brachycarpus* is a valid species, more closely related to *P. schmitti* Glassell and *P. platymerus*, new species, than to *P. gracilis* Stimpson. It occurs throughout the Galapagos Archipelago.

With the exception of three specimens taken at Bahía Honda, Panama, the species is known only from the Galapagos Islands. In view of the lack of additional material from among extensive mainland collections, it is believed that the Bahía Honda record is probably due either to an error in recording the locality or to accidental introduction.

*Range:* Galapagos Islands. Extralimital: Bahía Honda, Panama.

***Petrolisthes platymerus*, new species**

Plate 4; plate 29, fig. 3

*Petrolisthes eriomerus*, Boone, 1931, p. 154 (part). Not *P. eriomerus* Stimpson.

*Previous records*: Panama. Isla Taboguilla: W. G. Van Name (Boone).

*Types*: Holotype, male, U. S. National Museum Cat. No. 102405, from Port Parker, Costa Rica, shore; February 9, 1935; collected during Allan Hancock Pacific Expedition of 1935 at *Velero III* station 466-35. Paratypes: same data as holotype, three males, three females (two ovigerous), one young (U. S. National Museum); two males, three ovigerous females (Allan Hancock Foundation). Paratype: north shore of Isla Taboguilla, Panama, shore; March 4 or 5, 1926; collected by W. G. Van Name and Mrs. S. E. Brewster; one female (American Museum of Natural History Cat. No. 6197).

*Diagnosis*: Carapace rough and uneven, regions distinct and defined by deep grooves; no epibranchial spine; front broad, sinuously triangular; carpus one and a half to nearly two times as long as wide, anterior margin unarmed, margins subparallel or very slightly converging distally; manus somewhat swollen on dorsal surface, outer margin with a sharp crest defined by a distinct groove; merus of walking legs unarmed, that of leg 3 broad, inflated.

*Description*: Carapace rough, uneven, the regions distinct, those on anterior half of carapace especially well defined by deep, broad grooves; lateral areas posterior to cervical groove with small scattered tubercles. Front broad, sinuously triangular, inner orbital angle somewhat produced; no supraocular spine; a deep median sulcus extending between protogastric lobes. Orbits deep, angular, outer orbital angle produced into a strong, narrow tooth. No epibranchial spine. Carapace covered with a short, sparse pubescence.

First movable segment of antenna with a low lamellar lobe on anterior margin; second granular, slightly produced at proximal and distal ends of anterior margin; third nearly smooth; flagellum with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose.

Merus of chelipeds covered with small rough granules, anterior margin with a small lobe. Carpus one and a half to slightly under two times as long as wide; a distinct longitudinal crest about the center of dorsal surface, and an obliquely rugose crest along posterior margin,

ending distally in a small incurving spine, between these crests a distinct broad groove; surface covered with scattered large rounded granules or small tubercles; margins subparallel or very slightly converging distally, anterior margin unarmed; surface with traces of pubescence. Manus rather swollen, highest on inner side, sloping gradually to outer margin, latter bearing a distinct sharp crest extending onto pollex, this crest defined by a strong groove near outer margin; surface with scattered small granules, a row of about eight larger rounded granules or small tubercles forming an even longitudinal row at about center; surface with traces of pubescence, thicker and a little longer along outer margin and extending onto ventral surface, there forming a short pile in a narrow band along margin. Fingers finely granular; gape with a thick pubescence produced on proximal half of fingers into a short tuft. Ventral surface of all segments smooth.

Walking legs short, granular, covered with plumose and non-plumose hairs; merus not armed with spines, that of leg 3 inflated, nearly as broad as long.

Abdomen smooth, covered with a short, thick pubescence.

*Measurements:* Holotype male: length 5.2 mm, width 5.2 mm. Paratypes: males, 2.5 to 4.3 mm; non-ovigerous females, 4.3 and 4.5 mm; ovigerous females, 3.5 to 4.9 mm.

*Color:* All traces of color had disappeared in the examined material.

*Ecology:* All the known material, consisting of 14 specimens from two stations, was collected in the littoral under stones. Included were ovigerous females taken at Port Parker, Costa Rica, in February.

*Relationships:* *Petrolisthes platymerus* is most closely related to *P. schmitti* Glassell and *P. brachycarpus* Sivertsen. All are small species with pubescent carapace, sinuously triangular to trilobate front, manus with dorsal surface swollen and outer margin crested, and gape of fingers with a thick tuft of pubescence. *P. platymerus* differs from the other two in having the entire carapace rough and uneven, and the merus of walking leg 3 short and broad. It is somewhat less closely related to *P. holotrichus* Nobili, which has a nearly smooth carapace, no swelling or outer crest on the manus, and no tuft in the gape of the fingers, and is tomentose over its entire surface.

*Remarks:* One of the specimens from Isla Taboguilla, Panama, reported by Boone (1931) as *Petrolisthes eriomerus* Stimpson, proved to belong to this species.

The specific name, from the Greek *πλατυς*, broad, and *μηρος*, thigh, refers to the broad, inflated merus of walking leg 3.

*Range:* Known only from the two localities listed above, Port Parker, Costa Rica, and Isla Taboguilla, Panama.

### ***Petrolisthes crenulatus* Lockington**

Plate 23, fig. 4

*Petrolisthes crenulatus* Lockington, 1878, pp. 395, 398 (type locality, Puerto Escondido, Gulf of California). Glassell, 1936, p. 286; 1937, p. 80; 1938a, p. 444.

*Previous records:* Gulf of California. Puerto Escondido: (Lockington); S. A. Glassell (Glassell 1936, 1937). Off Arena Bank: W. Beebe on *Zaca* (Glassell 1937).

*Diagnosis:* Carapace plicate, rather rough and granular along lateral margins, anterior regions and grooves strongly accentuated; no epibranchial spine; front trilobate; carpus about one and a half times as long as wide, covered with long hairs, proximal half of anterior margin with three or four blunt, wide-set teeth; manus not swollen, without a heavy crest on outer margin; merus of walking legs unarmed.

*Description:* Carapace covered with short plications, becoming rough and granular on lateral margins; protogastric and hepatic lobes, and the grooves defining them, strongly accentuated and elevated above frontal region, the latter strongly deflexed. Front trilobate, median lobe broadly triangular and projecting only slightly beyond lateral lobes. Outer orbital angle produced into a very small tooth. No epibranchial spine. Frontal and posterolateral regions bearing long plumose hairs, indistinct in young specimens.

First and second movable segments of antenna somewhat roughened by granules; third nearly smooth; flagellum naked. Outer maxillipeds faintly rugose.

Merus of chelipeds smooth, armed on anterior margin with a low, finely granular lobe; covered with long plumose hairs. Carpus about one and a half (1.4 to 1.7) times as long as wide, with three or four blunt, wide-set teeth on proximal half of anterior margin, proximal tooth usually smallest; surface covered with granules, rough and projecting along posterior margin; a median longitudinal crest of raised granules, it and posterior crest defined by a broad groove; groove and dorsal crest usually obscured by the long, plumose hairs covering the



carpus. Manus without a dorsal swelling, outer margin thin; covered with fine granules, and proximal outer portion covered with long plumose hairs. Fingers covered with fine granules; gape with a short, thick pubescence, not produced into a tuft.

Walking legs smooth or punctate, covered with long, scattered non-plumose setae and fringed with plumose hairs. Merus unarmed, that of leg 3 not inflated.

*Material examined:* See Table 33.

*Measurements:* Males, 2.8 to 13.4 mm; non-ovigerous females, 3.9 to 14.5 mm; ovigerous females, 5.6 to 7.9 mm. The type was reported to measure 10 by 10 mm.

*Color:* Ground color of carapace white. Dark tawny on front becoming lighter on branchial areas. Eyestalk white with a little color under eye. Eye bright green. Antennae very pale russet. Chela white with ochraceous tawny on merus and two blotches on carpus. Fingers light russet with reddish purple tint. Tip of fixed finger white. Ochraceous tawny on fifth leg, and lightly on ambulatory legs and dactyl. Dactyl of walking legs white with blackish brown tip. Ventral side white. (Petersen, of a live specimen from Isla Isabel, Mexico)

Many preserved specimens show a distinct orange color on the fingers.

*Ecology:* The species was dredged once by the *Velero III* off Isla Isabel, Mexico, in 10-15 fathoms, along with corallines and gorgonids. On another occasion it was cracked from coral heads taken in 1 fathom at Isla Espíritu Santo, Gulf of California. Glassell (1937) reported it from coral heads taken by the *Zaca* in 2.5 fathoms. According to Glassell, it is usually found in the lower part of the intertidal zone; most of the Hancock material was taken under stones in the littoral.

Ovigerous females were collected in March.

*Remarks:* *Petrolisthes crenulatus* is restricted to the Gulf of California, with slight extensions to the offshore islands to the south and to the southern portion of the west coast of Baja California. In the southern part of its range it overlaps with its closest relative, *P. ortmanni* Nobili.

*Range:* Bahía de la Magdalena, Baja California; Gulf of California, from Isla Angel de la Guarda to Mazatlán; Isabel and Tres Mariás Islands.

**Petrolisthes ortmanni** Nobili

Plate 23, fig. 3

*Petrolisthes ortmanni* Nobili, 1901b, p. 16 (type locality, Bahía de Santa Elena, Ecuador). Rathbun, 1910, p. 599. Haig, 1957b, p. 6.

*Petrolisthes* sp., Nobili, 1901b, p. 16. Rathbun, 1910, p. 599.

*Previous records:*

Panama. Isla Flamenco: E. Festa (Nobili).

Colombia. Isla Gorgona: Askoy (Haig).

Ecuador. Bahía de Santa Elena: E. Festa (Nobili).

*Diagnosis:* Carapace nearly smooth, anterior regions and grooves strongly accentuated; no epibranchial spine; front trilobate; carpus less than one and a half times as long as wide, naked or sparsely hairy, proximal half of anterior margin with three broad teeth, occasionally somewhat coalesced; manus not swollen, without a heavy crest on outer margin; merus of walking legs unarmed.

*Description:* Carapace nearly smooth, but with distinct plications on lateral margins and on protogastric and hepatic regions. Protogastric and hepatic lobes, and the grooves defining them, strongly accentuated. Frontal region strongly deflexed; front trilobate, median lobe projecting only slightly beyond lateral lobes. Outer orbital angle only very slightly produced. No epibranchial spine. Entire carapace nearly glabrous, only a slight trace of hairs on frontal region.

First and second movable segments of antenna roughened by granules; third nearly smooth; flagellum variable, usually naked but occasionally with long or vestigial hairs. Outer maxillipeds faintly rugose.

Merus of chelipeds nearly smooth, armed on anterior margin with a finely granular lobe. Carpus less than one and a half times as long as wide, anterior margin with three broad teeth, distal one usually smallest, these teeth confined to proximal half of margin and occasionally somewhat coalesced; surface covered with flattened granules; a median longitudinal crest, obsolescent in some specimens; granules raised and obliquely elongated to form a low crest along posterior margin. Manus finely granular, not swollen, its outer margin thin; granules rather rough and projecting in occasional specimens. Fingers granular as in manus; gape with a short, thick pubescence. Chelipeds with a trace of fine hairs in some specimens.

Walking legs smooth or punctate, all segments with long scattered setae. Merus unarmed, that of leg 3 slightly inflated.

*Material examined:* See Table 34.

*Measurements:* Males, 2.6 to 6.7 mm; non-ovigerous females, 3.1 to 6.5 mm; ovigerous females, 3.6 to 7.0 mm. A male syntype examined by the writer measures 5.2 mm in length, 4.8 mm in breadth; a female ovigerous syntype, 5.3 by 5.0 mm.

*Color:* In alcohol, some specimens show traces of reddish blotches on the carapace and chelipeds.

*Ecology:* *Petrolisthes ortmanni* inhabits the littoral zone, where it has been taken under stones and from coral. The *Askoy* recovered it from coral taken from 2 to 3.5 fathoms (Haig, 1957b).

Ovigerous females have been collected in January, February, March, and April.

*Relationships:* *Petrolisthes ortmanni* is most closely related to *P. crenulatus* Lockington; the latter species differs from it chiefly in its larger size, hairier chelipeds and carapace, and more elongate carpus.

*Remarks:* Earlier the writer determined (Haig, 1957b) that the two specimens from Isla Flamenco, Panama, reported by Nobili (1901b) as *Petrolisthes* sp., fall within the normal range of variation of his *P. ortmanni*. Material studied for the present report extends the range of the species still further in both directions.

*Range:* Puerto San Carlos, Gulf of California, south to Islas Lobos de Afuera, Peru; Islas Las Tres Marías and Isla del Coco, Costa Rica.

### ***Petrolisthes lewisi lewisi* (Glassell)**

Plate 23, fig. 1

*Pisosoma lewisi* Glassell, 1936, p. 287 (type locality, Bahía Tenacatita, Mexico). Steinbeck and Ricketts, 1941, p. 458.

*Petrolisthes lewisi*, Haig, 1957b, p. 7 (part of synonymy; not new records).

#### *Previous records:*

Gulf of California. Punta Lobos, Isla Espiritu Santo: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

Mexico. Bahía Tenacatita; Bahía de Tequepa N of Acapulco: F. O. Lewis on *Stranger* (Glassell).

*Diagnosis:* Carapace nearly smooth, anterior regions and grooves strongly accentuated; no epibranchial spine; front trilobate; carpus

about one and a half times as long as wide or a little less, proximal two-thirds of anterior margin with three or four narrow, well separated, strongly projecting conical teeth; manus with two strong dorsal crests and a third along outer margin; merus of walking legs unarmed.

*Description:* Carapace subquadrate, margins subparallel posterior to epibranchial angles; plicate on posterolateral regions, otherwise nearly smooth. Frontal groove, and grooves defining protogastric and hepatic regions, strongly accentuated. Front trilobate, the lobes rounded, about equal in breadth, median lobe projecting beyond lateral lobes, sometimes rather strongly so; frontal region deflexed, sometimes making front appear sinuate in dorsal view. Orbits shallowly concave; outer orbital angle not produced. No epibranchial spine. Carapace finely pubescent in young specimens, adults with a trace of hairs on frontal region.

Movable segments of antenna smooth or nearly so, the first bearing a low crest on anterior margin, second and third without projections; flagellum with long hairs. Outer maxillipeds faintly rugose.

Merus of chelipeds lightly rugose, armed on anterior margin with a strongly projecting granular lobe. Carpus about one and a half times as long as wide or a little less, anterior margin with three or four narrow, well separated, strongly projecting conical teeth, distal one usually the smallest, these teeth granular and confined to proximal two-thirds of margin; surface strongly granular, with two heavy longitudinal crests composed of oblique, elongate granules; a third strong crest along posterior margin, composed of an irregular double row of obliquely elongate granules, sometimes produced into spinules, giving margin a serrate appearance; deep grooves between these crests, that between dorsal crests extending to level of proximal carpal tooth, that between median dorsal and posterior crests extending to articulation with merus. Manus with three heavy crests, obliquely granulate as in carpus or nearly smooth; one along outer margin and two on upper surface, the latter joined at proximal end; these crests defined by deep grooves. Gape of fingers with a short pubescence.

Walking legs smooth or punctate. Merus unarmed, anterior margin with a short fringe of plumose hairs and with scattered, long non-plumose setae near posterior margin, that of leg 3 slightly inflated; other segments rather thickly covered with long and short setae.

*Material examined:* See Table 35.

*Measurements:* Males, 2.9 to 5.2 mm; non-ovigerous females, 2.8 to 5.4 mm; ovigerous females, 4.1 to 5.7 mm. The ovigerous female holotype measures 5.5 by 5.5 mm; male paratype, 4.9 by 4.8 mm.

*Color:* Color in alcohol uniform light red. (Glassell) Specimens in the collection of the Allan Hancock Foundation are a light orange buff; a few show traces of broad reddish stripes on the fingers.

*Ecology:* With one exception, all known specimens have been taken from under stones in the intertidal zone. The typical subspecies was once collected at Isla Isabel, Mexico, from a rocky substrate in 0-3 fathoms.

Ovigerous females were collected in every month from December through April.

*Remarks:* The species as a whole ranges throughout the Panamic Province, but material is lacking for the area between Bahía de Tequepa, Mexico, the most southerly locality at which the typical subspecies was taken, and Bahía de Salinas, Costa Rica, north of which the new subspecies was not found. Therefore it cannot be determined at the present time where the break between the two populations occurs.

*Range:* Isla del Carmen, Gulf of California, south to Bahía de Tequepa, Mexico; Isabel and Tres Mariás Islands.

#### ***Petrolisthes lewisi austrinus*, new subspecies**

Plate 5; plate 23, fig. 2

*Petrolisthes sinuimanus*, Nobili, 1901b, p. 15. Rathbun, 1910, p. 599 (part). Not *Megalobrachium sinuimanus* (Lockington).

*Petrolisthes lewisi*, Haig, 1957b, p. 7 (part of new records; not all synonymy). Not *P. l. lewisi* (Glassell).

*Previous records:* Panama. Isla Flamenco: E. Festa (Nobili). Guayabo Chiquito: *Askoy* (Haig).

*Types:* Holotype, male, U. S. National Museum Cat. No. 102406, from Port Parker, Costa Rica, rocky shore; February 9, 1935; collected during Allan Hancock Pacific Expedition of 1935 at *Velero III* station 466-35. Paratypes: 145 specimens from the same and 18 other stations (see Table 36).

*Diagnosis:* Carapace nearly smooth, anterior regions and grooves strongly accentuated; no epibranchial spine; front trilobate; carpus about one and a half times as long as wide or a little less, proximal

two-thirds of anterior margin with three or four teeth, all but the distal one wholly or partially coalesced; manus with two strong dorsal crests and a third along outer margin; merus of walking legs unarmed.

*Description:* Carapace subquadrate, nearly smooth, with grooves defining the anterior regions distinct, as in *Petrolisthes l. lewisi*. Front, orbits, and antennae as in the typical form.

Merus of chelipeds as in the typical form. Carpus with a similar length-width ratio; teeth on anterior margin not well separated, as in *Petrolisthes l. lewisi*, but the proximal two or three partially coalesced, or completely joined to form a narrow, strongly projecting lobe or broad tooth, followed by a smaller, separated distal tooth; dorsal and posterior crests usually exactly as in typical form, but the oblique granules sometimes low and partially obscured, the crests then appearing somewhat smooth. Manus with crests as in typical form, dorsal ones sometimes low, smooth, in latter case the groove between them somewhat obscured; distinct groove near outer margin always present, defining the heavy, smooth outer marginal crest. Gape of fingers with a short pubescence. Chelipeds devoid of hairs except for occasional traces near posterior margin of carpus.

Walking legs as in *Petrolisthes l. lewisi*.

*Measurements:* Holotype male: length 4.7 mm, width 4.7 mm. Paratypes: males, 3.1 to 6.4 mm; non-ovigerous females, 3.5 to 4.7 mm; ovigerous females, 2.9 to 6.3 mm.

*Color:* No color remains on any of the preserved material examined, except for traces of reddish stripes on the fingers as in the typical form. These stripes were present in only a few specimens.

*Ecology:* As in the typical subspecies, *Petrolisthes lewisi austrinus* occurs under stones in the intertidal zone. There is no record of its association with corals. As previously noted by the writer (Haig, 1957b), the *Askoy* record of a single specimen from mud bottom in 24-64 meters (13-15 fathoms) was probably an error.

Ovigerous females were collected in January, February, March, September, and December.

*Remarks:* The structure of the carpal teeth, which are separated in *Petrolisthes lewisi lewisi* and coalesced in *P. l. austrinus*, was a constant character in all the specimens examined.

The two specimens from Isla Flamenco, Panama, referred by Nobili (1901b) to *Petrolisthes sinuimanus*, were seen by the writer and

found to belong to *P. lewisi austrinus*. Specimens from the *Askoy* Expedition referred by the writer (Haig, 1957b) to *P. lewisi* Glassell have since been re-examined. A portion of those from Guayabo Chiquito, Panama, are now placed in the new subspecies, while the rest of the Guayabo Chiquito material, as well as that from Golfo de Cupica, Colombia, is referred to *Petrolisthes artifrons*, new species.

The subspecific name is from the Latin *austrinus*, southern.

*Range*: Bahía de Salinas, Costa Rica, south to Punta Santa Elena, Ecuador.

### ***Petrolisthes cocoensis*, new species**

Plate 6; plate 22, fig. 2

*Types*: Holotype, male, U. S. National Museum Cat. No. 102408, from Bahía de Wafer, Isla del Coco, Costa Rica, rocky shore; March 2, 1933; collected during Allan Hancock Pacific Expedition of 1933 at *Velero III* station 107-33. Paratypes: same data as holotype, two males, seven ovigerous females (U. S. National Museum); two males, four ovigerous females (Allan Hancock Foundation). Paratypes: Bahía de Chatham, Isla del Coco, Costa Rica, shore; January 14, 1938; collected at *Velero III* station 778-38; one ovigerous female.

*Diagnosis*: Carapace nearly smooth, anterior regions and grooves strongly accentuated; no epibranchial spine; front broadly triangular or rounded in dorsal view, strongly deflexed; orbits very shallow, in dorsal view forming a nearly straight line with front; carpus about one and a half times as long as wide, anterior margin with a strong, broad lobe; manus with two strong dorsal crests and a third along outer margin, these crests defined by broad grooves; merus of walking legs unarmed.

*Description*: Carapace subovate or subquadrate, margins parallel posterior to epibranchial regions; nearly smooth, lightly plicate on post-erolateral regions and punctate anteriorly. Frontal groove and grooves defining protogastric and hepatic regions strongly accentuated. Front broad, strongly deflexed; broadly triangular or somewhat rounded in dorsal view, in frontal view trilobate, the lobes rounded, about equal in breadth, median one more projecting. Orbits very shallow, in dorsal view forming a nearly straight line with front, latter somewhat resembling that of *Petrolisthes violaceus* (Guérin); outer orbital angle not produced. Epibranchial region projecting at a distinct, obtuse angle to hepatic region; no epibranchial spine. Carapace with traces of hairs anteriorly.

Movable segments of antenna smooth or nearly so, without anterior projections; flagellum with long hairs. Outer maxillipeds lightly rugose.

Chelipeds covered dorsally with small granules, lightly pubescent; smooth on ventral surface. Merus armed on anterior margin with a small conical lobe. Carpus about one and a half times as long as wide, or a little less; armed on anterior margin with a strong, rounded lobe, anterior and posterior margins markedly converging distally from its highest point, lobe sometimes minutely denticulate along its edge; surface with a strong longitudinal crest; posterior margin with a strong crest covered with slightly elongate granules a little larger than those on rest of chelipeds, this crest usually produced distally into a small tooth; dorsal and posterior crests defined by two deep, broad grooves on dorsal surface; another, faint crest sometimes present on dorsal surface near base of lobe. Manus with a distinct longitudinal crest about center of dorsal surface, on its inner side another, shorter crest joined to first at proximal end and extending to base of dactylus; outer margin with a smooth, distinct crest, defined by a deep, broad groove extending well onto pollex. Dactylus with a deep longitudinal groove; gape of fingers with a short pubescence.

Merus of walking legs unarmed, anterior margin with a short fringe of plumose hairs, a few long non-plumose setae near posterior margin; that of leg 3 slightly inflated. Other segments covered with long setae.

*Measurements:* Holotype male: length 5.0 mm, width 4.8 mm. Paratypes: males, 2.8 to 4.6 mm; ovigerous females, 3.3 to 5.2 mm.

*Color:* No color or markings remain on any of the material examined.

*Ecology:* The type series was taken in the intertidal zone under stones. Twelve females out of twelve were ovigerous; they were collected in January and March.

*Relationships:* *Petrolisthes cocoensis* is very closely related to *P. lewisi* (Glassell), from which it is distinguished only by a slight difference in the shape of carapace and front, and by the presence of a lobe instead of teeth on the anterior margin of the carpus. It was probably derived originally from an isolated population of *P. lewisi*; indeed, it might be considered a third subspecies of the latter in which complete coalescence of the carpal lobes has taken place. However, it differs considerably more from the two subspecies of *P. lewisi* than they do from each other, and it is here considered a full species.



*Remarks:* This form has been found so far only on Isla del Coco, an isolated island with a high degree of endemism in its fauna.

*Range:* Isla del Coco, Costa Rica.

***Petrolisthes artifrons*, new species**

Plate 7; plate 22, fig. 4

*Petrolisthes lewisi*, Haig, 1957b, p. 7 (part). Not *P. lewisi* (Glassell).

*Previous records:*

Panama. Guayabo Chiquito: *Askoy* (Haig).

Colombia. Bahía Limón, Golfo de Cupica: *Askoy* (Haig).

*Types:* Holotype, male, U. S. National Museum Cat. No. 102407, from south of Punta Santa Elena, Ecuador, rocky shore; January 18, 1933; collected during Allan Hancock Pacific Expedition of 1933 at *Velero III* station 10-33. Paratypes: 197 specimens from the same and 15 other stations (see Table 37).

*Diagnosis:* Carapace nearly smooth, anterior regions and grooves strongly accentuated; no epibranchial spine; front narrow, trilobate; carpus about one and a half times as long as wide, proximal two-thirds of anterior margin with a broad, strongly projecting lobe, its edge obscurely divided into three; manus swollen on dorsal surface, with two low longitudinal crests separated by a narrow groove, outer margin with a crest defined by a distinct groove; merus of walking legs unarmed.

*Description:* Carapace subovate, margins posterior to epibranchial angle not parallel; covered with light plications except for metabranchial regions, the latter smooth. Frontal groove and grooves defining the various regions strongly accentuated. Carapace convex front to back; front rather narrow, distinctly trilobate in dorsal view (sinuously triangular in some small specimens), median lobe broad, rounded-triangular, strongly produced beyond eyes, lateral lobes narrower, rounded, directed forward, less strongly produced than median lobe but extending beyond eyes. Orbits rather shallow, obliquely concave; outer orbital angle only very slightly produced. No epibranchial spine. Carapace with a trace of hairs on frontal region in adults.

Movable segments of antenna smooth to lightly granular, first with a low crest on anterior margin, second and third without projections; flagellum with scattered long hairs. Outer maxillipeds lightly rugose.

Merus of chelipeds covered with large flattened granules; anterior margin with a small, strongly projecting, rounded, granular lobe. Carpus about one and a half times as long as wide, finely granular, armed on anterior margin with a broad, strongly projecting lobe occupying the proximal two-thirds of margin, this lobe rounded on its proximal side, forming an obtuse angle on its distal side, its edge sometimes obscurely subdivided into three parts; dorsal surface with a distinct median longitudinal crest; posterior margin markedly convex, with an obliquely rugose crest ending distally in a very small tooth, this crest sometimes covered with small crowded granules instead of rugae; the distinct groove between posterior and median crests with scattered granules a little larger than those on rest of dorsal surface and on lobe, this groove sometimes very broad, the median crest then correspondingly narrow; another broad groove sometimes present anterior to median crest, extending for only about distal half of carpus; a few scattered hairs sometimes present near posterior margin. Manus finely granular, heavy, surface swollen, the swollen area often lightly, longitudinally grooved to form two low, close-set crests; outer margin with a distinct rounded crest, defined by a strong, broad groove near outer margin and usually extending well onto pollex. Fingers finely granular; curved at tips, meeting entire length in one cheliped, usually shorter and slightly gaping in the other; dactylus usually deeply grooved along center; gape with a short, thick pubescence, usually extending to tips of fingers. Ventral surface of chelipeds smooth.

Merus of walking legs unarmed, anterior margin with a short, thick fringe of plumose hairs, that of leg 3 slightly inflated; other segments thickly covered with tufts of long non-plumose setae.

*Measurements:* Holotype male: length 8.0 mm, width 7.2 mm. Paratypes: males, 3.0 to 8.6 mm; non-ovigerous females, 4.2 to 6.5 mm; ovigerous females, 3.6 to 7.9 mm.

*Color:* Specimens preserved in alcohol were pale orange, with lighter spots on the carapace and chelipeds.

*Ecology:* Usually occurring in the littoral, under stones. It was taken once by the *Velero III* from a sand and shell bottom at 10 fathoms.

*Relationships:* This new species is allied to *Petrolisthes crenulatus* Lockington, *P. ortmanni* and *P. hians* Nobili, *P. lewisi* (Glassell), and *P. cocoensis*, new species. It may be readily distinguished from these forms by its narrower, more produced and less deflexed front.

*Remarks:* *Petrolisthes artifrons* occupies much the same range as *P. lewisi austrinus*, new subspecies, and the two forms often occur together.

The name *artifrons* is from the Latin *artus*, narrow, and *frons*, forehead, in reference to the narrow front characteristic of this species.

*Range:* Port Parker, Costa Rica, south to Punta Santa Elena, Ecuador.

### *Petrolisthes hians* Nobili

Plate 22, fig. 3

*Petrolisthes hians* Nobili, 1901b, p. 17 (type locality, Bahía de Santa Elena, Ecuador). Rathbun, 1910, p. 599. Haig, 1957b, p. 7.

*Pisosoma flagraciliata* Glassell, 1937, p. 82, pl. 1, fig. 2 (type locality, off Arena Bank, Gulf of California). Steinbeck and Ricketts, 1941, p. 458.

#### *Previous records:*

Gulf of California. Off Arena Bank: W. Beebe on *Zaca* (Glassell).

Pulmo Reef; Cabo de San Lucas: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

Colombia. Bahía Humboldt: *Askoy* (Haig).

Ecuador. Bahía de Santa Elena: E. Festa (Nobili).

*Diagnosis:* Carapace nearly smooth, anterior regions and grooves strongly accentuated; no epibranchial spine; front trilobate, the median lobe very narrow; carpus less than one and a half times as long as wide, anterior margin with three or four broad rounded teeth; manus with a crest on outer margin, defined by a distinct groove; merus of walking legs unarmed; telson of abdomen with five plates.

*Description:* Carapace covered with rough plications anteriorly, smooth or punctate posteriorly; protogastric, hepatic, and epibranchial regions, and the grooves defining them, strongly accentuated. Frontal region deflexed; front broad, trilobate, lateral lobes broad and sinuate, median lobe narrow, only slightly projecting beyond them. Outer orbital angle produced into a small, strong tooth. No epibranchial spine. Carapace devoid of hairs.

First movable segment of antenna with two minute spinules on anterior margin; second with a minute spinule on anterior margin at distal end, and often one at proximal end as well; third without anterior projections; flagellum with long hairs. Outer maxillipeds rugose.

Merus of cheliped smooth, armed on anterior margin with a small, strongly projecting lobe. Carpus less than one and a half times as long as wide, with three or four broad teeth on anterior margin, proximal one the largest; covered with rough, oblique granules, especially along posterior margin; a median longitudinal crest, often indistinct, it and posterior crest defined by a groove; small specimens with a trace of another dorsal crest anterior to median one. Manus covered with rough plications; surface not swollen, outer margin with a crest defined by a distinct groove continuing onto pollex. Fingers punctate; gape devoid of pubescence. Chelipeds without pubescence.

Walking legs nearly smooth, all segments with long setae. Merus not armed with spines.

Telson of abdomen with five plates.

*Material examined:* See Table 38.

*Measurements:* Males, 2.1 to 4.3 mm; non-ovigerous females, 1.8 to 4.4 mm; ovigerous females, 1.9 to 5.6 mm. A male syntype examined by the writer measured 4.0 mm; an ovigerous female syntype, 3.9 mm. Nobili gave measurements for a male specimen of 5.0 by 4.5 mm. The holotype of *Pisosoma flagraciliata* (an ovigerous female) measures 4.9 by 5.1 mm; a male paratype, 4.2 by 4.0 mm.

*Color:* In alcohol, carapace with a ground color of red; plications red and white. Chelipeds with maroon blotches, the plications banded with red and white; fingers red with white tips. Ambulatory legs banded with red and white. (Glassell)

*Ecology:* *Petrolisthes hians* is commonly found in coral heads from the littoral to a depth of about four fathoms. It occurs less frequently under stones in the intertidal zone. A Hancock expedition recovered it on one occasion from a sponge dredged in 1-4 fathoms at Acapulco, Mexico. It was once dredged by the *Velero III* in 14-18 fathoms from a sand and nullipore bottom off Isla Socorro; this depth must be considered exceptional.

Aside from the common coral and occasional sponge association, the only reference to commensalism for the species was by Steinbeck and Ricketts (1941), who found it attached to a sea urchin, probably *Centrostephanus*, in the Gulf of California.

Ovigerous females have been collected in every month from December through June.

*Relationships:* This species is most closely related to *Petrolisthes jugosus* Streets, 1872, a western Atlantic form. *P. jugosus* differs in

having a lightly pubescent carapace and chelipeds, and a trace of pubescence in the gape of the fingers. These differences appear to be constant, judging from the comparatively small series of the Atlantic species available for examination.

*Remarks:* The holotype of *Pisosoma flagraciliata* Glassell was compared with two of the 12 syntypes of *Petrolisthes hians*. The two nominal species proved to be identical, and *Pisosoma flagraciliata* becomes a synonym.

With the removal of several species from *Petrolisthes* to other genera, *Petrolisthes hians* and its close relative *P. jugosus* Streets become the only New World *Petrolisthes* with five plates instead of seven in the telson of the abdomen. It is not known whether any members of the genus from other parts of the world have a five-plated telson.

*Range:* Bahía de Santa María, Baja California; Guaymas, Gulf of California, south to Bahía de Santa Elena, Ecuador; Isabel, Tres Mariás, and Revillagigedo Islands. Shore to about 4 fathoms; exceptionally to 18 fathoms.

#### NEOPISOSOMA, new genus

*Type species:* *Neopisosoma bicapillatum*, new species.

Carapace rounded or subquadrate, approximately as broad as or a little broader than long. Side walls incomplete, ending at epibranchial level or tapering off at this point with a narrow projection extending to mesobranchial level, the posterior portion occupied by membrane only. Front narrow, rounded and usually rather strongly produced in dorsal view, trilobate or transversely sinuate in frontal view. Eyestalks short and stout, retractile.

Basal segment of antenna not produced forward to meet anterior margin of carapace; sometimes with a small inward projection.

Basal segment of antennule broad, anterior face truncate, anterior margin sinuate.

Chelipeds large, thick, and robust, one distinctly larger than the other; carpus short and stout, about as broad as long; manus and fingers differing in form in the two chelipeds.

Walking legs of moderate length, somewhat flattened; propodus with movable spinules on posterior margin; dactylus ending in a simple spine, with small movable accessory spinules on posterior margin.

Telson of abdomen composed of either seven or five plates. Male pleopods lacking in some species.

Contains five known species, from the east and west American coasts.

*Remarks:* *Neopisosoma* shares with *Pachycheles* three characters which occur nowhere else in the family: the chelipeds are thick, robust, and markedly differing in size (and bent in the normal manner at the articulation of carpus and manus, not straight as in *Orthochela*); the number of plates in the telson of the abdomen may vary within a single species; and male pleopods are absent in some species. The principal difference between the two genera lies in the structure of the side walls of the carapace. In *Pachycheles* the chitinous material in the posterior portion of the side wall is broken up into one or more separate pieces, while in *Neopisosoma* these fragments are entirely lacking, leaving membrane only. It may be that, when the species included in *Pachycheles* are reviewed on a worldwide basis, *Neopisosoma* will prove to be referable to it as a subgenus.

Besides the three species treated in this report, *Neopisosoma* is represented by two Caribbean forms previously included in *Pisosoma*: these are *Neopisosoma angustifrons* (Benedict), 1901, and *N. curacaoense* (Schmitt), 1924.

The name of this genus is derived from the Greek *neos*, new, and *Pisosoma*.

#### KEY TO THE EASTERN PACIFIC SPECIES

- 1a. Chelipeds with flattened granules; carpus with crests; telson 7-plated; male pleopods present . . . . . 2
- 1b. Chelipeds with rounded, projecting granules; no crests on carpus; telson 5-plated; no male pleopods . . . . . *dohenyi*
- 2a. Carpus with 4-5 teeth occupying entire anterior margin; its surface with 3 distinct longitudinal crests, and a fourth along posterior margin; manus of both chelipeds thickly covered with long hairs . . . . . *bicapillatum*
- 2b. Carpus with 3 teeth occupying not more than proximal two-thirds of anterior margin; its surface with 3 low, often obsolescent crests; pubescence on manus of minor cheliped only . . . . . *mexicanum*

#### *Neopisosoma bicapillatum*, new species

Plate 8; plate 30, fig. 3

*Types:* Holotype, male, U. S. National Museum Cat. No. 102409, from reef north of Tagus Hill, Isla Albemarle, Galapagos Islands;

February 9, 1933; collected during Allan Hancock Pacific Expedition of 1933 at *Velero III* station 65-33. Paratypes: 13 specimens from the same and four other stations (see Table 39).

*Diagnosis:* Chelipeds covered with flattened granules; dorsal surface of carpus with three longitudinal crests defined by distinct grooves; anterior margin of carpus entirely occupied by four or five conical teeth; manus of both chelipeds thickly covered with long hairs; telson seven-plated; a pair of pleopods in male.

*Description:* Carapace about as broad as long, subquadrate, regions usually distinct; posterolateral regions lightly plicate, surface otherwise punctate, devoid of hairs except for occasional traces anteriorly. Front arcuate and rather strongly projecting in dorsal view, with a shallow median groove; in frontal view trilobate or transverse with a strongly deflexed median projection. Orbits deep, sharply oblique. Side wall extending to epibranchial level, with a narrow posterior projection continuing to level of mesobranchial region.

First movable segment of antenna with a strong crest on anterior margin; second finely granular, with a vestigial anterior crest in large specimens; third nearly smooth; flagellum with short hairs. Outer maxillipeds lightly punctate.

Merus of chelipeds rugose or with flattened granules on dorsal surface; anterior margin armed with a strongly projecting, conical lobe; ventral surface smooth. Carpus devoid of pubescence, armed on anterior margin with four or five strong, conical, smooth-edged teeth, about equal in size, a similar additional tooth formed by a projection of the anterodistal angle; surface with four longitudinal crests defined by distinct grooves: the first at base of teeth, extending to distal end of carpus; second at about center of carpus, not extending its entire length but interrupted near distal end; third narrow, near posterior margin of carpus and extending to about same level as second, the grooves defining it and second crest joined around their ends; fourth extending along posterior margin, its surface obliquely rugose; ventral surface smooth. Manus of both chelipeds covered with flattened granules; a strong longitudinal crest near inner margin extending to base of dactylus; entire surface, from outer margin of this crest to outer margin of manus, thickly covered with long plumose hairs, the pile often extending nearly to tip of pollex, and ending sharply along outer margin of manus; outer edge of manus decorated with a row of small granules; ventral surface smooth or punctate. Fingers nearly smooth. Dactylus of major cheliped often strongly curved, cutting edge with a

large proximal tubercle; pollex with an elongate tubercle on proximal half of cutting edge, its tip long and sharply incurved; fingers gaping, especially in males, but usually crossing at tips. Pollex of minor cheliped with long incurving tip as in major cheliped; fingers meeting entire length, crossing at tips. Gape in both chelipeds with a trace of pubescence.

Merus of walking legs with an anterior fringe of plumose hairs; a similar fringe on the distal half or two-thirds of carpus; hairs also on dorsal surface of carpus near articulation with propodus; propodus and dactylus covered with plumose hairs and a few scattered, non-plumose setae.

Abdomen punctate, telson with seven plates. A pair of pleopods in male.

*Variations:* The crests on the dorsal surface of the carpus are sometimes quite high and at other times low, but always more distinct than in *Neopisosoma mexicanum*; the crests may be smooth or covered with flattened granules. In addition to the four or five teeth usually present on the anterior margin of the carpus, a small distal tooth may be present between the last full-sized tooth and the one formed by the projection of the anterodistal angle. In one specimen examined, the two proximal teeth were coalesced.

*Measurements:* Holotype male: length 5.4 mm, width 5.4 mm. Paratypes: males, 3.6 to 6.4 mm; ovigerous females, 4.5 to 5.3 mm.

*Color:* All specimens were faded in alcohol to a pale buff. The hairs on the dorsal surface of the manus were straw-colored, but the pile was filled with silt in most cases and consequently appeared black.

*Ecology:* All specimens were taken in the littoral, presumably under stones, with the exception of the three from La Libertad, Ecuador, which were collected by diving in 2 fathoms.

All female specimens were ovigerous, and were collected in December, January, and February.

*Relationships:* *Neopisosoma bicapillatum* has two close relatives, *N. mexicanum* (Streets) and *N. curacaoense* (Schmitt), 1924. *N. mexicanum* usually has but three carpal teeth, which occupy no more than two-thirds of the anterior margin; the crests on the carpus are always low, sometimes obsolescent; and long plumose hairs are present on the manus of the minor cheliped only. *N. bicapillatum* is closer to the Caribbean species *N. curacaoense*, which has very similar carpal crests and teeth. In *N. curacaoense* the long hairs are not invariably



present on the manus of both chelipeds, as in *N. bicapillatum*, but may occur on one, both, or neither manus, their presence on both being predominantly a female characteristic. In the Atlantic species the number of plates in the telson of the abdomen appears to be variable in both sexes, specimens having been observed in which it was five-, seven-, or partially seven-plated. Like the related Pacific coast species, *N. curacaoense* has a pair of pleopods in the male.

*Remarks:* The specific name is from the Latin *bi-*, twice, doubly, and *capillatus*, hairy, in reference to the presence of long hairs on the manus of both chelipeds.

*Range:* Known from only two mainland stations, at Puerto Utría, Colombia, and La Libertad, Ecuador; Galapagos Islands.

***Neopisosoma mexicanum* (Streets), new combination**

Plate 30, fig. 2

*Pachycheles mexicanus* Streets, 1871a, p. 225, pl. 2, fig. 1 (type locality, Golfo de Tehuantepec, Mexico). Ortmann, 1897, pp. 292, 293. Haig, 1957b, p. 3. Not Moreira, 1901, pp. 32, 91.

*Previous records:*

Mexico. Golfo de Tehuantepec: (Streets).

Panama. Guayabo Chiquito: *Askoy* (Haig).

Colombia. Bahía Limón, Golfo de Cupica: *Askoy* (Haig).

*Diagnosis:* Chelipeds covered with flattened granules; dorsal surface of carpus with three low, often obsolescent crests; anterior margin of carpus with three conical teeth occupying the proximal half or two-thirds of margin; manus of major cheliped with a short pubescence, that of minor cheliped usually thickly covered with long hairs; telson seven-plated; a pair of pleopods in male.

*Description:* Carapace about as broad as long, regions distinct; plicate on posterolateral regions, otherwise punctate or faintly granular, naked except for traces of pubescence on frontal region. Front rather strongly projecting and arcuate in dorsal view, in frontal view trilobate, median lobe produced and strongly deflexed. Side wall extending to epibranchial level, with a narrow posterior projection continuing to level of mesobranchial region.

First movable segment of antenna with a crest on anterior margin, low to strongly projecting; second finely granular; third nearly smooth; flagellum with short hairs.

Dorsal surface of chelipeds more or less evenly covered with small, somewhat flattened granules. Merus with a strongly projecting, rounded lobe on anterior margin. Carpus with three distinct conical teeth occupying proximal half or two-thirds of anterior margin, proximal one the largest, a fourth tooth occasionally present; dorsal surface with two low longitudinal crests, one at about center and other near posterior margin, a third crest, usually obsolescent, near anterior teeth, these crests sometimes covered with enlarged granules; posterior margin obliquely rugose; surface covered with a short pubescence. Manus of major cheliped with a low rounded crest on outer margin, defined by a shallow groove extending to base of pollex; a low, broad swelling at articulation with dactylus; surface covered with a short pubescence, slightly longer toward outer margin; fingers strongly curved, cutting edges with a row of small granules, usually more projecting in smaller individuals, obsolescent in some large specimens, fingers usually not meeting at tips, gape naked or with a slight trace of pubescence. Manus of minor cheliped with crest and groove near outer margin similar to that of major cheliped; outer half thickly covered with long plumose hairs, the pile extending to base of pollex or occasionally about half way onto it; dactylus strongly curved; fingers meeting entire length, crossing at tips, gape naked or with a slight trace of pubescence.

Anterior margin of walking legs with a fringe of plumose hairs, this fringe often obsolescent on carpus; propodus and dactylus with scattered tufts of plumose hairs and a few non-plumose setae on dorsal surface.

Telson of abdomen with seven plates. A pair of pleopods in male.

*Variations:* Usually only the smaller specimens have strongly projecting granules on the cutting edge of the dactylus of the major cheliped (not strong teeth as shown in Streets's illustration of the type). In most specimens there is a row of small granules on the cutting edge of both pollex and dactylus, but in some larger individuals the cutting edges are perfectly smooth.

In several of the specimens examined the plumose hairs on the manus of the minor cheliped were not developed into a long thick pile, but remained short as in the manus of the major cheliped.

*Material examined:* See Table 40.

*Measurements:* Males, 3.1 to 7.2 mm; non-ovigerous females, 2.3 to 7.7 mm; ovigerous females, 3.4 to 7.6 mm. Because of its dried con-

dition the juvenile holotype specimen could not be measured accurately. Streets reported it as 0.18 inch.

*Color:* In alcoholic specimens collected in 1954, the entire crab was pale orange, with the granules on the chelipeds a darker orange and small dark orange spots on the carapace. Older preserved specimens retained traces of red blotches on the chelipeds. None had a white spot on the front or striped legs, as noted by Streets for the holotype.

*Ecology:* Nearly all the known material was collected in the littoral, under stones. Specimens from Mexico taken by E. Y. Dawson may have been washed from algae. The species was taken once from the *Velero III* by diving at 2 fathoms, and was once dredged in 10 fathoms from a sand and shell bottom.

Ovigerous females have been collected in January, March, May, and September.

*Remarks:* Prior to the recent report on *Askoy* porcellanids (Haig, 1957b), this species was known only from the holotype, a dried juvenile specimen in the collections of the Academy of Natural Sciences of Philadelphia.

The identity of the Brazilian species listed by Moreira (1901) as *Pachycheles mexicanus* is not known.

*Range:* Mazatlán at the mouth of the Gulf of California, south to Punta Santa Elena, Ecuador. ?Extralimital: Isla Charles, Galapagos Islands.

### ***Neopisosoma dohenyi*, new species**

Plate 9; plate 30, fig. 4

*Types:* Holotype, male, Allan Hancock Foundation Cat. No. 562, from Islas Las Tres Marietas, Bahía de Las Banderas, Mexico, shore; March 21, 1956; collected by Jens W. Knudsen. Paratypes: 46 specimens from the same and five other stations (see Table 41). Specimens collected by J. Xantus at Cabo San Lucas, Gulf of California (Museum of Comparative Zoology 1373) were not at hand during the drawing up of the description and consequently are not designated paratypes.

*Diagnosis:* Chelipeds covered with rounded, projecting granules; no crests on dorsal surface of carpus; anterior margin of carpus with four to six narrow teeth, some of them bifid at tips; manus of both chelipeds covered with a short pubescence; telson five-plated; no pleopods in male.

*Description:* Carapace usually a little broader than long (1.0 or 1.1 times in males, 1.2 or 1.3 in females), strongly convex front to back, surface punctate, slightly uneven, devoid of hairs or at most with traces visible only under magnification. Front rounded in dorsal view, in frontal view transversely sinuate or faintly trilobate. Orbits rather shallow. Side wall consisting only of a small anterior wedge, ending at epibranchial level; posterior membrane thickly covered with fine hairs.

First movable segment of antenna with a strongly projecting tubercle on anterior margin; second and third lightly granular; flagellum with short hairs. Outer maxillipeds smooth or punctate, surface of ischium with scattered hairs.

Merus of chelipeds covered with flattened, scale-like granules; distal end of anterior margin with a small granular lobe; ventral surface smooth. Carpus armed on anterior margin with four to six narrow, rounded, well-separated teeth, some of them bifid at their tips, all about equal in size; surface evenly covered with large rough granules, between the granules a short pubescence; ventral surface smooth. Manus and fingers covered with granules, larger than those of carpus, somewhat more projecting toward outer margin of manus and pollex; between the granules a short pubescence, as in carpus; ventral surface with flattened granules, rougher toward outer margin of manus. Dactylus of major cheliped with a row of three or four tubercles on cutting edge, proximal one larger and more projecting than others; pollex short, conical, with a large tubercle on cutting edge; fingers meeting at tips, slightly gaping, gape with traces of hair. Dactylus of minor cheliped with a row of small tubercles on cutting edge; pollex short, conical, with a row of small tubercles; fingers meeting for entire length, gape with traces of hair.

Walking legs punctate or lightly granular; fringed on anterior margins with plumose and non-plumose hairs.

Abdomen smooth or punctate; telson with five plates. No pleopods in male.

*Measurements:* Holotype male: length 4.2 mm, width 4.5 mm. Paratypes: males, 1.7 to 6.0 mm; non-ovigerous females, 1.9 to 2.3 mm; ovigerous females, 2.1 to 5.2 mm.

*Color:* The color in life was not recorded. In specimens preserved only a few years in alcohol the carapace is orange, with a white spot on the front, a narrow longitudinal white streak on the mesogastric region, and an oblique white streak or a white spot on each mesobranchial area. The chelipeds are orange, with the granules darker, and

there is a large median white area on the carpus and some white on the outer side of the manus; the tips of the fingers are white. This pattern was observed in specimens from several Mexican localities, and is probably characteristic of the species in life.

*Ecology:* Mexican specimens were collected in the littoral; those taken by E. Y. Dawson may have been washed from algae. The single specimen from Panama was recovered from coral dredged in 2-4 fathoms.

Ovigerous females were collected in December, January, and March.

*Relationships:* *Neopisosoma dohenyi* is most closely related to a west Atlantic species, *N. angustifrons* (Benedict), 1901, which like it has the chelipeds covered with rough granules, lacks crests on the carpus, has a five-plated telson, and lacks male pleopods. In *N. angustifrons* there are two rows of enlarged granules or small tubercles near the outer margin of the manus and extending onto the pollex; the carpal teeth are less projecting than in *N. dohenyi*; and the side walls of the carapace have a narrow, curved posterior projection extending to the mesobranchial level.

It was noted that some alcoholic specimens of *N. angustifrons* had a color pattern very similar to that of *N. dohenyi*.

*Remarks:* The new species is named for Mr. Patrick A. Doheny, who sponsored the expedition on which the holotype was taken, along with many other materials of scientific interest.

*Range:* Cabo San Lucas and Mazatlán at the mouth of the Gulf of California, south to Bahía Piñas, Panama.

#### PACHYCHELES Stimpson 1858

*Pachycheles* Stimpson, 1858, p. 228 (type species *Porcellana grossimana* Guérin, 1835, by original designation).

*Pisosoma* Stimpson, 1858, p. 228 (type species *Porcellana pisum* H. Milne Edwards, 1837, by original designation).

Carapace rounded or subquadrate, usually about as broad as long in males, a little broader than long in females. Side walls incomplete, the posterior portion consisting of one or more pieces separated by membranous interspaces. Front not prominent, usually rounded or transversely sinuate in dorsal view, trilobate in frontal view. Eyestalks short and stout, retractile.

Basal segment of antenna not produced forward to meet anterior margin of carapace; usually somewhat produced inward to form a partial suborbital margin.

Basal segment of antennule broad, anterior margin truncate; anterior margin sinuate, sometimes armed with one or two spinules on inner side.

Chelipeds large, thick, and robust, one distinctly larger than the other; carpus short and stout, usually about as broad as long; manus and fingers often different in form in the two chelipeds.

Walking legs of moderate length, somewhat flattened; propodus with movable spinules on posterior margin; dactylus ending in a simple spine, with small movable accessory spinules on posterior margin (and very rarely with a few fixed spines as well).

Telson of abdomen composed of either seven or five plates, the number within each species constant in males, sometimes variable in females. Male pleopods frequently reduced in size or completely lacking.

*Remarks:* *Pisosoma* was very poorly defined by its author (Stimpson, 1858), and a heterogeneous assemblage of species has been assigned to it from time to time by various writers. Ortmann (1897) considered it a subgenus of *Petrolisthes*, placing in it forms in which the basal antennal article is short, the side walls of the carapace are entire, and the chelipeds are somewhat thickened; but at the same time he assigned its type species, *Porcellana pisum* H. Milne Edwards, 1837, to *Pachycheles*. Miyake (1943), recognizing that *Pisosoma* must be confined to species related to *Pisosoma pisum*, gave the first satisfactory definition of the genus on that basis. Among the five Nipponese species in which the side walls of the carapace are divided, Miyake was able to distinguish between *Pachycheles* and *Pisosoma* on the basis of several characters, the most clear-cut distinctions being the presence in *Pachycheles* of a tuft of hairs on the front and spinules on the anterior margin of the basal antennal article, and the absence of these features in *Pisosoma*. However, when these criteria were applied to the eighteen eastern Pacific species no clear distinction between the two genera could be drawn. In this report *Pisosoma* is considered a synonym of *Pachycheles*.

## KEY TO THE EASTERN PACIFIC SPECIES

- 1a. Carapace with a distinct tuft of hairs on front, or surface covered with distinct hairs. . . . . 2
- 1b. Carapace devoid of hairs, or at most with traces scarcely visible except under magnification. . . . . 13
- 2a. Front with a distinct tuft of hairs . . . . . 3
- 2b. Front without a distinct tuft, but hairs sometimes present. . . 10
- 3a. Carpus and manus each with 3 longitudinal rows of large flattened tubercles, the spaces between them filled with a short pubescence. . . . . *monilifer*
- 3b. Chelipeds without rows of large tubercles as in 3a. . . . . 4
- 4a. Manus with a large granulate protuberance at base of pollex; telson with 5 plates in both sexes. . . . . 5
- 4b. No distinct protuberance on manus at base of pollex; telson 7-plated in males, 7- or 5-plated in females. . . . . 6
- 5a. Carpus with a broad triangular lobe; front with a tuft of non-plumose setae; chelipeds with long, scattered plumose hairs. . . . . *rudis*
- 5b. Carpus with a broad serrate-edged lobe; front with a tuft of plumose hairs; chelipeds with short, thick-set plumose hairs. . . . . *holosericus*
- 6a. Frontal tuft composed of plumose hairs only; manus nearly naked or with plumose hairs, scattered non-plumose setae sometimes interspersed with them; telson of female 7-plated. . . 7
- 6b. Frontal tuft composed of mixed plumose and non-plumose hairs; manus covered with long, stiff, non-plumose setae; telson of female 5- or incompletely 7-plated. . . . . 9
- 7a. Carpus with 2 teeth; chelipeds nearly naked or with plumose hairs, but no non-plumose setae; male pleopods present. . . . . *grossimanus*
- 7b. Carpus with 3-4 teeth; chelipeds (manus of minor chelipeds, at the very least) thickly covered with plumose hairs, and scattered, long non-plumose setae interspersed with them. . . . 8
- 8a. Non-plumose setae mixed with plumose pubescence on manus of both chelipeds; male pleopods present. . . . . *pubescens*
- 8b. Non-plumose setae mixed with plumose pubescence on manus of minor cheliped, that of major cheliped with plumose pubescence only; no male pleopods. . . . . *crinimanus*

- 9a. Carpus with a broad serrate-edged lobe, surface nearly smooth except near posterior margin; chelipeds with non-plumose setae only; male pleopods present. . . . *subsetosus*
- 9b. Carpus with 3-4 teeth, surface covered with small tubercles; chelipeds with tufts of long, non-plumose setae surrounded by short plumose hairs; no male pleopods. . . . *spinidactylus*
- 10a. Front rounded in dorsal view; carpus with 2 teeth; telson 7-plated in males. . . . . 11
- 10b. Front shallowly trilobate in dorsal view; carpus with 3-5 teeth; telson 5-plated (male of *velerae* unknown). . . . . 12
- 11a. Chelipeds with non-plumose setae only; walking legs with non-plumose setae; male pleopods present. . . . *panamensis*
- 11b. Chelipeds covered with non-plumose setae, plumose hairs near outer margins; walking legs with plumose hairs; no male pleopods. . . . . *trichotus*
- 12a. Inner half of carpus nearly smooth, outer half with 3 longitudinal rows of projecting granules; chelipeds with tufts of short, plumose bristles. . . . . *marcortezensis*
- 12b. Inner half of carpus with a series of transverse ridges, outer half with 3 longitudinal rows of strongly projecting granules, series of transverse ridges between the rows; chelipeds with scattered long, non-plumose setae. . . . . *velerae*
- 13a. Carpus and manus with strong crests and grooves. . . . *vicarius*
- 13b. No strong crests and grooves on dorsal surface of chelipeds. 14
- 14a. Carpus and manus nearly smooth, manus with a distinct groove near outer margin. . . . . *biocellatus*
- 14b. Carpus and manus covered with granules. . . . . 15
- 15a. Carapace smooth, shining, very strongly convex front to back; dactylus of walking legs with 2 strong fixed spines on posterior margin in addition to terminal claw. . . . . *crassus*
- 15b. Carapace not markedly convex; dactylus of walking legs without fixed spines. . . . . 16
- 16a. Carpus and manus thickly covered with long plumose hairs, fingers naked. . . . . *setimanus*
- 16b. Chelipeds devoid of hairs, or at most with traces of pubescence. 17
- 17a. Carpus with a broad lobe armed with about 8 small teeth or serrations; walking legs almost devoid of hairs; telson 5-plated in both sexes; male pleopods present. . . . . *chacei*



- 17b. Carpus with a broad lobe notched to form 2 shallow teeth; walking legs with long plumose hairs; telson 7-plated in males, incompletely so in females; no male pleopods. . *calculosus*

***Pachycheles chacei* Haig**

Plate 31, fig. 3

Restricted synonymy:

*Pachycheles rudis*, Nobili, 1901b, p. 18 (part). Not *P. rudis* Stimpson.  
*Pachycheles chacei* Haig, 1956a, p. 9, pl. 1 (type locality, Bahía Caledonia, Atlantic Panama); 1957b, p. 6.

*Previous Pacific records:*

Colombia. Bahía Humboldt: *Askoy* (Haig 1957b).

Ecuador. Bahía de Santa Elena: E. Festa (Nobili).

*Diagnosis:* Carapace practically devoid of hairs; carpus covered with small granules tending to form longitudinal rows on outer half, anterior margin with a broad lamellar lobe with a row of about eight strongly projecting granules or small teeth along its edge; manus and fingers with granules similar to those of carpus; walking legs almost devoid of hairs; telson five-plated; a pair of pleopods in male.

*Description:* Carapace about as broad as long in males, usually slightly broader (1.1 times) in females; plicate on posterolateral and frontal regions, otherwise smooth or punctate; devoid of hairs except for occasional traces on frontal region, visible only under high magnification. Front rounded in dorsal view, sinuously triangular or faintly trilobate in frontal view. Outer orbital angle produced into a small tooth. Separated portion of side wall consisting of one large piece and usually two smaller ones.

First movable segment of antenna smooth, with a distinct conical tubercle on anterior margin; second and third smooth; flagellum naked.

Merus of chelipeds lightly rugose, with a small granular lobe on anterior margin. Carpus armed on anterior margin with a broad lamellar lobe, occupying nearly entire margin and with a row of about eight strongly projecting granules or small teeth along its edge, the distal ones a little larger; surface of carpus and lobe covered with small granules, larger and sometimes a little elongate on outer half, there tending to form more or less even longitudinal rows. Manus and fingers with rough granules, similar to those of carpus, more projecting toward outer margin. Dactylus of major cheliped strongly curved; fingers gaping in major cheliped, meeting entire length in minor cheliped; gape

without pubescence. Entire cheliped devoid of hairs, or at most a faint trace of pubescence between granules on manus of major cheliped.

Walking legs almost devoid of hairs, a few scattered setae on propodus and dactylus.

Telson of abdomen with five plates. A pair of pleopods in male.

*Material examined*: See Table 42.

*Measurements*: Males, 3.0 to 4.5 mm; non-ovigerous female, 2.9 mm; ovigerous females, 3.0 to 4.5 mm. The holotype, an ovigerous female, is 3.7 mm in length.

*Color*: The color in life was not recorded. Alcoholic specimens have faded to a pale buff.

*Ecology*: *Pachycheles chacei* has been taken in the Pacific from coral recovered at 1-4 fathoms. On the Atlantic coast it was taken in the littoral.

Ovigerous females (Pacific coast specimens) were collected in January.

*Remarks*: This species was originally described from the western Atlantic; on that side of the American continent it is known from only two stations, Bahía Caledonia, Panama, and Cartagena, Colombia. The present writer reported it from the eastern Pacific on the basis of a specimen collected by the *Askoj* Expedition, and referred specimens called *Pachycheles rudis* Stimpson by Nobili (1901b) to this species (Haig, 1957b). Additional material studied in connection with the present report shows the species to be well established on the Pacific coast. It has not been taken in abundance anywhere.

*Range*: San José, Guatemala, south to Bahía de Santa Elena, Ecuador. Western Atlantic: Panama and Colombia.

### ***Pachycheles calculus*, new species**

Plate 10; plate 31, fig. 4

*Types*: Holotype, male, U. S. National Museum Cat. No. 102410, from south of La Libertad, Ecuador, rocky shore; January 20, 1933; collected during Allan Hancock Pacific Expedition of 1933 at *Velero III* station 16-33. Paratypes: 42 specimens from the same and nine other stations (see Table 43).

*Diagnosis*: Carapace practically devoid of hairs; carpus covered with granules flattened on anterior half or two-thirds, its anterior margin with a broad lobe, notched to form two shallow teeth; similar gran-

ules on manus and fingers, sometimes more projecting and tending to form longitudinal rows on outer part of manus, outer margin of latter with a low granular crest; walking legs 2 and 3 thickly covered with long plumose hairs; telson seven-plated in males, incompletely so in females; no pleopods in male.

*Description:* Carapace slightly broader than long (1.1 times in males, 1.1 to 1.3 in females), somewhat convex; plicate on posterolateral regions, elsewhere covered with scattered punctae or short rugae, particularly in frontal and lateral regions; appearing devoid of hairs, but under high magnification often showing very short setae arising from the punctae and plications. Front rounded in dorsal view, in frontal view faintly trilobate or transverse with a slight median projection. Outer orbital angle produced into a small, sometimes indistinct tooth. Separated portion of side wall consisting of one large piece, sometimes a very small one posterior to it.

First movable segment of antenna with a distinct conical tubercle on anterior margin; second somewhat roughened; third smooth; flagellum naked. Outer maxillipeds punctate, under high magnification usually showing short setae as on carapace.

Merus of chelipeds rugose on dorsal surface, with a rugose, subtriangular lobe, rather strongly projecting, on anterior margin; ventral surface smooth. Carpus armed on anterior margin with a broad lamellar lobe, occupying entire margin and shallowly notched along its edge to form a low, broad tooth followed distally by a smaller one, the surface of the lobe covered with small, crowded granules; dorsal surface of carpus covered with granules somewhat larger than those of lobe and not crowded so closely together, flattened and slightly imbricate in anterior half or two-thirds, rounded and projecting in posterior third; somewhat flattened and elongate on posterior margin, forming oblique rugae; ventral surface smooth. Manus and fingers covered with granules similar to those on outer third of carpus; a trace of pubescence sometimes, but not always, present between granules; outer margin with a low, indistinct crest covered with smaller granules. Dactylus of major cheliped curved, a large tubercle on cutting edge near articulation with manus; pollex with a tubercle on cutting edge near tip; fingers gaping. Fingers in minor cheliped straight, meeting for entire length or nearly so. Gape of both fingers with a trace of pubescence. Ventral surface of pollex and outer part of manus with flattened granules; rest of manus roughened; dactylus punctate.

Walking legs lightly rugose, surface with rather strong, flattened granules; carpus and propodus, and to a lesser extent merus, of legs 2 and 3 thickly covered with long plumose hairs.

Abdomen smooth; telson seven-plated in males, nearly always incompletely so in females. No pleopods in male.

*Variations:* In some specimens there are enlarged granules forming two more or less regular longitudinal rows along the outer part of the manus of the major cheliped, and a few granules grouped together near the gape of the fingers. In a few of the specimens from Bahía Tangola-Tangola these larger granules are bunched together to form several large tubercles, the one at the gape of the fingers being particularly outstanding. In these same specimens the tubercles are present, but less distinctly, on the minor cheliped also.

The teeth on the outer margin of the carpus are quite strongly projecting in occasional examples, and in others tend to divide slightly along their edges.

The tubercle on the cutting edge of the pollex is usually larger and more projecting than is shown in the illustration of the holotype (Plate 10, fig. 1) but in one or two specimens it was entirely lacking.

*Measurements:* Holotype male: length 5.1 mm, width 5.9 mm. Paratypes: males, 2.4 to 5.3 mm; non-ovigerous females, 2.3 and 5.0 mm; ovigerous females, 2.5 to 6.6 mm.

*Color:* All the specimens examined had faded in alcohol to a pale orange-buff. In some examples the tips of the fingers are white.

*Ecology:* Specimens from Bahía Tangola-Tangola were recovered from coral; the single specimen from Bahía Santa Lucía was taken from sponge dredged in 1-4 fathoms. The rest of the material for which data are available was found on rocky reefs, presumably concealed under stones.

Ovigerous females were taken in every month from January through May.

*Relationships:* *Pachycheles calculosus* appears to be most closely related to *P. greeleyi* (Rathbun), 1900, a Brazilian species. In both forms the carapace and chelipeds are nearly devoid of hairs, the chelipeds are covered with granules, the telson of the abdomen is seven-plated, and male pleopods are lacking. In *P. greeleyi* the carapace is somewhat rugose, the outer orbital angle is produced into a distinct tooth, and the granules of the chelipeds and the tubercles on the cutting edges of the fingers are unlike those of *P. calculosus*.

*Remarks:* The specific name, from the Latin *calculosus*, pebbly, was suggested by the granular appearance of the chelipeds.

*Range:* Acapulco, Mexico, south to La Libertad, Ecuador.

***Pachycheles setimanus* (Lockington)**

Plate 31, fig. 2

*Petrolisthes (Pisosoma) setimanus* Lockington, 1878, pp. 396, 402 (type localities, Bahía Mulegé and Isla San José, Gulf of California).

*Pachycheles panamensis?* Schmitt, 1924b, p. 385. Not *P. panamensis* Faxon.

*Pachycheles setimanus*, Glassell, 1936, p. 292; 1938a, p. 444. Steinbeck and Ricketts, 1941, p. 456.

*Previous records:* Gulf of California. Bahía de Tepoca, Sonora: F. Baker (Schmitt). Bahía Mulegé: (Lockington). Bahía Concepción: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Isla San José: (Lockington). Pulmo Reef: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

*Lectotype:* Male, 6.4 mm in length by 6.9 mm in width, in Paris Museum, labelled "*Petrolisthes setimanus* Lockington. California—Lockington 6-99 (Type)." This specimen is hereby designated lectotype at the request of Mr. Jacques Forest.

*Diagnosis:* Carapace practically devoid of hairs; carpus covered with large granules, depressed or obsolescent on anterior two-thirds and strongly projecting on posterior third, its anterior margin with three strong granular teeth; manus with rounded granules, its surface and that of carpus thickly covered with long plumose hairs, longer toward outer margins; fingers devoid of hairs, nearly smooth; walking legs covered with long plumose hairs and a few scattered, non-plumose setae; telson seven-plated; a pair of pleopods in male.

*Description:* Carapace about as broad as long in males, slightly broader (1.1 or 1.2 times) in females; posterolateral and frontal regions plicate, surface otherwise smooth or punctate; naked except for traces of pubescence on anterior regions, not visible except under high magnification, or at most with a few long, scattered plumose hairs in occasional specimens. Front rounded in dorsal view, trilobate in frontal view, the median lobe rounded and produced. Outer orbital angle produced into a strong tooth. Separated portion of side wall consisting of one large piece and usually a few fragments.

Movable segments of antenna smooth or lightly granular, without anterior projections; flagellum naked.

Merus of chelipeds rugose, with a large, rugose, strongly projecting subtriangular lobe on anterior margin. Anterior margin of carpus with three strong teeth, the proximal one largest, covered with small granules; surface of carpus with large granules, somewhat imbricate, depressed or obsolescent in anterior two-thirds, more projecting toward the obliquely rugose posterior margin; covered with plumose hairs, latter longer toward outer margin, sometimes scarcely evident in anterior two-thirds of surface. Manus covered with granules, somewhat smaller than those of carpus and more projecting toward outer margin; covered with plumose hairs, latter longer on outer margins and sometimes extending onto proximal half of pollex. Dactylus long and slender, devoid of hairs; pollex shorter, curved, devoid of hairs at least in distal half; fingers punctate or lightly granular, gaping and crossing at tips in major cheliped, meeting for entire length in minor cheliped, gape without pubescence.

All segments of walking legs thickly covered with long plumose hairs, a few scattered, non-plumose setae interspersed with them.

Telson of abdomen seven-plated in males, sometimes incompletely so in females. A pair of pleopods in male.

*Material examined:* See Table 44.

*Measurements:* Males, 2.9 to 8.2 mm; non-ovigerous females, 3.1 to 8.4 mm; ovigerous females, 3.3 to 8.4 mm. One of Lockington's types was reported to be 9 mm in length.

*Color:* Color (in alcohol) bright red, deeper on the chelipeds. (Lockington) Color in life has not been noted.

*Ecology:* Most of the *Velero III* and *IV* material was taken in the intertidal zone, under stones; the species was dredged on one occasion in 7 fathoms (substrate not recorded) and once in 25-28 fathoms from a bottom of sand, mud and shell. Steinbeck and Ricketts (1941) reported it from coral interstices and on or about *Pinna*.

The writer has examined ovigerous female specimens taken in every month from January through May. Lockington reported ovigerous females in August or September.

*Relationships:* *Pachycheles setimanus* is closely related to the west Atlantic species *P. serratus* (Benedict), 1901, which like it has a seven-plated telson, pleopods present in males, depressed granules on the an-

terior portion of the carpus, and plumose hairs on the carpus and manus of the chelipeds and on the walking legs. In *P. serratus* the anterior margin of the carpus is not cut into three distinct teeth, and the pubescence covering the chelipeds is finer and thicker than in the Pacific species.

*Remarks:* According to J. Forest (personal communication), the type specimen in the Paris Museum, here designated lectotype, lacks the maxillipeds on the right side. Mr. Forest has compared the type with specimens from the Hancock Foundation, and found them to be identical.

Schmitt (1924b) tentatively identified specimens from Bahía de Tepoca as *Pachycheles panamensis* Faxon. From his discussion it seems probable that this material was actually *P. setimanus*. Confirmation comes from a specimen, evidently from the same collection, examined by the writer at the U. S. National Museum; this specimen was labelled *Pachycheles panamensis* but was found to be *P. setimanus*. None of the porcellanids from this collection could be located at the California Academy of Sciences, which sponsored the expedition on which they were taken.

*Range:* Throughout the Gulf of California, from San Felipe south to Pulmo Reef; shore, exceptionally to about 28 fathoms.

### *Pachycheles crassus* (A. Milne Edwards)

Plate 31, fig. 1; text-fig. 4

*Porcellana (Pachycheles) crassa* A. Milne Edwards, 1869, p. 128, pl. 26, fig. 12 (type locality, Islas de las Perlas, Panama). Ortmann, 1897, p. 294.

*Pachycheles crassus*, Haig, 1957b, p. 5.

#### *Previous records:*

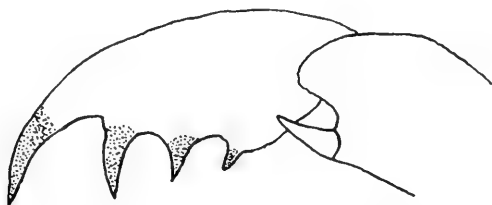
Panama. Islas de las Perlas: (A. Milne Edwards).

Colombia. Isla Gorgona: *Askoy* (Haig).

*Diagnosis:* Carapace smooth, shining, devoid of hairs, strongly convex from front to back and, in females, markedly broader than long; carpus covered with large, rather flattened granules, its anterior margin with four or five teeth, the proximal one broad and truncate, others narrow, conical, and progressively smaller; manus heavy, swollen, it and fingers covered with large, coarse granules; walking legs almost devoid of hairs; dactylus with two strong fixed spines on posterior mar-

gin in addition to terminal claw; telson five-plated; no pleopods in male.

*Description:* Carapace markedly broader than long (1.1 or 1.2 times in males, 1.3 to 1.5 in females), very strongly convex front to back; posterolateral regions plicate, carapace otherwise smooth, shining, devoid of hairs. Front transverse in dorsal view, in frontal view faintly trilobate or transverse with a slight median projection. Outer orbital angle forming a small, sharp tooth. Separated portion of side wall consisting of one small irregular-shaped piece.



Text-fig. 4. Dactyl of walking leg of *Pachycheles crassus*, x 84.

First movable segment of antenna with a low tubercle at anterior margin; second and third smooth; flagellum naked.

Chelipeds appearing devoid of hair, but under magnification showing a low pile between granules. Merus rugose, with a low rugose crest on anterior margin. Carpus armed on anterior margin with four or five smooth-margined teeth, the proximal one broad and truncate, sometimes tending to be divided into two, the others narrow, conical, and progressively smaller in size; surface covered with large, rather flattened and scale-like granules. Manus heavy, swollen, covered with large, coarse granules, more rounded than those of carpus, those toward outer margin often pointed, giving the margin a serrate-edged appearance. Fingers covered with granules similar to those of manus; pollex short, conical, and flattened, dactylus strongly curved; fingers meeting for entire length in both chelipeds, gape without pubescence.

Walking legs almost devoid of hairs, a few scattered setae on propodus and dactylus only. Dactylus with two strong fixed spines on posterior margin in addition to the terminal claw; proximad to them a single movable spinule (see text-fig. 4).

Telson of abdomen with five plates. No pleopods in male.

*Material examined:* Balboa, Canal Zone, Panama, on reefs; M. Ward, collector; one male, one ovigerous female (U. S. National Museum Cat. No. 77509).



Bahía Piñas, Panama, 2-4 fathoms; January 29, 1935; *Velero III* station 444-35; one male, one ovigerous female.

Bahía Octavia, Colombia, shore; January 28, 1935; *Velero III* station 435-35; one male, one ovigerous female.

*Measurements*: Males, 3.2 to 4.9 mm; ovigerous females, 3.3 to 5.7 mm. The following table, which is based on all known specimens, illustrates the marked difference in the length-width ratio in the two sexes.

Males		Females	
Length	Width	Length	Width
3.2	3.7	3.3	4.7
3.9	4.7	3.7	5.6
4.5	5.7 (holotype)	4.1	6.2 ( <i>Askoy</i> )
4.9	6.2	4.2	5.8 ( <i>Askoy</i> )
		5.7	7.9

*Color*: Color of a dry specimen red washed with yellow; tips of the fingers white. (A. Milne Edwards)

*Ecology*: Two *Velero III* specimens were recovered from coral in shallow water, and two others from coral taken in 2-4 fathoms. Specimens taken by the *Askoy* Expedition were from coral at a depth of 2 to 3.5 fathoms. Habitat data are not available for the holotype or for specimens taken on reefs at Balboa by Melbourne Ward.

Ovigerous females were collected in January and in April.

*Relationships*: *Pachycheles crassus* is closely related to *P. ackleianus* A. Milne Edwards, 1880, a western Atlantic species. Both species are transversely elongate, with coarsely granular chelipeds, and both have a five-plated telson and lack male pleopods. In addition, both have strong fixed spines on the posterior margin of the dactylus of the walking legs, somewhat as in *Polyonyx*; as far as the writer is aware, this character is found in no other members of the genus *Pachycheles*. In *P. ackleianus* the manus of the cheliped is less swollen than in *P. crassus*, and there is a distinct tubercle near the base of the pollex, on the distal side of which is a fine pubescence; the granules on the chelipeds tend to form longitudinal rows, instead of being evenly distributed; and there are scattered setae on the merus of the walking legs.

*Remarks*: A specimen was sent to Mr. Jacques Forest of the Paris Museum, who kindly compared it with the holotype and confirmed its identity with the present species. The type, a dry specimen in poor condition, is labelled "Mr. de Follin—Ile aux Perles (Panama)."

The specimens listed under Material Examined, above, plus the holotype and two ovigerous females from the *Askoy* Expedition, are so far the only known representatives of the species. It is not known whether it is a very rare species or whether its apparent scarcity merely reflects collecting methods. Although most of the material was taken from coral heads, it was not found in abundance as are most porcellanid members of the coral community. The closely related *Pachycheles ackleianus* has been taken in quantity from coral heads and sponges dredged in 14 to 37 fathoms; this suggests that *P. crassus* may normally live under similar conditions.

*Range:* Balboa, Panama, south to Isla Gorgona, Colombia.

### *Pachycheles biocellatus* (Lockington)

Plate 32, fig. 1

*Petrolisthes (Pisosoma) biocellatus* Lockington, 1878, pp. 396, 403 (type locality, Baja California, exact locality unknown).

*Petrolisthes (Pisosoma) gibbosicarpus* Lockington, 1878, pp. 396, 402 (type locality, Baja California, exact locality unknown).

*Pisosoma aphrodita* Boone, 1932, p. 53, text-figs. 17-18 (type locality, Bahía de Gardner, Isla Hood, Galapagos Islands).

*Pachycheles biocellatus*, Glassell, 1937, p. 84 (neotype designated; neotype locality, off Arena Bank, Gulf of California); 1938a, p. 444. Schmitt, 1939, pp. 16, 25. Steinbeck and Ricketts, 1941, p. 455. Haig, 1957b, p. 4.

#### *Previous records:*

Gulf of California. "Lower California" [probably Gulf]: (Lockington). Off Arena Bank: W. Beebe on *Zaca* (Glassell 1937). Pulmo Reef: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

Clipperton Island: Presidential Cruise of 1938 (Schmitt).

Colombia. Bahía Humboldt; Isla Gorgona: *Askoy* (Haig).

Ecuador. Isla La Plata: *Askoy* (Haig).

Galapagos Islands. Bahía de Sullivan, Isla James: Presidential Cruise of 1938 (Schmitt). Bahía de Gardner, Isla Hood: W. Beebe on *Arcturus* (Boone).

*Diagnosis:* Carapace smooth, devoid of hairs; carpus nearly smooth, anterior margin with a broad lamellar lobe, latter indistinctly to distinctly subdivided into three lobes; manus nearly smooth, outer margin with a smooth crest extending onto pollex and defined by a distinct groove; walking legs covered with long setae; telson five-plated; no pleopods in male.

*Description:* Carapace about as broad as long in males, slightly broader (1.1 or 1.2 times) in females; lightly plicate on posterolateral and frontal regions, otherwise smooth; devoid of hairs. Front in dorsal view either transversely sinuous or with three shallow lobes, the median one broad and rounded, lateral ones narrow, diverging; trilobate in frontal view, the lobes about equal in breadth, lateral ones diverging, median one slightly produced. Outer orbital angle strongly produced into a narrow, acute tooth. Separated portion of side wall consisting of one large piece and numerous fragments.

First movable segment of antenna with a conical tubercle on anterior margin; second and third nearly smooth; flagellum naked.

Chelipeds devoid of hairs. Merus faintly rugose, with a broad, strongly projecting subtriangular lobe on anterior margin. Carpus with a broad, strongly projecting lamellar lobe occupying entire anterior margin, its edge sinuate and forming three indistinct lobes, the proximal one the largest; surface of lobe and carpus nearly smooth, carpus becoming roughened toward posterior margin, latter bearing a distinct, obliquely rugose crest. Manus nearly smooth; outer margin with a smooth crest extending onto pollex, defined by a distinct groove near margin. Fingers smooth, usually slightly gaping in major cheliped, meeting entire length in minor cheliped; no pubescence in gape.

Walking legs covered with long, flexible setae, more thick-set on three distal segments.

Telson of abdomen with five plates. No pleopods in male.

*Variations:* In smaller specimens the lobe on the anterior margin of the carpus is more distinctly divided into three; in occasional large examples it is entire.

*Material examined:* See Table 45.

*Measurements:* Males, 2.8 to 7.0 mm; non-ovigerous females, 3.0 to 5.8 mm; ovigerous females, 2.4 to 6.7 mm. Glassell's neotype female measures 5.8 mm, his neoallotype male 5.5 mm. The male holotype of *Pisosoma aphrodita* Boone is 4.0 mm in length.

*Color:* Carapace carmine, slightly darker on frontal and margins. A large white blotch on anterolateral just below eye, and a halfmoon-shaped spot of white on each side of cardiac area. Striations and punctations also white. Eyestalk dark carmine and eye black. Antennule white and last segment yellow. Antenna brownish red, becoming lighter toward tip. Chela very dark carmine, a blackish tint on outer surface. Tips of fingers white. Walking legs same as carapace but with brownish

tint. Basal portion of merus white, distal end of propodus and dactyl cadmium orange. Ventral side light carmine. (Petersen, of a freshly captured specimen from Islas Secas, Panama)

The white-tipped fingers, white spots on the epibranchial "shoulders," and white areas on the merus of the walking legs are characteristic, and are still visible in most specimens after years in alcohol. The vivid dark carmine coloration of the carapace, also characteristic of live specimens, soon disappears with preservation.

*Ecology:* Specimens have been taken in the littoral and to a depth of 4 fathoms. The species is usually found associated with corals, but also occurs under stones. A single specimen was recovered from sponge dredged in 1-4 fathoms at Acapulco, Mexico.

Ovigerous females have been collected in every month from December through July.

*Relationships:* *Pachycheles biocellatus* is extremely close to *P. riisei* (Stimpson), 1858, an Atlantic species ranging from the Florida Keys to southern Brazil. Careful comparison of large series of both populations may prove them to be conspecific.

*Remarks:* Lockington made the following statement in his description of *Petrolisthes (Pisosoma) biocellatus*: "The larger of the two specimens measures barely three centimetres in length." As Glassell (1937) pointed out, "centimetres" in this sentence was undoubtedly an error for "millimetres." Individuals of 3 mm or less would be small, although not necessarily juveniles, and the fact that Lockington described the anterior margin of the carpus as being "divided into three low lobes" makes it even more probable that his description was based on small specimens.

*Petrolisthes (Pisosoma) gibbosicarpus* Lockington has not been previously identified with any known species. It is apparent from the description, however, that Lockington's type, a 6 mm female, belonged to the same taxon as the smaller individuals described by him as *biocellatus*. The International Rules of Zoological Nomenclature, as revised at Copenhagen in 1953, require that when two or more species published in the same paper and on the same date are united to form a single species, the first reviser must select the name of one of them to be used for that species. Accordingly the name *biocellatus* is hereby selected in preference to *gibbosicarpus*, because the former name is already established in the literature.

Glassell (1937) placed *Pisosoma aphrodita* Boone in the synonymy of *Pachycheles biocellatus*. The types of *Pisosoma aphrodita* and the neotypes of *Pachycheles biocellatus*, all of which were formerly in the collection of the New York Zoological Society, are now housed in the American Museum of Natural History.

*Range*: Isla Espíritu Santo, Gulf of California, south to Isla La Plata, Ecuador; Isabel, Tres Mariás, Revillagigedo, Clipperton, and Galapagos Islands. Shore to 4 fathoms.

### ***Pachycheles vicarius* Nobili**

Plate 32, fig. 2

*Pachycheles vicarius* Nobili, 1901b, p. 19 (type locality, Bahía de Santa Elena, Ecuador). Rathbun, 1910, p. 601. Haig, 1957b, p. 4.

#### *Previous records:*

Colombia. Bahía Humboldt; Isla Gorgona: *Askoy* (Haig).  
Ecuador. Bahía de Santa Elena: E. Festa (Nobili).

*Diagnosis*: Carapace practically devoid of hairs; surface of carpus with four strong crests defined by deep, narrow grooves, anterior margin with three or four broad, strongly projecting teeth; manus with four similar crests; walking legs thickly covered with plumose hairs; telson seven-plated in males, five-plated or incompletely seven-plated in females; a pair of pleopods in male.

*Description*: Carapace slightly broader than long (1.1 times in males, 1.2 or 1.3 in females); plicate on posterolateral regions and usually on frontal regions also, otherwise smooth or lightly punctate; devoid of hairs or with slight traces on frontal region, visible only under high magnification. Front slightly rounded in dorsal view; trilobate in frontal view, the lateral lobes broad, transverse, median one narrow, conical and slightly produced. Outer orbital angle produced into a small sharp tooth. Separated portion of side wall consisting of one large piece.

First movable segment of antenna with a low tubercle on anterior margin; second and third nearly smooth; flagellum naked.

Merus of chelipeds faintly rugose, with a broad, strongly projecting, subtriangular lobe on anterior margin. Carpus with three or four broad, strongly projecting, smooth-margined teeth on anterior margin, proximal one the largest, others progressively smaller; dorsal surface with four strong crests, defined by deep, narrow grooves: anterior crest broadest, composed of large, flattened, transverse, elliptical tu-

tubercles; second with similar but somewhat more projecting and oblique tubercles, crest not extending whole length of carpus but interrupted near distal end, the two grooves defining it joined around its end; third narrow, formed of oblique, strongly projecting, small tubercles, and ending at about same point as second; fourth similar to third, forming the posterior margin of the carpus. Manus with four distinct crests defined by deep grooves, the crests composed of large flattened granules: first extending to base of dactylus; second, joined to it proximally, extending to base of pollex; third nearly to end of pollex; fourth along outer margin of manus and pollex. Fingers gaping in major cheliped, meeting for entire length in minor cheliped; gape without pubescence.

Merus of walking legs with a few scattered plumose hairs, other segments thickly covered with plumose hairs on dorsal surface and anterior margins.

Telson of abdomen seven-plated in males, five- or incompletely seven-plated in females. A pair of pleopods in male.

*Variations:* In some specimens the tubercles forming the carpal crests are obsolescent, the crests appearing nearly smooth or lightly, obliquely rugose; in others, the two anterior crests may be very low and the grooves defining the other crests shallow. Similarly, the granules forming the manal crests may be obsolescent, the two inner crests nearly absent and the grooves defining the others shallow. In smaller specimens the teeth of merus and carpus are somewhat pointed on their ends; in some adults, also, they are pointed and show traces of division.

*Material examined:* See Table 46.

*Measurements:* Males, 2.9 to 4.9 mm; non-ovigerous females, 2.9 to 5.2 mm; ovigerous females, 3.0 to 5.7 mm. The two syntypes examined by the writer measure 4.3 mm (male) and 4.4 mm (ovigerous female).

*Color:* Terracotta red, carapace lighter than chelipeds, with two posterolateral white areas. (Nobili)

*Ecology:* *Velero III* collectors took this species on two occasions under stones in the intertidal zone. It occurs more commonly in coral, from shore to about 4 fathoms.

Ovigerous females have been collected in January, February, and April.

*Remarks:* Specimens from Colombia collected by the *Askoy* (Haig, 1957b) were the first to be recorded since the original description of the species. Present material extends the range northward to El Salvador.

*Range:* Acajutla, El Salvador, south to Bahía de Santa Elena, Ecuador. Shore to 4 fathoms.

### *Pachycheles marcortezensis* Glassell

Plate 33, fig. 3

*Pachycheles marcortezensis* Glassell, 1936, p. 290 (type locality, off Isla Angel de la Guarda, Gulf of California); 1937, p. 86; 1938a, p. 444.

*Previous records:* Gulf of California. Off Isla Angel de la Guarda: S. A. Glassell (Glassell 1936). Arena Bank: *Zaca* (Glassell 1937).

*Diagnosis:* Carapace covered with non-plumose setae, shorter and more close-set on front; carpus with four or five long, narrow, slightly falcate teeth on anterior margin, outer half with three even longitudinal rows of small projecting granules, entire surface (including teeth) covered with tufts of short setae becoming plumose in larger specimens; manus covered with small projecting granules and with setae similar to those of carpus; walking legs with long, non-plumose setae; telson five-plated; no pleopods in male.

*Description:* Carapace about as broad as long; plicate on postero-lateral regions, otherwise punctate; covered with non-plumose setae forming a short pile on frontal region, longer and more scattered elsewhere. Front transversely sinuous or with three shallow lobes in dorsal view, distinctly trilobate in frontal view, the lobes about equally projecting. Outer orbital angle produced into a narrow, acute tooth. Separated portion of side wall consisting of one small piece.

First movable segment of antenna with a spinule on anterior margin; second with two spinules; third nearly smooth; flagellum naked.

Merus of chelipeds with a strongly projecting, subtriangular lobe on anterior margin, rugose and often armed with a few spinules; lobe and dorsal surface covered with short, non-plumose setae. Carpus with four or five long, narrow teeth on anterior margin, somewhat falcate, the proximal one longest and others progressively shorter; teeth and anterior half of carpus covered with much-flattened granules, appearing nearly smooth; posterior half with three even, longitudinal rows of small, strongly projecting granules, a fourth row along posterior

margin; entire carpus, including teeth, covered with short setae arising in tufts from distal side of each granule. Manus covered with small projecting granules, arranged in three even longitudinal rows below pollex; a fourth along outer margin, extending to tip of pollex; a group of somewhat larger granules near inner margin; arising from the distal end of each granule a tuft of short setae, these setae, and those of carpus, showing a slight plumosity in larger specimens; a few scattered longer setae near outer margin. Fingers with somewhat flattened small granules, outer margins serrate, devoid of setae; gaping slightly in major cheliped, meeting entire length in minor cheliped, gape devoid of hairs.

All segments of walking legs with an anterior fringe of long setae. Telson of abdomen with five plates. No pleopods in male.

*Material examined:* See Table 47.

*Measurements:* Males, 2.9 to 5.2 mm; non-ovigerous females, 4.2 to 4.5 mm; ovigerous females, 3.1 to 4.5 mm. The ovigerous female holotype measures 4.8 mm long, 5.2 mm wide.

*Color:* Color in alcohol red mottled with white; bristles a straw color. (Glassell, 1936)

*Ecology:* *Velero III* collectors obtained this species at two shore stations, under stones in one case and from coral in the other. It is otherwise known from depths of 2 to 45 fathoms, where it has been dredged on various substrates such as sand, shell, sand and gravel, sand and corallines, and coral and nullipores. It was taken by the *Zaca* at 40 fathoms from a bottom of mud and shell. "This species frequents a rather rough bottom, where it is able to secure shelter." (Glassell, 1937)

Ovigerous females have been collected in January, February, and March.

*Range:* Bahía de Santa María, Baja California; Gulf of California, from Isla Angel de la Guarda south to Arena Bank. Shore to 45 fathoms.

### ***Pachycheles velerae*, new species**

Plate 11

*Type:* Holotype, female, U. S. National Museum Cat. No. 102411, from off Isla Bindloe [Marchena], Galapagos Islands, 20 fathoms; December 3, 1934; collected during Allan Hancock Pacific Expedition of 1935 at *Velero III* station 311-35.



*Diagnosis:* Carapace covered with long, scattered non-plumose setae except on frontal region, the latter practically devoid of hairs; carpus with three strongly projecting teeth on anterior margin, inner half with a series of transverse ridges, outer half with three longitudinal rows of strongly projecting granules, a series of transverse ridges between these rows, surface and teeth with scattered, long, non-plumose setae; manus covered with small projecting granules, proximal half with long, non-plumose setae; walking legs with short plumose hairs and long, non-plumose setae; telson five-plated in females; males unknown.

*Description:* Carapace about as broad as long, slightly convex front to back; plicate on posterolateral regions, elsewhere punctate; covered with long, scattered, non-plumose setae, but only a trace of hairs apparent on frontal region. Front in dorsal view rather strongly projecting, shallowly trilobate, the lateral lobes produced beyond eye, narrow, diverging, median lobe broad, slightly more produced than lateral lobes, with a shallow sulcus; in frontal view strongly trilobate, the lobes about equal in breadth, median one slightly more produced; faintly granulate on edge, the granules produced to form about six minute spinules at the tip of each lobe. Orbits deep; outer orbital angle produced into a narrow, acute tooth. Separated portion of side wall consisting of one small piece.

First movable segment of antenna with a high, broad spinule occupying most of anterior margin; second with a smaller spinule at distal end of anterior margin; third without anterior projection; flagellum naked. Outer maxillipeds rugose.

Merus of chelipeds lightly rugose on dorsal surface, with a broad, rugose, strongly projecting subtriangular lobe, a blunt spine at its tip, on anterior margin; ventral surface smooth. Carpus armed on anterior margin with three teeth (a trace of a fourth present in major cheliped), broad, strongly projecting, slightly curved, proximal one largest, others progressively smaller; surface of teeth covered with small, crowded granules; inner half of carpus with a series of distinct transverse ridges, followed distally by several flattened granules; outer half with three even, longitudinal rows of small granules, latter strongly projecting and tending to be obliquely elongate; between the rows, series of short transverse ridges similar to those on inner half of surface; posterior margin obliquely rugose, the rugae forming strong ridges and extending onto outer margin of ventral surface, latter otherwise smooth; dorsal surface of carpus and teeth with a few scattered, long, flexible non-plumose setae. Manus covered with small, strongly

projecting granules, those on outer margin arranged in an even longitudinal row extending onto pollex; near base of pollex a small tubercle, covered with similar granules; outer margin with a sharp, granulate ridge; proximal half of surface with long, flexible, non-plumose setae, somewhat more abundant than those of carpus; distal half, as well as fingers, devoid of hairs. Fingers covered with flattened granules, dactylus with a small conical tubercle at proximal end of cutting edge; gaping slightly in major cheliped, meeting entire length in minor cheliped, gape with a trace of pubescence.

Walking legs slightly rugose; all segments with short plumose hairs and scattered, long, non-plumose setae.

Abdomen smooth; telson five-plated in females. Males unknown.

*Measurements*: Holotype female: length about 3.8 mm. Because of the soft-shelled condition of the carapace, measurements could not be determined with accuracy.

*Ecology*: The holotype was dredged at 20 fathoms from a rocky substrate. Deep water is presumably the natural habitat of the species, as is the case with its closest relatives, *Pachycheles marcortezensis* and *P. rugimanus*.

*Relationships*: Although not strictly analogous to either, *Pachycheles velerae* is closely related to *P. marcortezensis* Glassell and to an Atlantic species, *P. rugimanus* A. Milne Edwards, 1880. All three forms have a somewhat projecting, trilobate front without a tuft and are provided with strong, narrow teeth on the anterior margin of the carpus. All inhabit fairly deep water; *P. marcortezensis* is known to a depth of 45 fathoms, *P. rugimanus* to 79 fathoms. In *P. marcortezensis* both carpus and manus are covered with small projecting granules, and in *P. rugimanus* both have strong longitudinal ridges with rows of transverse ridges between them; in this respect the new species is intermediate between the other two. *P. rugimanus* lacks the hairs on the carapace and chelipeds which are characteristic of both *P. marcortezensis* and *P. velerae*. The former two species have five plates in the telson in both sexes; the same will probably prove to be true of the new species. Male pleopods are present in *P. rugimanus* and lacking in *P. marcortezensis*.

*Remarks*: It is unfortunate that *Pachycheles velerae* is known from a single female specimen, which is soft-shelled and probably undersized as well. It is believed, however, that most of the descriptive characters given here will prove to be valid when more material becomes avail-

able. The species should be looked for in depths of 10 fathoms and greater, in the Galapagos Islands and the adjacent mainland.

The new species is named in honor of the research vessel *Velero III*, from which, during the years 1932 through 1941, many biological novelties were collected.

*Range:* Known only from the type locality, off Isla Bindloe, Galapagos Islands.

### ***Pachycheles spinidactylus* Haig**

Plate 33, fig. 2

*Pachycheles spinidactylus* Haig, 1957a, p. 31, pl. 7, figs. 1-4 (type locality, Islas Las Tres Marietas, Bahía de Las Banderas, Mexico); 1957b, p. 3.

#### *Previous records:*

Mexico. Isla Isabel: (Haig 1957a). Islas Las Tres Marietas, Bahía de Las Banderas: J. W. Knudsen (Haig 1957a). Acapulco: (Haig 1957a).

Colombia. Bahía Humboldt: *Askoy* (Haig 1957b).

*Diagnosis:* Carapace with a tuft of plumose and non-plumose hairs on front; carpus covered with small conical tubercles with tufts of long, stiff, non-plumose setae surrounded by clumps of short plumose hairs arising from their bases, its anterior margin with three (occasionally four) teeth; manus and fingers with similar stiff, non-plumose setae and plumose hairs; walking legs with long plumose hairs and a few non-plumose setae; telson seven-plated in males, five-plated or incompletely seven-plated in females; no pleopods in male.

*Description:* Carapace about as long as broad or slightly broader; posterolateral regions plicate, surface otherwise faintly rugose; front with a tuft of plumose and non-plumose hairs, scattered short hairs elsewhere anteriorly. Front narrow, rounded or sinuous in dorsal view, trilobate in frontal view, the median lobe somewhat produced. Outer orbital angle produced into a low, broad tooth. Separated portion of side wall consisting of one large piece and sometimes a number of fragments.

First movable segment of antenna with a tubercle, sometimes spine-tipped, on anterior margin; second and third granular; flagellum naked.

Merus of chelipeds rugose, anterior margin with a broad, rugose, strongly projecting, granulate-edged lobe, sometimes obscurely bifid at tip. Carpus armed on anterior margin with three spine-tipped teeth, a fourth occasionally present; dorsal surface covered with small conical

tubercles, larger and more projecting toward posterior margin, with tufts of long, stiff, non-plumose setae surrounded by clumps of short plumose hairs arising from their bases; posterior margin often with a fringe of long plumose hairs. Manus and fingers of both chelipeds covered with tubercles and hairs similar to those of carpus; granules along outer margins of manus elongate and pointed, forming a serrate edge. Fingers with a row of rounded or pointed tubercles near outer margins, usually in the form of spines; gaping in major cheliped, meeting for entire length in minor cheliped, gape with short plumose and non-plumose hairs.

All segments of walking legs with long plumose hairs, and a few long, scattered non-plumose setae.

Telson of abdomen seven-plated in males, five-plated or incompletely seven-plated in females. No pleopods in male.

*Material examined*: See Table 48.

*Measurements*: Males, 2.4 to 7.3 mm; non-ovigerous females, 2.9 to 5.8 mm; ovigerous females, 3.5 to 8.2 mm. The male holotype is 7.3 mm in length, 7.7 mm in width.

*Color*: Alcoholic specimens are reddish orange, tips of fingers white, setae straw-colored.

*Ecology*: Occurs in the intertidal zone, occasionally under stones but more often in coral heads; it has been taken from coral to depths of 4 fathoms. Two specimens were recovered from sponge dredged in 1-4 fathoms at Acapulco, Mexico.

Ovigerous females have been collected in January, February, March, and April.

*Relationships*: *Pachycheles spinidactylus* is most closely related to two Atlantic species, *P. pilosus* (H. Milne Edwards), 1837, from South Carolina, Florida, and the Caribbean area, and *P. barbatus* A. Milne Edwards, 1878, from west Africa. All three species are distinguished by the presence of long, stiff, non-plumose setae and short plumose hairs on the chelipeds, tubercles on the surface of the carpus, and three or more teeth on the anterior margin of the carpus. The two Atlantic species differ from *P. spinidactylus* in having a five-plated telson in both sexes. *P. pilosus* has no tuft of mixed plumose and non-plumose hairs on the front as in *P. spinidactylus*, but instead has short, non-plumose bristles over the surface of the carapace, more concentrated in the frontal region. In *P. barbatus* male pleopods are present.

*Range:* Bahía de Santa María, Baja California; Isla Isabel; Cabo San Lucas at the mouth of the Gulf of California south to Puerto Utría, Colombia. Shore to 4 fathoms.

***Pachycheles panamensis* Faxon**

Plate 33, fig. 1

*Pachycheles panamensis* Faxon, 1893, p. 175 (type locality, Panama [City?]); 1895, p. 71, pl. 15, figs. 2, 2a. Ortmann, 1897, p. 293 (part). Nobili, 1901b, p. 19. Rathbun, 1910, p. 601. Steinbeck and Ricketts, 1941, p. 456, pl. 29, fig. 2. Not Schmitt, 1924b, p. 385.

*Pachycheles sonorensis* Glassell, 1936, p. 291 (type locality, Bahía Miramar near Guaymas, Sonora, Gulf of California); 1937, p. 86; 1938a, p. 444.

*Previous records:*

Gulf of California. Bahía Miramar near Guaymas, Sonora: S. A. Glassell (Glassell 1936). Off Arena Bank: W. Beebe on *Zaca* (Glassell 1937). Pulmo Reef: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

Panama. "Panama" [City?]: *Albatross* (Faxon); (Ortmann).

Ecuador. Bahía de Santa Elena: E. Festa (Nobili).

*Diagnosis:* Carapace covered with short, non-plumose setae; carpus covered with short rugae or flattened granules and with short, non-plumose setae, its anterior margin with two distinct teeth (a third occasionally present); manus and fingers covered with long, non-plumose setae; walking legs with long, non-plumose setae; telson seven-plated; a pair of pleopods in male.

*Description:* Carapace about as broad as long, in females slightly broader (1.1 times, rarely 1.2), posterolateral regions plicate, otherwise smooth or punctate; surface covered with short, non-plumose setae, more distinct on anterior regions and particularly on front. Front rather broad, rounded or sinuously triangular in dorsal view, faintly trilobate in frontal view, the median lobe produced. Outer orbital angle produced into a strong tooth. Separated portion of side wall consisting of one large piece, one smaller piece, and several very small fragments.

First movable segment of antenna with a distal tubercle on anterior margin; second granular, with a few short setae; third nearly smooth; flagellum naked.

Merus of chelipeds rugose, with a large, strongly projecting, rugose, subtriangular lobe on anterior margin. Anterior margin of carpus with

two strong, granulate-edged teeth, a third occasionally present; surface covered with short rugae or much-flattened granules, more projecting toward posterior margin, and with short, non-plumose setae. Manus and fingers granulate and covered with long, non-plumose setae; fingers long and slender, gaping in major cheliped, meeting for entire length in minor cheliped, gape with long setae extending onto ventral surface of manus near articulation with dactylus.

All segments of walking legs with long setae.

Telson of abdomen with seven plates. A pair of pleopods in male.

*Variations*: Occasional female specimens have the telson of the abdomen incompletely seven-plated; however, this condition was observed only three or four times among the 50 females examined and cannot be considered characteristic.

*Material examined*: See Table 49.

*Measurements*: Males, 3.0 to 8.2 mm; non-ovigerous females, 2.1 to 6.5 mm; ovigerous females, 2.3 to 8.5 mm. The ovigerous female holotype of *Pachycheles panamensis* measures 6.5 mm in length by 7.0 mm in breadth; the male holotype of *P. sonorensis*, 7.0 by 7.5 mm.

*Color*: Ground color in alcohol a pink-tinted cream overlaid with numerous small, red, irregular spots; lighter on the ventral side, but still spotted. (Glassell, 1937, of *Pachycheles sonorensis*)

*Ecology*: Occurs most commonly in the intertidal zone, under stones and in interstices of coral. The *Velero III* dredged it from a sand bottom at 4 fathoms off La Libertad, Ecuador, and *Velero IV* collectors recovered it from masses of sponge dredged in 1-4 fathoms off Acapulco, Mexico.

Ovigerous females have been encountered in every month from December through April.

*Remarks*: Steinbeck and Ricketts (1941, p. 456) noted that, according to a personal communication from S. A. Glassell, the latter writer's *Pachycheles sonorensis* is a synonym of *P. panamensis*. The types of both nominal species were examined in connection with this report.

Specimens from the Bahamas identified by Ortmann (1897, p. 293) as *Pachycheles panamensis* are almost certainly not this species, which has not otherwise been reported from the Atlantic coast. Ortmann's specimens may have been *P. pilosus* (H. Milne Edwards), the only western Atlantic porcellanid with which *P. panamensis* might be confused.

One of the specimens examined, an ovigerous female from San Francisco, Panama, had the walking legs infested by a rhizocephalan (*Thompsonia* sp.).

*Range:* Isla Tiburón, Gulf of California, south to Bahía de Santa Elena, Ecuador; Isla Isabel, Mexico. Shore to 4 fathoms.

***Pachycheles trichotus*, new species**

Plate 12; plate 32, fig. 3

*Types:* Holotype, male, U. S. National Museum Cat. No. 102412, from Isla Verde, Panama; January 9, 1939; collected by students of Elinor D. Robson. Paratypes: Acajutla, El Salvador; April 23, 1912; collected by R. Paessler; two ovigerous females (Hamburg Museum Cat. No. K26836).

*Diagnosis:* Carapace with a few short plumose and non-plumose hairs on front; carpus nearly smooth except near posterior margin, covered with short non-plumose setae and with a few long plumose hairs at posterior margin, anterior margin with two teeth; manus nearly smooth, covered with short non-plumose setae, outer margin with a few long plumose hairs; walking legs with long plumose hairs; telson seven-plated in males, incompletely so in females; no pleopods in male.

*Description:* Carapace slightly (1.1 times) broader than long, surface uneven, regions distinct, plicate on posterolateral and frontal regions, otherwise smooth or punctate; front covered with a few very short plumose and non-plumose hairs, traces of hairs occurring elsewhere anteriorly. Front rounded in dorsal view, faintly trilobate in frontal view, the median lobe slightly produced. Outer orbital angle produced into a small, distinct tooth. Separated portion of side wall consisting of one large piece.

First movable segment of antenna with a small, broadly rounded, anterior projection; second and third nearly smooth; flagellum naked. Outer maxillipeds lightly rugose.

Merus of cheliped with short rugae or small flattened granules on dorsal surface; anterior margin with a large, rugose, subtriangular lobe on anterior margin, finely serrate on edge; ventral surface smooth. Carpus armed on anterior margin with two distinct, serrate-edged teeth, about equal in size, a trace of a third tooth sometimes present; teeth and anterior half of dorsal surface nearly smooth, posterior proximal half with two longitudinal rows of strongly projecting small granules; a double row of similar granules along posterior margin; surface cov-

ered with short non-plumose setae, and a few longer plumose hairs along posterior margin; ventral surface smooth. Manus nearly smooth dorsally, with projecting granules toward outer margin; covered with short non-plumose setae, those toward outer margin a little longer than those of carpus, and outer margin with a few long plumose hairs; ventral surface granulate toward outer margin, otherwise smooth. Dactylus of major cheliped strongly curved, with three longitudinal rows of small granules on dorsal surface, and a few plumose and non-plumose hairs near proximal end; cutting edge with a double row of small granules and a large proximal tubercle; pollex shorter than dactylus, broad and flattened, with non-plumose setae nearly to tip, and a large tubercle on cutting edge; fingers slightly gaping, gape with a few short plumose hairs. Dactylus of minor cheliped finely granular, with a few short, scattered, non-plumose setae near proximal end; pollex broad and flattened, roughly granular, with somewhat longer non-plumose setae extending nearly to tip, outer edge serrate; fingers meeting for entire length, gape with a trace of plumose hairs.

Walking legs faintly rugose; all segments with a thick fringe of long plumose hairs along anterior margin.

Abdomen smooth; telson seven-plated in males, incompletely so in females. No pleopods in male.

*Measurements*: Holotype male: length 4.7 mm, width 5.4 mm. Paratype ovigerous females: length 4.7 mm, width 5.3 mm; length 4.8 mm, width 5.3 mm.

*Color*: In alcohol all three specimens had faded to a pale buff, and original distinguishing marks, if any, had disappeared.

*Ecology*: No data were provided for either collecting station. Presumably the specimens were taken in the intertidal zone, probably under stones.

The ovigerous female paratypes were taken in April.

*Relationships*: This new species resembles *Pachycheles panamensis* Faxon, but differs in the shape of the fingers, the presence of plumose hairs on the front, chelipeds, and walking legs, and the absence of male pleopods.

*Remarks*: The specific name *trichotus* is derived from the Greek *τριχωτος*, hairy.

*Range*: Known so far from only two localities, Acajutla, El Salvador, and Isla Verde, Panama.



***Pachycheles subsetosus*, new species**

Plate 13; plate 32, fig. 4

*Types*: Holotype, male, Hamburg Museum Cat. No. K27053, from Puntarenas, Costa Rica, 6-8 fathoms; 1894; collected by L. Leibfarth. Paratypes: same data as holotype, one male, two females (one ovigerous), two young (Hamburg Museum Cat. No. K7559); one male and one ovigerous female, Allan Hancock Foundation.

*Diagnosis*: Carapace with a tuft of plumose and non-plumose hairs on front; anterior margin of carpus with a broad, granulate- or serrate-edged lobe, surface nearly smooth except near posterior margin, with a few scattered, non-plumose setae; manus nearly smooth, covered with long, stiff, non-plumose setae; walking legs with wide-set plumose hairs and long, stiff, non-plumose setae; telson seven-plated in males, five-plated or incompletely seven-plated in females; a pair of pleopods in male.

*Description*: Carapace about as broad as long, slightly broader (1.1 times) in females; strongly convex front to back, surface uneven, regions distinct, plicate on posterolateral regions, otherwise covered with punctae and short rugae; front with a tuft of plumose and non-plumose hairs, carapace otherwise naked except for vestigial hairs arising from punctae and rugae. Front rounded in dorsal view, trilobate in frontal view, the median lobe rather strongly produced. Outer orbital angles produced into a small tooth. Side wall rugose, covered with long plumose hairs; separated portion consisting of numerous small pieces.

First movable segment of antenna lightly granular, with a low tubercle on anterior margin; second and third lightly granular, without projections; flagellum naked. Outer maxillipeds lightly rugose, ischium covered with long plumose hairs.

Merus of chelipeds rugose on dorsal surface, with a broad, rugose, subtriangular lobe on anterior margin; a fringe of plumose hairs near posterior margin; ventral surface smooth. Anterior margin of carpus produced into a rounded, granulate- or serrate-edge lobe, not cut into teeth; lobe and anterior two-thirds of surface nearly smooth, covered with very short rugae similar to those of carapace, and with small projecting granules, forming irregular longitudinal rows, near posterior margin; a few scattered non-plumose setae on carpus and lobe; ventral surface smooth. Manus nearly smooth, except for a few small, strongly projecting tubercles; covered with very short rugae, granular toward outer margin, the granules projecting there to form a serrate edge; surface rather thickly covered with long, stiff, non-plumose setae; ven-

tral surface with flattened granules, devoid of setae except for traces near outer margins. Fingers covered with punctae and very short rugae, occasionally with one or two setae, otherwise devoid of hairs. In males, dactylus of major cheliped strongly curved, cutting edge with a large proximal tubercle; pollex slightly curved, broad, and flattened, cutting edge with a large proximal tubercle; fingers gaping except at tip, gape with traces of plumose hair. In minor cheliped (males) and both major and minor chelipeds (females), dactylus and pollex straight, slender, without tubercles or teeth on cutting edge, meeting for entire length, crossing at tips, gape without pubescence.

Walking legs faintly rugose or punctate, all segments with an anterior fringe of wide-set plumose hairs, surface of carpus and propodus with long, stiff, non-plumose setae.

Abdomen smooth or punctate; telson of male seven-plated, that of female five- or incompletely seven-plated. A pair of pleopods in male.

*Measurements:* Holotype male: length 5.4 mm; width 5.9 mm. Paratypes: males, 3.9 and 5.9 mm; non-ovigerous female, 6.8 mm; ovigerous females, 5.2 and 5.6 mm; young, to 2.8 mm.

*Color:* All specimens had faded in alcohol, and no markings were visible.

*Ecology:* Taken at 6-8 fathoms, the bottom not recorded.

*Relationships:* This new species does not closely resemble any other eastern Pacific form, nor does it appear to be closely allied to any of them.

*Remarks:* The specific name is from the Latin *sub-*, somewhat, and *setosus*, bristly.

*Range:* Known only from the type locality, Puntarenas, Costa Rica.

### ***Pachycheles monilifer* (Dana)**

Plate 33, fig. 4

Restricted synonymy:

*Porcellana rugosimanus* White, 1847, p. 63 (*nomen nudum*).

*Porcellana monilifera* Dana, 1852, p. 413; 1855, pl. 26, fig. 3 (type locality, Rio de Janeiro, Brazil).

*Pachycheles moniliferus*, Stimpson, 1858, p. 228.

*Pachycheles monilifer*, Rathbun, 1900, p. 148.

*Previous records:* None from the Pacific coast.

*Diagnosis:* Carapace with a tuft of plumose hairs on front; chelipeds with three longitudinal rows of large, flattened, imbricate tubercles, spaces between tubercles filled with a fine, short pubescence; carpus with three distinct tubercle-covered teeth on anterior margin; fingers of major cheliped widely gaping, hiatus filled with a long, thick tuft of plumose hairs; walking legs thickly covered with long plumose hairs; telson five-plated; no pleopods in male.

*Description:* Carapace about as broad as long in males, very slightly broader in females; posterolateral regions plicate, rest of surface punctate; a tuft of fine plumose hairs extending beyond margin of front, carapace otherwise devoid of hairs except for traces visible under high magnification. Front narrow, rounded in dorsal view, trilobate in frontal view, the median lobe produced. Outer orbital angle produced into a strong tooth. Separated portion of side wall usually consisting of one large piece and a number of fragments.

First movable segment of antenna slightly roughened, with a tubercle on anterior margin; second and third nearly smooth; flagellum naked.

Merus of chelipeds rugose, a few large, flattened tubercles near posterior margin, anterior margin with a low, subtriangular lobe covered with rugae. Anterior margin of carpus with three distinct tubercle-covered teeth, the proximal one largest; surface covered with large, flattened, imbricate tubercles, arranged in three more or less regular longitudinal rows; a fourth row of much elongated tubercles along posterior margin; spaces between the tubercles filled with a fine, thick, short pubescence. Manus with three longitudinal rows of similar tubercles, the outer row double and extending onto pollex; several smaller tubercles near inner margin, and a row of elongated ones along outer margin, extending into strong rugae covering the outer part of the ventral surface; spaces between tubercles filled with pubescence, as in carpus. Dactylus with tubercles and flattened granules nearly to tip. Fingers of major cheliped gaping, not nearly meeting, the hiatus filled with a long, thick tuft of plumose hairs; fingers of minor cheliped meeting entire length or nearly so, gape with only traces of pubescence.

Anterior margin of merus of walking legs with a thick, long fringe of fine plumose hairs; similar hairs on dorsal surface, as well as anterior margin, of three following segments.

Telson of abdomen with five plates. No pleopods in male.

*Variations:* In small specimens, the tubercles on the chelipeds tend to be lower and less imbricate, and the felty pubescence between them

is often reduced to a vestige. In very small examples, the major cheliped has the same shape as the minor, with the hiatus between the fingers not present; however, the thick tuft of pubescence characteristic of the major cheliped may be seen in even the youngest specimens.

*Material examined:* Off beach at La Libertad, Ecuador, 4 fathoms; January 19, 1933; *Velero III* station 12-33; one young female.

*Measurements:* The single juvenile specimen measured 2.6 mm. The Hancock Foundation collections include Atlantic coast males to 8.6 mm, females to 9.0 mm in length.

*Ecology:* The Pacific coast specimen was dredged in 4 fathoms from a sand bottom. In the Atlantic, the species is known in the intertidal zone and to a depth of 18 fathoms. It has been found on algae (*Fucus*).

*Remarks:* The above description was prepared from a series of nine specimens from Hillsboro Reef, Florida, and Isla Cubagua, Venezuela, in the collections of the Hancock Foundation. The juvenile female from Ecuador agrees in every respect with specimens of *Pachycheles monilifer* of comparable size, and is therefore tentatively referred to this species. The exact determination of its status, whether *P. monilifer* or a closely related but distinct form, must await recovery of adult material from the Pacific coast.

*Range:* Recorded for the first time from the Pacific coast, at La Libertad, Ecuador. Known in the Atlantic from Hillsboro Reef, Florida, to Rio de Janeiro, Brazil.

### ***Pachycheles pubescens* Holmes**

Plate 34, fig. 3

*Pachycheles pubescens* Holmes, 1900, p. 110 (type localities, Drakes Bay, Farallon Islands, and Humboldt County, California). Rathbun, 1904, p. 168. Schmitt, 1921, p. 177, pl. 33, fig. 4; text-fig. 112. Johnson and Snook, 1927, p. 350. Glassell, 1935, p. 105; 1938a, p. 444. Hart, 1940, p. 92; 1953, p. 140. Light, 1954, pp. 183, 186, text-fig. 90e. Not Balss, 1913, p. 32, text-figs. 22-24.

#### *Previous records:*

British Columbia. Goose Island (Hart 1953). Nuchatlitz Inlet and Esperanza Inlet, Vancouver Island: E. G. Hart (Hart 1940).

Washington. Port Orchard, Puget Sound: (Schmitt).

California: Humboldt County; Drakes Bay: (Holmes). Oakland: H. Hemphill (Schmitt). Farallon Islands: (Holmes). Monterey Bay: (Schmitt).

Baja California. Ensenada: S. A. Glassell (Glassell 1935).

*Diagnosis:* Carapace with a tuft of plumose hairs on front; chelipeds covered with short plumose hairs and scattered tufts of long, stiff, non-plumose setae; anterior margin of carpus with three or four shallow, uneven, serrate teeth; manus covered with large granules nearly concealed by pubescence; walking legs with long plumose hairs; telson seven-plated; a pair of pleopods in male.

*Description:* Carapace slightly broader than long, strongly convex front to back, plicate on posterolateral regions, otherwise punctate; naked except for a tuft of plumose hairs on front, and sometimes traces of pubescence in young specimens. Front narrow, sinuously triangular in dorsal view, trilobate in frontal view, the median lobe produced. Outer orbital angle produced into a tooth. Separated portion of side wall consisting of one large piece and a number of fragments.

First movable segment of antenna with a pointed tubercle or spinule on anterior margin; second granular; third nearly smooth; flagellum naked.

Merus of chelipeds with short rugae or flattened granules; anterior margin with a strongly projecting, subtriangular lobe covered with small imbricate granules. Carpus with a broad lobe on anterior margin, cut into three or four uneven, serrate teeth; lobe and surface of carpus covered with small, flattened granules, latter tending to become enlarged and elongate near and along posterior margin. Manus and fingers covered with large, coarse granules, projecting more toward outer margins. Entire surface of chelipeds thickly covered with short plumose hairs, arising in groups from the distal end of each granule; carpus, manus, and fingers with scattered tufts of long, stiff, non-plumose setae. Fingers gaping but slightly in major cheliped, meeting entire length in minor cheliped; gape thickly covered with short plumose hairs, more pronounced in major cheliped and extending along cutting edges of fingers nearly to their tips.

Merus of walking legs with a fringe of plumose hairs on anterior margin; carpus and propodus covered with similar hairs, scattered long, non-plumose setae interspersed with them.

Telson of abdomen with seven plates. A pair of pleopods in male.

*Material examined:* See Table 50.

*Measurements*: Males, 4.6 to 14.2 mm; non-ovigerous females, 4.8 to 9.9 mm; ovigerous females, 6.0 to 14.1 mm. The length of one of the types, sex not stated, was reported to be 15 mm (Holmes). Schmitt gave the length of a specimen as 18 mm.

*Color*: "The carapace is brick red in formalin, except for the rostrum and posterior margin, which is grey mottled with brown. The granules on the chelae are white and the inner margin is reddish." (Hart, 1940)

*Ecology*: It will be observed from the table of material examined that, with one exception, all collecting localities from Oregon to Cayucos, San Luis Obispo County, California, were in the littoral; and all mainland localities south of this point, again with a single exception, were dredge stations with depths of 5 to 30 fathoms, as were those around the northern Santa Barbara islands off the California coast. Apparently the species normally inhabits the intertidal zone in the cold-temperate, and deeper waters in the warm-temperate part of its range. Most of the littoral specimens collected in Oregon were taken during minus tides. The substrates recorded for the dredge stations are as follows: sand; sand and rock; rock with kelp; rock and corallines; rock and sand; gravel; shell; sand and kelp.

Ovigerous females were collected in February, March, June, July, August, and December.

*Remarks*: Melin (1939, pp. 114-115) and Miyake (1943, p. 106) showed that specimens from Japan referred to *Pachycheles pubescens* by Balss (1913) belong to a distinct species. The western Pacific form, which Miyake (1943) named *Pachycheles balssi*, does not appear to be closely related to the present species.

*Range*: Goose Island, British Columbia, south to Thurloe Head, Baja California; off San Miguel and Santa Rosa Islands, California. Shore to 30 fathoms.

### ***Pachycheles crinimanus*, new species**

Plate 14; plate 34, fig. 4

*Pachycheles grossimanus*, Rathbun, 1910, p. 559 (part). Not *P. grossimanus* (Guérin).

*Previous records*: Peru. Bahía de Sechura W of Matcaballa: R. E. Coker (Rathbun).

*Types*: Holotype, male, Allan Hancock Foundation Cat. No. 3815, from Bahía de Sechura, Peru, 9½ fathoms; February 15, 1938; col-

lected during Allan Hancock Pacific Expedition of 1938 at *Velero III* station 845-38. Paratypes: 94 specimens from the same and nine other stations (see Table 51). Specimens collected by R. E. Coker at Bahía de Sechura and by W. L. Schmitt on October 23-24 at Salaverry are not designated paratypes, since they were not at hand during the drawing up of the description.

*Diagnosis:* Carapace with a tuft of plumose hairs on front; anterior margin of carpus with two to four granulate-edged teeth; manus covered with small granules, that of major cheliped with vestigial plumose hairs or a short pile, that of minor cheliped with a thick pile and with scattered long, flexible, non-plumose setae; walking legs with long plumose hairs; telson seven-plated; no pleopods in male.

*Description:* Carapace about as broad as long or very slightly broader; strongly convex front to back, surface slightly uneven, lightly plicate on posterolateral regions, otherwise punctate; front with a tuft of plumose hairs, carapace otherwise naked except for traces of pubescence revealed, under high magnification, as very short tufts arising from punctae. Front narrow, rounded in dorsal view, trilobate in frontal view, the median lobe produced. Orbits deep; outer orbital angle produced into a tooth. Separated portion of side wall consisting of one large piece and sometimes several very small ones.

First movable segment of antenna granular, with a tubercle on anterior margin; second granular; third nearly smooth; flagellum with very short hairs visible only under magnification. Outer maxillipeds faintly rugose, ischium usually covered with scattered short hairs.

Merus of chelipeds rugose dorsally, with large flattened granules near posterior margin; anterior margin armed with a strongly projecting, subtriangular lobe, covered with small flattened granules; ventral surface nearly smooth. Carpus with a broad lobe on anterior margin, cut into two to four distinct, granulate-edged teeth, the proximal the largest, others progressively smaller; lobe and upper surface of carpus covered with small granules, latter flattened anteriorly, becoming larger and more projecting near posterior margin, arranged in uneven longitudinal rows; surface covered with short plumose hairs arising in groups from the distal end of each granule, usually long enough to conceal all but the most projecting granules, but only scattered plumose hairs present in small specimens; ventral surface nearly smooth. Manus of major cheliped with small granules, flattened on inner side, larger and more projecting near outer margin; on fingers, the granules tending to be-

come flattened and imbricate; dactylus long, slender, curved, with a double row of small tubercles and a large proximal tubercle on cutting edge; pollex short, conical; hand with a pile like that of carpus, this pile extending onto pollex, or at least with scattered plumose hairs; fingers gaping, gape thickly covered with plumose hairs, latter sometimes extending along cutting edges of fingers nearly to tips. Manus and fingers of minor cheliped with small granules; pollex, inner half of dactylus, and almost entire surface of manus densely covered with plumose hairs, always longer and thicker than those of major cheliped; interspersed among the pubescence a few long, scattered, flexible, non-plumose setae; fingers meeting for entire length, gape with a short pubescence, less pronounced than in major cheliped. In both chelipeds, the ventral surface of manus granular, and covered with a short pubescence near outer margin.

Walking legs faintly rugose dorsally, smooth ventrally. Merus with a fringe of long plumose hairs on anterior margin; carpus, propodus, and dactylus covered with long plumose hairs, the latter two segments with a few long non-plumose setae.

Abdomen smooth or punctate; telson with seven plates. No pleopods in male.

*Measurements:* Holotype male: length 19.0 mm, width 20.4 mm. Paratypes: males, 2.5 to 19.5 mm; non-ovigerous females, 4.3 to 7.8 mm; ovigerous females, 3.7 to 19.3 mm.

*Color:* No particular color pattern was discernible in any of the specimens examined, all of which had been in alcohol for 20 years or longer. All were a light yellow-buff, with hairs yellow.

*Ecology:* The species was dredged at three *Velero III* stations in depths of 5 to 9½ fathoms, the substrate being sand in two cases and rock in the third. W. L. Schmitt recovered it from wreckage off the beach at Salaverry. A single specimen was taken in the littoral by *Velero III* collectors.

Ovigerous females were collected in January and February by the *Velero III*, in April by R. E. Coker, and in October by W. L. Schmitt.

*Relationships:* *Pachycheles crinimanus* is closely related to *P. grossimanus* (Guérin), which inhabits the same territory, and to *P. pubescens* Holmes, a northern hemisphere form. Following are the chief characters distinguishing the three species:



<i>crinimanus</i>	<i>grossimanus</i>	<i>pubescens</i>
Flagellum with very short hairs	Flagellum naked	Flagellum naked
Ant. margin of carpus with 3-4 (occasionally 2) teeth	Ant. margin of carpus with 2 teeth	Ant. margin of carpus with 3-4 teeth
Manus of major cheliped covered (usually thickly) with short plumose hairs; no long, non-plumose setae	Manus of major cheliped covered with vestigial plumose hairs, occasionally a thick, short pile; no long, non-plumose setae	Manus of major cheliped thickly covered with short plumose hairs; tufts of long, stiff, non-plumose setae
Manus of minor cheliped thickly covered with short plumose hairs; a few long, flexible, non-plumose setae	Manus of minor cheliped covered with vestigial plumose hairs, occasionally a thick, short pile; no long, non-plumose setae	Manus of minor cheliped thickly covered with short plumose hairs; tufts of long, stiff, non-plumose setae
Fingers with small, flattened granules	Fingers with small, flattened granules; nearly smooth	Fingers with large, coarse granules
No male pleopods	Male pleopods present	Male pleopods present

*Remarks:* Peruvian specimens collected by R. E. Coker and referred by Rathbun (1910) to *Pachycheles grossimanus* (Guérin) were seen by the present writer at the U. S. National Museum. Those from Bahía de Sechura were found to be *P. crinimanus*.

The specific name is derived from the Latin *crinis*, hair, and *manus*, hand.

*Range:* Peru, from Bahía de Sechura south to Bahía de San Juan. Shore to about 10 fathoms.

### *Pachycheles grossimanus* (Guérin)

Plate 35, fig. 1

*Porcellana grossimana* Guérin, 1835, p. 116 (type locality, Chile); 1838b, p. 8, pl. VII 26, fig. 3 (type locality restricted to Valparaiso); 1839, p. 176, pl. 52, fig. 3. H. Milne Edwards and Lucas, 1844, p. 34. Nicolet, 1849, p. 198. Dana, 1852, p. 414.

*Pachycheles grossimanus*, Stimpson, 1858, p. 228. Cano, 1889, pp. 96, 99, 259. Ortmann, 1897, pp. 292, 293. Lenz, 1902, p. 748. Rathbun, 1910, pp. 559, 600, pl. 46, fig. 5 (part). Haig, 1955, pp. 42, 43. Not Porter, 1936a, p. 255, pl. 18.

*Pachycheles laevidactylus* Ortmann, 1892, p. 266, pl. 12, fig. 1 (type locality, Brazil; this locality is incorrect *fide* Ortmann, 1897, p. 293).

*Previous records:*

- Peru. San Lorenzo: U. S. Expl. Exped. (Dana). North Chincha Island, Islas de Chincha: R. E. Coker (Rathbun).
- Chile. "Chile": (Guérin 1835); F. T. Delfin (Haig). Isla Alacrán near Arica; Pisagua; Junín; Caleta Buena: R. Paessler (Haig). Iquique: F. Beumer; F. Ringe; Lund Univ. Chile Exped. (Haig). Cavancha: L. H. Plate (Lenz); Lund Univ. Chile Exped. (Haig). S of Cavancha near Iquique: R. Paessler (Haig). Punta de Lobos; Tocopilla; Puerto Mejillones del Sur: Lund Univ. Chile Exped. (Haig). Antofagasta: A. Gassmann; R. Paessler (Haig). Taltal: R. Paessler (Haig). Península Coquimbo; Montemar: Lund Univ. Chile Exped. (Haig). Valparaiso: *Favorite* (Guérin 1838b); (H. Milne Edwards and Lucas); U. S. Expl. Exped. (Dana); *Vettor Pisani* (Cano). Tumbes: L. H. Plate (Lenz). Bahía San Vicente; W of Rocas Amazonas, Canal Chacao: Lund Univ. Chile Exped. (Haig).

*Diagnosis:* Carapace with a tuft of plumose hairs on front; chelipeds usually with vestigial plumose hairs, these hairs sometimes forming a short pile over surface; anterior margin of carpus with lobe cut into two teeth; manus covered with small granules, fingers nearly smooth; walking legs with long plumose hairs; telson seven-plated; a pair of pleopods in male.

*Description:* Carapace slightly broader than long, strongly convex front to back, plicate on posterolateral regions, otherwise punctate; naked except for a short tuft of plumose hairs on front. Front narrow, rounded in dorsal view, trilobate in frontal view, the median lobe produced. Outer orbital angle produced into a tooth. Separated portion of side wall consisting of one large piece and numerous small ones.

Movable segments of antenna lightly granular, first sometimes with a conical tubercle; flagellum naked.

Merus of chelipeds with short rugae and flattened granules; anterior margin with a strongly projecting, subtriangular, granulate lobe. Carpus with a serrate- or granulate-edged lamellar lobe occupying proximal two-thirds of anterior margin, usually divided by a notch near distal end to form two teeth; lobe and carpus covered with small, flattened granules, tending to become enlarged near and along posterior margin, there forming irregular longitudinal rows. Manus covered with granules, somewhat larger, more rounded and more projecting than those of carpus, especially toward outer margin. Fingers with small, much-

flattened granules, dactylus nearly smooth. Entire surface of chelipeds with short plumose hairs, arising in groups from the distal end of each granule; usually these hairs vestigial and visible only under high magnification, so that chelipeds appear naked or nearly so, but in occasional specimens forming a short pile obscuring the granules; at greatest length this pile extending about half the length of the pollex. Fingers meeting only at tip in major cheliped, for entire length in minor cheliped; gape filled with a thick pubescence, more pronounced in major cheliped, on cutting edge of pollex extending nearly to tip.

Merus of walking legs with a thick fringe of long plumose hairs on anterior margin; carpus and propodus thickly covered with similar hairs.

Telson of abdomen with seven plates. A pair of pleopods in male.

*Material examined:* See Table 52.

*Measurements:* Males, 5.1 to 20.7 mm; non-ovigerous females, 4.0 to 14.9 mm; ovigerous females, 7.5 to 20.5 mm. The maximum lengths for male and ovigerous female were attained by specimens from the Lund University Chile Expedition (Haig, 1955).

*Color:* "Spotted with brownish black of different shades and a light red tint, carpus brownish, apex of fingers approaching vermilion." (Dana, of preserved specimens) Some of the specimens examined by the writer were a pale yellow-buff, while others had a pinkish tinge. In a few individuals there were small, pale orange spots on the carapace and abdomen.

*Ecology:* *Pachycheles grossimanus* seems to occur almost exclusively in the intertidal zone; two specimens were dredged by the Lund University Chile Expedition at Canal Chacao in 40 meters (22 fathoms) from a bottom of small stones. The species has been reported under stones, from holdfasts of algae (*Macrocystis* and *Lessonia*), and from the hull of a barge.

Ovigerous females have been taken in January, February, May, June, July, October, and November.

*Range:* San Lorenzo, Peru, south to Canal Chacao, Chile. Shore; exceptionally to 22 fathoms.

**Pachycheles rudis** Stimpson

Plate 34, fig. 1

*Pachycheles rudis* Stimpson, 1858, p. 228 (listed only; type locality, California); 1859, p. 76, pl. 1, fig. 5 (description; type localities restricted to Monterey, San Luis Obispo, and near San Francisco). Lockington, 1878, pp. 396, 404. Newcombe, 1893, p. 30. Ortmann, 1897, p. 294. Calman, 1898, p. 260. Doflein, 1899, p. 184. Holmes, 1900, p. 109. Nobili, 1901b, p. 18 (part; not Ecuador record). Rathbun, 1904, p. 168, pl. 6, fig. 6. Baker, 1912, p. 102. Taylor, 1912, p. 208. Hilton, 1916, p. 72. Nininger, 1918, p. 41. Schmitt, 1921, p. 176, pl. 33, fig. 2; text-fig. 111. Johnson and Snook, 1927, p. 349, text-fig. 298. Clemens, 1933, p. 50. MacGinitie, 1935, p. 712. Hewatt, 1937, pp. 186, 189; 1938, p. 285; 1946, pp. 191, 193, 194, 195, 200. Glassell, 1938a, p. 444. Ricketts and Calvin, 1939, pp. 94, 106, 178, 236, pl. 46, fig. 105. Hart, 1940, p. 91. Light, 1954, pp. 182, 186, text-fig. 90d. Not Moreira, 1901, pp. 32, 91.

*Previous records:*

Alaska. Kodiak (Schmitt).

British Columbia. Esperanza Inlet; Nootka Sound; Clayoquot Sound: E. G. Hart (Hart). Clayoquot: C. F. Newcombe (Newcombe). Ucluelet: Macoun (Taylor). Victoria: G. W. Taylor; C. F. Newcombe (Newcombe).

Washington. Puget Sound: Columbia Univ. Exped. (Calman); Nobili).

California. Humboldt County; San Francisco Bay: (Holmes). Near San Francisco: Trask (Stimpson 1859). Monterey Bay: F. Doflein (Doflein). Elkhorn Slough, Monterey Bay: G. E. MacGinitie (MacGinitie). Cabrillo Point, Monterey Bay: W. G. Hewatt (Hewatt 1937, 1938). Monterey: A. S. Taylor (Stimpson 1859); (Holmes). San Luis Obispo: Newberry (Stimpson 1859). Santa Rosa Island: W. G. W. Harford (Lockington); (Holmes). Scorpion Harbor, Smugglers Cove, Pelican Bay, and between Pelican Bay and Prisoner's Harbor, all Santa Cruz Island: W. G. Hewatt and W. Williams (Hewatt 1946). Santa Catalina Island: (Holmes). Laguna Beach: (Baker); (Hilton); H. H. Nininger (Nininger). San Diego (Schmitt).

Baja California. "Lower California": (Lockington). Ensenada: G. E. MacGinitie (MacGinitie).

*Diagnosis:* Carapace with a tuft of non-plumose setae on front; carpus with scattered long plumose hairs and large coarse granules, its anterior margin armed with a broad triangular lobe, nearly entire except in small specimens; manus covered with long plumose hairs and large coarse granules, and with a large granulate protuberance at base of pollex; walking legs covered with long plumose hairs; telson five-plated; a pair of pleopods in male.

*Description:* Carapace about as broad as long (very slightly broader in females), strongly convex front to back, plicate on posterolateral regions, otherwise punctate or with flattened granules; naked except for traces of pubescence anteriorly, and very short, thick-set, non-plumose setae on frontal region. Front narrow, sinuously triangular in dorsal view, trilobate in frontal view, the median lobe strongly projecting. Outer orbital angle produced into a broad tooth, sometimes spine-tipped. Separated portion of side wall usually consisting of one small piece.

First movable segment of antenna with a tubercle at distal end of anterior margin; second and third granular; flagellum naked or with vestigial hairs.

Merus of chelipeds rugose and granular; anterior margin with a broad, subtriangular, strongly projecting, granular lobe. Carpus with a broad subtriangular lobe on anterior margin, highest near proximal end; it and rest of dorsal surface covered with scattered long plumose hairs and large coarse granules; surface with three irregular longitudinal crests, indistinct on some specimens. Manus and fingers with large coarse granules; a large granular protuberance at base of pollex; surface covered with long plumose hairs, somewhat more thickly than on carpus, the hairs not extending onto fingers except for proximal portion of pollex. Fingers gaping in major cheliped, meeting for entire length in minor cheliped; short plumose hairs along cutting edges, extending nearly to tips.

All segments of walking legs with a thick fringe of plumose hairs along anterior margins; dorsal surface of propodus covered with similar hairs.

Telson of abdomen with five plates. A pair of pleopods in male.

*Variations:* In small specimens (about 5 mm and under) the tubercle on the anterior margin of the first movable antennal segment is often in the form of a spinule, and two similar spinules are present on the second segment, one at either end of the anterior margin. In small

specimens, also, the margin of the anterior carpal lobe appears serrate-edged because of distinct granules along it, and the margin may be notched to form two or three teeth; the granular longitudinal crests on the carpus are usually much more distinct; the tubercle at the base of the pollex is occasionally obsolescent; the granules near the outer margin of the manus tend to form irregular longitudinal rows; and there may be only traces of the long hairs which cover the chelipeds of larger individuals.

*Material examined:* See Table 53.

*Measurements:* Males, 3.4 to 17.0 mm; non-ovigerous females, 3.4 to 14.6 mm; ovigerous females, 4.0 to 17.4 mm. The maximum lengths are considerably greater than that given by Stimpson for one of the type males, 0.43 inches (= 10.9 mm).

*Color:* Specimens preserved in alcohol in the Hancock Foundation collections are light orange, many of them showing spots and blotches of darker orange on the carapace and chelipeds.

*Ecology:* *Pachycheles rudis* is an almost strictly littoral species; in the intertidal zone it has been found in various situations, such as under stones, in roots of kelp, in sponge cavities, among rock oysters and mussels, beneath sponge and tunicate beds, in the discarded burrows of dead boring clams, on pilings, and in discarded shells of barnacles. According to MacGinitie (1935), a male and female live together in pairs. Occasional specimens have been taken to a depth of 16 fathoms. The *Velero III* dredged it off Santa Rosa Island in 13-16 fathoms from a rock and coralline substrate; T. A. Burch recovered it from submerged pilings in a depth of 6.5 fathoms at Redondo Beach; he *Velero IV* took it at Santa Catalina Island in 9-11 fathoms and at Bahía de Colnett in 5-6 fathoms, with the bottom unrecorded in both cases. It may be significant that all the recoveries in depths of 5-16 fathoms were made in the southern part of its range.

The Hancock Foundation collections include ovigerous females taken in every month of the year except September.

*Relationships:* This species appears to be most closely related to *P. stevensii* Stimpson, 1858, which has been reported from Vladivostok, the Kuril Islands, and the colder waters of Japan. *P. stevensii* lacks the long plumose hairs which decorate the chelipeds of *P. rudis*; the anterior margin of the carpus is armed with three or more distinct teeth; and the manus bears three longitudinal grooves and lacks a large tubercle at the base of the pollex.

*Remarks:* Moreira (1901) listed *Pachycheles rudis* from Brazil. The identity of the species on which this record was based is not known.

*Range:* Kodiak, Alaska, south to Bahía de la Magdalena, Baja California; Santa Rosa, Santa Cruz, and Santa Catalina Islands off the California coast. Shore; occasionally to 16 fathoms.

### *Pachycheles holosericus* Schmitt

Plate 34, fig. 2

*Pachycheles holosericus* Schmitt in Nininger, 1918, p. 39 (not described), text-fig. 18 (not recognizable to species). Schmitt, 1921, p. 177 (description; type locality, Venice, California); pl. 33, fig. 3. Glassell, 1935, p. 105; 1938a, p. 444.

#### *Previous records:*

California. Venice; Long Beach: (Schmitt). Laguna Beach: H. H. Nininger (Nininger); (Schmitt). La Jolla; San Diego: (Schmitt). Baja California. Ensenada: S. A. Glassell (Glassell 1935).

*Diagnosis:* Carapace with a tuft of plumose hairs on front; carpus with granules concealed by short plumose hairs and with two longitudinal rows of small pearly tubercles arising from this pile, its anterior margin armed with a lobe edged with groups of large, pointed, conical granules; manus covered with large coarse granules nearly concealed by a similar pubescence, out of it rising a large granulate protuberance at base of pollex and an irregular longitudinal row of similar protuberances near outer margin; walking legs with long plumose hairs; telson five-plated; a pair of pleopods in male.

*Description:* Carapace about as broad as long (very slightly broader in females), strongly convex front to back, plicate on posterolateral regions, otherwise smooth or punctate; naked except for traces of pubescence anteriorly, and very short, thick-set plumose hairs on frontal region. Front narrow, sinuously triangular in dorsal view, trilobate in frontal view, the median lobe produced. Outer orbital angle produced into a broad tooth. Separated portion of side wall usually consisting of one small piece.

First movable segment of antenna with a tubercle at distal end of anterior margin; second and third granular; flagellum naked.

Merus of chelipeds rugose and granular; anterior margin with a broad, subtriangular, strongly projecting, granular lobe. Carpus with a

broad lobe on anterior margin, edged with large, pointed, conical granules arranged in groups, giving the margin an irregular sawtoothed appearance; lobe and rest of surface covered with small granules, latter concealed by short, thick-set plumose hairs; two even, longitudinal rows of small pearly tubercles on dorsal surface and a double row along posterior margin, not concealed by this pubescence. Manus and fingers with large coarse granules; a large, strongly projecting granular protuberance at base of pollex; an irregular longitudinal row of smaller protuberances, composed of groups of pointed tubercles, near outer margin of manus and a double row of tubercles along the margin; surface of manus covered with short plumose hairs as in carpus, extending onto proximal two-thirds of pollex and inner proximal fourth of dactylus, and not concealing the tubercles and protuberances. Fingers gaping in major cheliped, meeting for entire length in minor cheliped; gape in major cheliped with a thick tuft of plumose hairs, extending along cutting edges of fingers nearly to tips; in minor cheliped, gape with shorter and sparser hairs.

All segments of walking legs with long plumose hairs; carpus and propodus with short, thick-set, plumose hairs on dorsal surface.

Telson of abdomen with five plates. A pair of pleopods in male.

*Material examined:* See Table 54.

*Measurements:* Males, 4.1 to 16.4 mm; non-ovigerous females, 3.9 to 12.8 mm; ovigerous females, 4.4 to 15.1 mm. The ovigerous female holotype measures 18 mm in length, 19 mm in width.

*Color:* Specimens preserved in alcohol vary in color from dark rust to pale yellow-buff, with the tips of the fingers nearly white. The thick pile covering the chelipeds usually appears black because of the fine silt with which it is filled.

*Ecology:* Usually occurring under stones in the intertidal zone. It has also been reported among polychaete tubes and from sponge cavities; it was taken by T. A. Burch in 6½ fathoms from submerged pilings at Redondo Beach.

Ovigerous females were encountered in every month from November through March, and in June and July.

*Relationships:* *Pachycheles rudis* Stimpson, which is commonly associated with *P. holosericus* in the southern part of its range, is closely related to the latter species but may readily be distinguished from it by the much less strongly projecting protuberances and tubercles on the



chelipeds; by the carpal lobe with its margin nearly entire; and by the long, scattered plumose hairs which decorate the chelipeds. *P. holosericus* is also related to the west African species *P. bellus* (Osorio), as defined by Chace (1956, p. 11, text-fig. 3). In that species, which like *P. holosericus* has a five-plated telson and male pleopods, the manus is more swollen and tuberculate than in the eastern Pacific form and there are long plumose hairs on the manus of the minor cheliped in addition to the short pile covering its surface.

*Range:* Santa Barbara, California, south to Bahía de la Magdalena, Baja California.

### CLASTOTOECHUS, new genus

*Type species:* *Petrolisthes diffractus* Haig, 1957.

Carapace rounded, approximately as broad as long; upper surface rough, uneven. Side walls incomplete, the posterior portion consisting of many very small fragments separated by narrow membranous interspaces. Front strongly produced, distinctly trilobate. Eyestalks short and stout, retractile.

Basal segment of antenna not produced forward to meet anterior margin of carapace; with a small inward projection. Movable segments somewhat nodulate.

Basal segment of antennule with three strong, lamellate, anterior lobes.

Chelipeds large, flattened, subequal but with fingers sometimes differing in the two chelipeds; carpus longer than broad, its anterior margin armed with prominent teeth.

Walking legs of moderate length, somewhat flattened; propodus with movable spinules on posterior margin; dactylus ending in a simple spine, with small, movable, accessory spinules on posterior margin.

Telson of abdomen composed of five plates.

Contains three species, one from Pacific and two from Atlantic America.

*Remarks:* This genus is proposed for the reception of two western Atlantic species, *Petrolisthes nodosus* Streets, 1872, and *P. vanderhorsti* Schmitt, 1924, and an eastern Pacific species, *P. diffractus* Haig. The form of the front, side walls of the carapace, carpus of the chelipeds, and basal segment of the antennules (text-fig. 5), together with the five-plated telson, are characters warranting generic distinction.

The name, derived from the Greek *κλαστος*, broken in pieces, and *τοιχος*, a wall, was suggested by the fragmented side walls of the carapace characteristic of members of this genus.

***Clastotoechus diffractus* (Haig), new combination**

Plate 30, fig. 1; text-fig. 5(1)

*Petrolisthes diffractus* Haig, 1957a, p. 36, pl. 9, figs. 1-6 (type locality, San Lorenzo Rocks, Acapulco, Mexico).

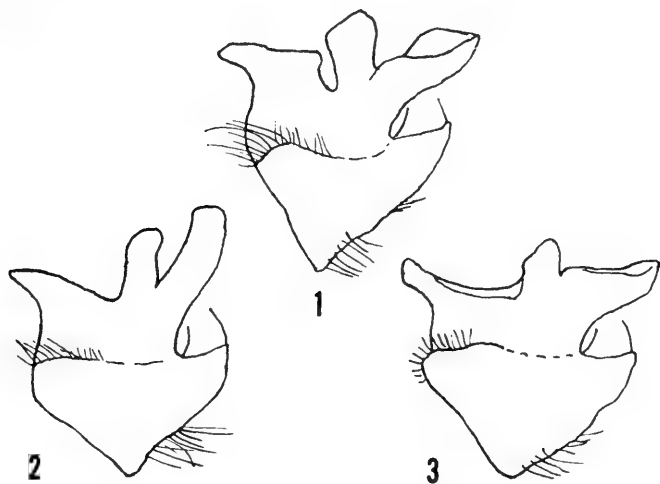
*Previous records*: Mexico. Bahía Tenacatita: (Haig). San Lorenzo Rocks, Acapulco: J. S. Garth from *Velero IV* (Haig).

*Diagnosis*: Lateral lobes of front truncate, not markedly elongate; orbits angular, strongly oblique; carpus with four broad, strongly projecting teeth on anterior margin, surface with a low crest; outer margin of manus with brush of hair usually present in females only.

*Description*: Carapace covered anteriorly with large, flattened, imbricate granules, smaller on frontal region, and posteriorly with elongate rugae; regions not distinct. Frontal region slightly depressed; frontal lobes extending beyond eyes, median lobe triangular and rounded at tip, lateral lobes truncate; in dorsal view the three lobes appearing to be about equal in length, but in frontal view the median one showing a long, acute, strongly deflexed extension. Orbits angular, strongly oblique; on either side a small, pointed preorbital lobe separated by a notch from lateral frontal lobe; outer orbital angle produced, pointed at tip. Rugae and granules of carapace setiferous on their anterior side, hairs not visible except under magnification.

First movable segment of antenna with a strongly projecting, finely granular lamellar lobe; second with a double row of large, strongly projecting nodules on anterior margin, and scattered smaller granules on surface; third more or less smooth; flagellum naked or with vestigial hairs, latter longer toward distal end. Outer maxillipeds rugose.

Merus of chelipeds covered with flattened setiferous granules, anterior margin with a small pointed lobe, only slightly produced. Carpus one and a half to two times as long as broad, covered with rough, rounded granules, more projecting than those of carapace, and with a short, fine pubescence not obscuring granules; anterior margin with four broad, strongly projecting, granular teeth, proximal one at right angle to carpus, others tilted progressively forward, with the distal tooth, formed of a projection of the anterodistal angle, lying nearly parallel with the long axis of the carpus; surface with a low longitudi-



Text-fig. 5. Basal segment of right antennule of 1, *Clastotoechus diffractus*, x 17; 2, *C. wanderhorstii*, x 26; 3, *C. nodosus*, x 56.

nal crest, granules of crest somewhat larger and more flattened; posterodistal angle produced into a curved spine. Manus and fingers covered with granules and pubescence as in carpus; outer margin of manus with a low rounded crest extending onto pollex, along it a row of small granules sometimes produced into spinules; outer margin approximately to base of pollex almost invariably provided with a thick brush of fine plumose hairs in females, devoid of this brush in males. Fingers rather long and slender, meeting entire length or slightly gaping, gape with a slight trace of pubescence.

Walking legs rugose, all segments with long non-plumose setae and anterior margins with a fringe of short plumose hairs.

*Material examined*: Cabo San Lucas, Gulf of California; J. Xantus, collector; eight males, five females (two ovigerous), one young (Museum of Comparative Zoology Cat. Nos. 1375 and 8019).

Cove west of Squall Point, Bahía Tenacatita, Mexico, shore; February 5, 1954; *Velero IV* station 2600-54, J. S. Garth, collector; one ovigerous female.

San Lorenzo Rocks, Acapulco, Mexico, shore; January 30, 1954; *Velero IV* station 2591-54, J. S. Garth, collector; male, holotype (Allan Hancock Foundation Cat. No. 542), and three males and four ovigerous females, paratypes.

*Measurements:* Males, 3.2 to 7.3 mm; ovigerous females, 5.5 to 8.3 mm. The male holotype is 6.3 mm long, 5.7 mm broad. Measurements of the 14 specimens from Cabo San Lucas were not recorded.

*Color:* In alcohol, pale reddish orange, the color a little darker on the granules and tips of the fingers.

*Ecology:* All the Hancock Foundation specimens were collected under stones in the littoral zone; so, presumably, were those taken at Cabo San Lucas by John Xantus. All females collected in January and February of 1954 were ovigerous.

*Relationships:* *Clastotoechus diffractus* is not analogous to either of the Atlantic species. It differs from both of them in having a more strongly granulate and rugose carapace, and in having the brush of hair on the outer margin of the manus characteristic of females only. In *C. vanderhorsti* the front and orbits are similar in form to those of *C. diffractus*, but the frontal lobes are markedly elongate; the carpal teeth are narrower in proportion to their breadth than in either *C. diffractus* or *C. nodosus*. The latter species differs from the other two in having the lateral lobes of the front pointed instead of truncate, and the orbits rounded instead of oblique.

*Remarks:* *Clastotoechus diffractus* is apparently a rare species. In spite of extensive collecting along the Mexican Pacific coast over a period of many years, only 23 specimens from three stations are known to date; it was described as recently as 1957. The species probably does not occur within the Gulf of California, or it would certainly have been taken during the intensive collecting carried on in that area.

*Range:* Known only from Cabo San Lucas at the mouth of the Gulf of California, south to Acapulco, Mexico.

#### ALLOPETROLISTHES, new genus

*Type species:* *Porcellana angulosa* Guérin, 1835.

Carapace rounded, approximately as broad as long. Front trilobate, two supplementary lobes sometimes present. Eyestalks short and stout, retractile.

Basal segment of antenna somewhat produced forward and narrowly in contact with outer orbital angle, thereby slightly excluding movable segments from orbit; strongly produced inward and, with the inner side of the basal segment of the antennule, forming a complete or nearly complete suborbital margin. Movable segments tuberculate.

Basal segment of antennule large, laterally expanded, with two to four broad lobes on anterior margin and often tuberculate on anterior face.

Chelipeds large, flattened, subequal; carpus longer than broad, its anterior margin armed with a strongly projecting, angular lobe; fingers long and slender.

Walking legs of moderate length, somewhat flattened; merus often greatly expanded, its anterior margin crested; movable spinules on posterior margin of propodus greatly reduced in number or absent, at most one or two at articulation with dactylus; dactylus very short, ending in a simple spine, posterior accessory movable spinules greatly reduced in size or entirely absent.

Telson of abdomen composed of five plates.

Contains three species, all eastern Pacific south-temperate.

*Remarks:* The three species for which this genus is proposed have several characters in common which set them apart from *Petrolisthes*. These include the slight forward projection of the basal antennal segment, which slightly excludes the movable segments from the orbit; the form of the basal segment of the antennule (text-fig. 6); the very short dactylus of the walking legs, with posterior movable spinules absent or greatly reduced in size; and the five-plated telson of the abdomen.

The name is derived from the Greek *αλλος*, other, different, and *Petrolisthes*.

#### KEY TO THE SPECIES

- 1a. Carapace covered with granules and tubercles, front with five lobes; lobe on proximal half of anterior margin of carpus joining distal half of margin at nearly a right angle . . . *spinifrons*
- 1b. Carapace smooth, front with three lobes; lobe on proximal half of anterior margin of carpus joining distal half of margin in a broad curve . . . . . 2
- 2a. Orbital margin nearly straight; carpus of walking legs with a sharp anterior crest . . . . . *angulosus*
- 2b. Orbital margin rounded, concave; carpus of walking legs without an anterior crest . . . . . *punctatus*

***Allopetrolisthes angulosus* (Guérin), new combination**

Plate 35, fig. 4; text-fig. 6(1)

*Porcellana angulosa* Guérin, 1835, p. 115 (type locality, Chile); 1838b, p. 7, pl. VII 25, fig. 3 (type locality restricted to Coquimbo); 1839, p. 175, pl. 51, fig. 3. H. Milne Edwards and Lucas, 1844, p. 34. Nicolet, 1849, p. 195. Targioni-Tozzetti, 1877, p. 212, pl. 12, figs. 6, 6a-b, d-e; pl. 13, figs. 1, 1a-b, d. Cano, 1889, pp. 96, 101, 259.

*Porcellana punctata*, Dana, 1852, p. 421. Not *Allopetrolisthes punctatus* (Guérin).

*Porcellana carinata* Kinahan, 1857, p. 347, pl. 14, fig. 3 (type locality, North Chincha Island, Peru).

*P[orcellana] angulosa?*, Stimpson, 1858, p. 229.

*Petrolisthes angulosus*, Targioni-Tozzetti, 1872a, p. 398; 1872b, p. 470. Ortmann, 1897, pp. 277, 279. Nobili, 1901a, p. 5; 1902, p. 233. Lenz, 1902, p. 745. Rathbun, 1910, p. 599. Porter, 1936b, p. 153; 1936c, p. 339. Haig, 1955, pp. 42, 46.

*Petrolisthes reissi* Ortmann, 1892, p. 260, pl. 11, fig. 15 (type locality, Golfo de Ancón, Ecuador; corrected to Ancón, Peru, by Ortmann, 1897, p. 279).

*Previous records:*

Peru. San Lorenzo: U. S. Expl. Exped. (Dana); *Vettor Pisani* (Cano). Ancón: Reiss (Ortmann 1892). Callao: Hamburg Mus. collection (Haig). North Chincha Island, Islas de Chincha: J. R. Kinahan (Kinahan).

Chile. "Chile": (Guérin 1835). Iquique: F. Beumer; F. Ringe; Lund Univ. Chile Exped. (Haig). Cavancha: Lund Univ. Chile Exped. (Haig). Antofagasta; Taltal; Huasco: R. Paessler (Haig). Coquimbo: *Favorite* (Guérin 1838b). Bahía Herradura de Guayaacán; Montemar: Lund Univ. Chile Exped. (Haig). Valparaiso: (H. Milne Edwards and Lucas); *Magenta* (Targioni-Tozzetti). Tumbes: L. H. Plate (Lenz). Bahía de Talcahuano: (Porter). Bahía San Vicente: Lund Univ. Chile Exped. (Haig). San Vicente: F. Silvestri (Nobili). Canal de Chacao; Golfo de Ancud: Lund Univ. Chile Exped. (Haig). Calbuco: L. H. Plate (Lenz).

*Diagnosis:* Carpace nearly smooth, regions not distinct; front with three lobes, median broadly triangular, lateral narrow and rounded; orbital margin without a concavity; carpus with a strong angular

lobe on proximal half of anterior margin, joining distal portion of margin in a broad curve.

*Description:* Carapace very strongly convex front to back, highest at epibranchial level; finely punctate or granulate anteriorly, otherwise nearly smooth, devoid of hairs; regions not distinct. Front trilobate, median lobe broadly triangular, pointed at tip, much more strongly produced than lateral lobes, latter narrow and rounded; in frontal view, median lobe showing a narrow, acute, strongly deflexed extension, present to a lesser degree on lateral lobes also. Orbital margin forming a nearly straight line from lateral lobe of front to groove separating hepatic and epibranchial regions; outer orbital angle slightly produced into an acute tooth, latter deflexed like tip of frontal lobes and scarcely visible in dorsal view.



Text-fig. 6. Right antennule of 1, *Allopetrolisthes angulosus*, x  $7\frac{1}{2}$ ; 2, *A. punctatus*, x 4; 3, *A. spinifrons*, x 9.

First movable segment of antenna smooth or granulate, with a low crest on anterior margin; second and third covered with tubercles or large granules; flagellum with vestigial hairs. Ischium of outer maxillipeds smooth or slightly granular, other segments roughly granular.

Chelipeds smooth or lightly granular, devoid of hairs. Merus armed on anterior margin with a narrow, rounded lobe. Carpus about one and a half times as long as broad, a strongly projecting, angular lobe occupying proximal half of anterior margin, and joining distal portion of margin in a broad curve; a smooth, longitudinal crest on dorsal surface, and another along posterior margin. Manus with a smooth, longitudinal crest, extending to base of dactylus; outer margin with a thin edge. Fingers smooth, meeting entire length or slightly gaping, crossing at tips; gape without pubescence.

Merus of walking legs devoid of hairs, greatly expanded and flattened, with a high, sharp crest on anterior margin; carpus devoid of hairs, with an anterior crest and another on dorsal surface; propodus

with a small tuft of hairs distally, and a single posterior movable spinule at articulation with dactylus; dactylus with short tufts of hairs, and three very small spinules on posterior margin.

*Material examined:* See Table 55.

*Measurements:* Males, 3.5 to 19.0 mm; non-ovigerous females, 4.2 to 15.0 mm; ovigerous females, 5.0 to 14.4 mm. The 19.0 mm male and 15.0 mm female were collected by the Lund University Chile Expedition. Lenz (1902) also recorded a measurement of 19 mm for a specimen with sex not stated. The types were reported to be 14 or 15 mm in length.

*Color:* In alcohol, ground color dirty yellow, with broad, irregular, ribbon-like stripes and spots of a red-brown color. (Lenz) Uniform yellowish-red; walking legs banded with darker red. (Kinahan)

*Ecology:* Common in the littoral, under stones. E. R. Guiler collected specimens on tunicates (*Pyura* sp.) and from algae, *Ulva* and *Lessonia*. Specimens were taken by the Lund University Chile Expedition from holdfasts of a brown alga. The species has been dredged on a few occasions to depths of 10 fathoms.

Ovigerous females have been collected in every month of the year except March, April, September, and December.

*Remarks:* Guérin (1838b) gave the locality as "Coquimbo and many other points in Chile." The Academy of Natural Sciences of Philadelphia has two dry specimens from the Guérin collection, taken at Valparaiso and questionably labelled as types.

Specimens identified by Dana (1852) as *Porcellana punctata* Guérin were seen by Ortmann in the Academy of Natural Sciences of Philadelphia, and redetermined by him (1897) as *Petrolisthes angulosus*. The present writer examined these same specimens, as well as five in the Museum of Comparative Zoology also taken by the U. S. Exploring Expedition and identified as *Porcellana punctata* by Dana.

*Range:* Paita, Peru, south to Calbuco, Chile. Shore to 10 fathoms.

#### *Allopetrolisthes punctatus* (Guérin), new combination

Plate 35, fig. 2; text-fig. 6(2)

*Porcellana punctata* Guérin, 1835, pl. 18, fig. 1 (Icon. Regn. Anim. Cuvier, 1829-44; pl. 18 published in 1835); 1835, p. 115 (type locality, Chile); 1838b, p. 7 (type locality restricted to Valparaiso); 1839, p. 175. H. Milne Edwards, 1837, p. 255. Cano, 1889, pp. 96, 99, 261. Not Dana, 1852, p. 421.



*Porcellana cristata* H. Milne Edwards, 1837, p. 254 (type locality unknown). Nicolet, 1849, p. 194. Cano, 1889, pp. 96, 99, 100, 260.

*P[orcellana] punctata?*, Stimpson, 1858, p. 229.

?*Porcellana (cristata?)*, Boas, 1880, pl. 1, fig. 13; pl. 2, fig. 63; pl. 3, fig. 122.

*Petrolisthes punctatus*, Ortmann, 1897, pp. 277, 279. Rathbun, 1910, p. 599. Haig, 1955, pp. 42, 48, text-fig. 11.

*Pachycheles grossimanus*, Porter, 1936a, p. 255, pl. 18. Not *P. grossimanus* (Guérin).

*Previous records:*

Peru. Ancón: *Vettor Pisani* (Cano).

Chile. "Chile": (Guérin 1835). Iquique; Punta de Lobos; Montemar: Lund Univ. Chile Exped. (Haig). Valparaiso: *Favorite* (Guérin 1838b); *Vettor Pisani* (Cano). San Antonio: (Porter). Talcahuano: MCZ collection (Haig).

*Diagnosis:* Carapace smooth, regions not distinct; front with three rounded lobes; orbits rounded, concave; carpus with a strong angular lobe on proximal half of anterior margin, joining distal portion of margin in a broad curve.

*Description:* Carapace very strongly convex front to back, smooth, devoid of hairs; regions not distinct. Front strongly trilobate, lobes rounded, median a little broader and more projecting than lateral lobes; in frontal view, median lobe showing a narrow, acute, strongly deflexed extension, present to a lesser degree on lateral lobes also. Orbits rounded, deeply concave; outer orbital angle produced into a strong pointed tooth.

First movable segment of antenna smooth, with a low crest on anterior margin; second and third smooth or nearly so, with more projecting anterior crests; flagellum with vestigial hairs. Outer maxillipeds smooth or punctate.

Chelipeds smooth, devoid of hairs. Merus armed on anterior margin with a small rounded lobe. Carpus about one and a half times as long as broad, a strongly projecting angular lobe occupying proximal half of anterior margin, and joining distal portion of margin in a broad curve; a smooth longitudinal crest on dorsal surface, and another along posterior margin. Manus with a smooth longitudinal crest extending to base of dactyl; outer margin with a smooth crest. Fingers smooth, gaping, crossing at tips; gape without pubescence.

Merus of walking legs devoid of hairs, greatly expanded and flattened, with a sharp crest on anterior margin; carpus devoid of hairs, rounded on anterior margin, a faint crest sometimes present on dorsal surface; propodus with short tufts of hairs distally, and a single pair of small posterior movable spinules at articulation with dactylus; dactylus with short tufts of hairs, posterior margin without movable spinules but with small corneous vestiges where they would normally occur.

*Material examined:* Estación de Biología Marina, Montemar, Chile, shore; September 19, 1948; Lund University Chile Expedition station M123; one male (Allan Hancock Foundation, gift of H. Brattström).

Valparaiso, Chile; Guérin collection [*Favorite*, collector?]; one dry specimen, not sexed, [syn?] type (Academy of Natural Sciences of Philadelphia Cat. No. 4133).

Talcahuano, Chile; 1872; *Hassler* Expedition, collector; twelve females (four ovigerous) (Museum of Comparative Zoology Cat. No. 7952).

*Measurements:* Males, 8.9 to 34.0 mm; non-ovigerous female, 9.0 mm; ovigerous females, 27.8 to 35.0 mm. The 34.0 mm male and 35.0 mm female were collected by the Lund University Chile Expedition. The type of *Porcellana cristata* H. Milne Edwards, of unspecified sex, was 9 lines (about 20.3 mm) in length. Cano (1889) reported a 38 mm male.

*Color:* Specimens preserved in alcohol were brick-red; markings, which were the same shade of red but darker, consisted of reticulations on the chelipeds, spots and less strongly marked reticulations on the carapace, and many very small spots on the walking legs and abdomen.

*Ecology:* The species has been taken under stones in the intertidal zone. The Lund University Chile Expedition recovered it on one occasion from the hull of a barge.

The Lund University Chile Expedition collected an ovigerous female at Montemar in October; ovigerous females from the *Hassler* Expedition were taken at Talcahuano, probably in April.

*Remarks:* This appears to be the largest of the porcellanid species with the exception of *Petrolisthes desmarestii* (Guérin), which also inhabits the Peruvian faunal province. In spite of its large size and striking appearance *Allopetrolisthes punctatus* is apparently rare, for it has been taken on relatively few occasions and never in abundance. The extensive shore collecting and dredging in Peru by the *Velero III* and Hancock Expedition collectors failed to recover it.

According to field notes made by Brattström and Dahl on the Lund University Chile Expedition, the local name for the species in Chile is "tijerita."

*Range:* Ancón, Peru, south to Talcahuano, Chile.

***Allopetrolisthes spinifrons* (H. Milne Edwards), new combination**

Plate 35, fig. 3; text-fig. 6(3)

*Porcellana spinifrons* H. Milne Edwards, 1837, p. 256 (type locality, shores of Chile). H. Milne Edwards and Lucas, 1844, p. 34. Nicolet, 1849, p. 193. Dana, 1852, p. 424. Philippi, 1860, p. 169. Cano, 1889, pp. 96, 99, 261.

*Petrolisthes spinifrons*, Nobili, 1901a, p. 6; 1902, p. 233. Lenz, 1902, p. 746, pl. 23, fig. 3. Rathbun, 1910, pp. 559, 599, pl. 48, fig. 5. Haig, 1955, pp. 42, 47.

*Previous records:*

Peru. San Lorenzo: U. S. Expl. Exped. (Dana). Islas Pescadores: R. E. Coker (Rathbun).

Chile. "Chile": (H. Milne Edwards). Pisagua: Kophamel (Haig). Caleta Buena: R. Paessler (Haig). Iquique: R. Paessler; F. Ringe (Haig). Antofagasta: R. Paessler (Haig). Mejillones del Sur: H. Piening (Haig). Coloso near Antofagasta; Taltal: R. Paessler (Haig). Isla Blanca: R. A. Philippi (Philippi). Coquimbo: *Vettor Pisani* (Cano). Bahía Herradura de Guayacan: Lund Univ. Chile Exped. (Haig). Montemar: Lund Univ. Chile Exped.; F. Riveros-Zuñiga (Haig). Valparaiso: (H. Milne Edwards and Lucas); U.S. Expl. Exped. (Dana). Tumbes: L. H. Plate (Lenz). Bahía San Vicente: Lund Univ. Chile Exped. (Haig). San Vicente: F. Silvestri (Nobili).

*Diagnosis:* Carapace covered with granules and tubercles, regions distinct; front with five lobes, median broadly triangular, lateral narrow and rounded, others smaller, lower placed; orbits angular, concave; carpus with a strong angular lobe on proximal half of anterior margin, joining distal portion of margin at nearly a right angle.

*Description:* Carapace convex front to back; surface very uneven, covered with large, rough granules and small tubercles, regions distinct; devoid of hairs. Front with five lobes, the median one broad, triangular, more projecting than lateral lobes, latter narrower, rounded at tips; between them and median lobe the two supplementary lobes,

smaller, pointed at tips, placed lower than the others and pointing inward and slightly downward. Orbits angular, deeply concave; outer orbital angle strongly produced into a broad pointed tooth.

First movable segment of antenna with a distal anterior tubercle; second and third covered with tubercles; flagellum with vestigial hairs. Outer maxillipeds smooth or punctate.

Chelipeds devoid of hairs. Merus with rough granules and tubercles on dorsal surface, anterior margin with a small, slightly projecting lobe; posterior margin with a roughened crest. Carpus nearly twice as long as broad; a strongly projecting lobe occupying proximal half of anterior margin, ending abruptly and joining distal portion of margin at nearly a right angle; dorsal surface roughened, with two low longitudinal crests; posterior margin with a roughened crest ending distally in a small tooth. Manus granulate to nearly smooth, outer margin with a thin edge. Fingers smooth, meeting for entire length, crossing at tips; gape without pubescence.

Merus of walking legs not unusually expanded or flattened, covered with rough granules, anterior margin with a low crest and a fringe of plumose hairs; carpus devoid of hairs, with a faint crest on anterior margin and one on dorsal surface; propodus devoid of hairs, without movable spinules on posterior margin; dactylus with short tufts of setae, and a row of very tiny movable spinules on posterior margin.

*Material examined:* See Table 56.

*Measurements:* Males, 3.1 to 14.4 mm; non-ovigerous females, 4.1 to 10.2 mm; ovigerous females, 8.5 to 17.4 mm. The 14.4 mm male was collected by the *Hassler* and the 17.4 mm female by the Lund University Chile Expedition. The type was reported to be "about 9 lines" (20.3 mm). Cano (1889) noted a 16.5 mm male.

*Color:* Ground color of carapace wall green. Tubercles dark carmine. A band of a brownish-red color around raised portions. Eye green. Merus and carpus of chela a bright Indian purple, green showing through in places. Granules carmine. Teeth pale vermilion. Hand and fingers bright orange, striped with Bordeaux red. Ambulatory legs Bordeaux red with yellowish white spots; some of red shows around edges of spots. Abdomen same as legs. Nail of dactyl yellow. Ventral side pale cream, lightly overcast with yellow and red. First segments of antenna red and green, others light brown and yellow. (Petersen, of a live specimen from Peru)

General color of the dorsal surface of the cephalothorax and legs yellowish tending to rose with red-scarlet lines; legs elegantly and regularly striped with the same color. Four longitudinal lines of the same color traverse the abdomen. (Nobili, 1901, of a preserved specimen)

*Ecology:* This species has been taken under stones in the littoral. It has also been dredged in depths to 12 fathoms, and taken from *Lessonia* holdfasts at 7 fathoms. It has been reported (Haig, 1955) as a commensal with sea stars, *Stichaster striatus* Müller and Troschel and *Meyenaster gelatinosus* (Meyen). The Peruvian specimen from which Anker Petersen prepared the color notes, above, was "associated with anemone."

Ovigerous females have been encountered in every month from October through February.

*Range:* San Lorenzo, Peru, south to San Vicente, Chile. Shore to 12 fathoms.

#### EUCERAMUS Stimpson 1860

*Euceramus* Stimpson, 1860, p. 445 (type species *Euceramus praelongus* Stimpson, 1860, by monotypy).

Carapace considerably longer than broad, markedly convex transversely; lateral margins subparallel. Front prominent, very narrow, tridentate. Orbits shallow; outer orbital angles not produced; eyestalks slender, retractile. Hepatic margin with a large orbitlike concavity, its outer angle formed by a tooth. Posterior to this hepatic tooth a distinct epibranchial spine, the two separated by a notch.

Basal segment of antenna either very short, without projections, or else produced inward and forward and narrowly in contact with anterior margin of carapace. First and second movable segments long, broader than eyestalk; third short.

Basal segment of antennule much longer than broad, with one or more strong projections on its anterior margin, and fringed internally with long plumose hairs.

Chelipeds small; carpi subcylindrical; hands weak, subcylindrical or somewhat flattened, fingers opening vertically. Walking legs subcylindrical; no posterior spinules on propodus; dactylus ending in a simple spine, posterior supplementary movable spinules absent or vestigial.

Telson of abdomen longer than broad, composed of seven plates.

Contains three species, two from Pacific and one from Atlantic America.

*Remarks:* *Euceramus* forms a transition between the group of genera in which the basal antennal segment is short and not broadly in contact with the anterior margin of the carapace, and the group of genera in which the basal segment is strongly produced forward so that the movable segments are far removed from the orbit. In *E. panatelus* the basal segment is not produced forward; in both *E. praelongus* and *E. transversilineatus* it has a small forward projection which narrowly separates the movable segments from the orbit.

#### KEY TO THE EASTERN PACIFIC SPECIES

- 1a. Carapace a little over twice as long as broad; flagellum much longer than carapace, with long plumose hairs . . . *panatelus*  
 1b. Carapace about one and a half times as long as broad; flagellum shorter than carapace, not hairy . . . *transversilineatus*

#### *Euceramus panatelus* Glassell

Plate 36, fig. 1; text-fig. 7(1)

*Euceramus panatelus* Glassell, 1938a, p. 423, pl. 29 (type locality, La Libertad, Ecuador).

#### *Previous records:*

Mexico. Bahía Tenacatita; Isla Grande: W. Williams on *Stranger* (Glassell).

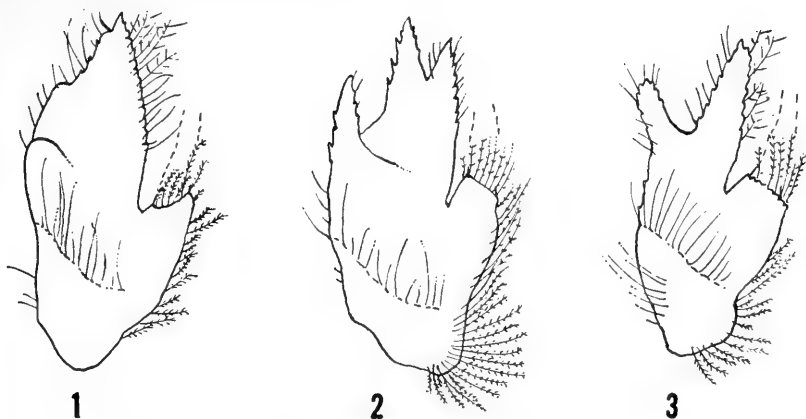
Guatemala. San José: W. Williams on *Stranger* (Glassell).

Ecuador. La Libertad: W. Williams on *Stranger* (Glassell).

*Diagnosis:* Carapace a little over twice as long as broad, lightly plicate; basal segment of antenna very short, without inward or forward projections; flagellum much longer than carapace, with long plumose hairs; dactylus of walking leg 3 flat, without a nail.

*Description:* Carapace a little over twice as long as broad, covered with light transverse plications; small flattened granules on frontal and hepatic regions; cervical groove well marked, but regions not distinct; devoid of pubescence. Front divided into three small pointed teeth, about equal in breadth; also equal in length, or median one a little longer. Hepatic spine small, epibranchial spine small but distinct; these spines separated by a shallow notch.

Basal segment of antenna very short, not produced either forward or inward; first and second movable segments massive, much broader than eyestalk; third very short; flagellum much longer than carapace, thickly covered with long plumose hairs. Outer maxillipeds punctate,



Text-fig. 7. Basal segment of right antennule of 1, *Euceramus panatelus*, x 48; 2, *E. transversilineatus*, x 22; 3, *E. praelongus*, x 22.

fringed on inner and outer margins with long plumose hairs; sternum truncate anteriorly.

Chelipeds rather roughly granular, covered with a short pubescence, latter longer on manus and fingers. Merus without anterior projections. Carpus short and stout, unarmed. Manus somewhat swollen; fingers gaping, meeting only at tips.

Walking legs long and slender, faintly granular; all segments with an anterior and a posterior fringe of long plumose hairs. Propodus subcylindrical in legs 1 and 2, shorter and flattened in leg 3. Dactylus of legs 1 and 2 subcylindrical, ending in a simple spine, without supplementary movable spinules; that of leg 3 flat, without a nail.

Telson of abdomen only slightly longer than broad.

*Material examined:* See Table 57.

*Measurements:* Males, 3.5 to 9.0 mm; non-ovigerous females, 4.4 to 8.9 mm; ovigerous females, 6.3 to 8.2 mm. The male holotype measures 8.7 mm in length, 4.0 mm in breadth.

*Color:* Carapace cream, with front red and a transverse red median band. Fingers of chelipeds flecked with red. (Glassell)

Carapace pale transparent mauvette and light bluish green. Colors are only faintly separated; the effect is opalescent. A dark area on cardiac region; rostrum vinaceous rufous. This color extended on base of eyestalk. Eye dull bluish purple. Antenna very pale blue-gray with touches of rufous on basal segments, gradually fading out. Ambulatory

legs same as carapace but much lighter. Eggs scarlet. Ventral surface same as ambulatory legs. Vinaceous rufous stripes on maxilliped. (Petersen, of a live specimen from Guatemala)

*Ecology*: "Without doubt, to judge from the structure of the ambulatory legs and the disposition of the peculiarly ciliated antennae, this species is a burrowing form which remains concealed under the surface of the sand." (Glassell) It has been dredged in depths of 5 to 22 fathoms. Substrates of material examined and that reported by Glassell were as follows: sand, from three stations; sand with shell and sand with mud, from two stations each; mud, from one station.

Ovigerous females were taken in January by the *Velero III*; Glassell reported one collected in April.

*Relationships*: *Euceramus panatelus* is closely allied to *E. praelongus* Stimpson, 1860, from the western Atlantic. They are alike in having the carapace over twice as long as broad; movable antennal segments 1 and 2 much broader than the eyestalk; and a long, hairy antennal flagellum. In *E. praelongus* the center lobe of the front is distinctly longer than the lateral lobes; the orbital margin is slightly more convex than in *E. panatelus*; the basal segment of the antenna is narrowly in contact with the anterior margin of the carapace, and has a broad inward projection as well; the flagellum of the antenna is shorter in proportion to the carapace length than in *E. panatelus*; the propodus and dactylus of walking leg 3 are not modified; and the sternum is broadly triangular anteriorly.

*Range*: Bahía Tenacatita, Mexico, south to La Libertad, Ecuador; 5 to 22 fathoms.

### ***Euceramus transversilineatus* (Lockington)**

Plate 36, fig. 2; text-fig. 7(2)

*Porcellana transversilineata* Lockington, 1878, pp. 396, 405 (type localities, Boca de las Piedras and Bahía de los Angeles, Gulf of California).

*Euceramus transversilineatus*, Glassell, 1938a, p. 426, pl. 30 (neotype designated; neotype localities, off N end Isla Tiburón and Punta Peñasco, Gulf of California).

*Previous records*: Gulf of California. Punta Peñasco, Sonora; San Felipe: S. A. Glassell (Glassell). Bahía de los Angeles: (Lockington). Off N end Isla Tiburón: S. A. Glassell (Glassell). Boca de las Piedras [Estero de las Piedras?], Sinaloa: (Lockington).



*Lectotype*: Ovigerous female, 6.7 mm in length by 4.4 mm in width, in Paris Museum, labelled "*Porcellana transversilineata* Lockington. Californie—Lockington 6-99 (Type)." This specimen, one of two so labelled, is hereby selected as the lectotype at the request of Mr. Jacques Forest.

*Diagnosis*: Carapace about one and a half times as long as broad, with distinct transverse striations; basal segment of antenna with a broad inward projection and a small forward projection, the latter narrowly separating movable segments from orbit; flagellum shorter than carapace, without hairs; dactylus of walking leg 3 normal.

*Description*: Carapace about one and a half times as long as broad, covered with distinct transverse striations broken up into large flattened granules anteriorly; protogastric lobes accentuated, regions otherwise not distinct; anterior regions with long, scattered setae, hooked at their tips. Front divided into three long slender teeth, median one the longest; margins of median tooth and inner margins of lateral teeth fringed with short plumose hairs. Hepatic and epibranchial spines large, distinct, separated by a deep U- or V-shaped notch.

Basal segment of antenna with a broad inward projection, almost entirely visible in dorsal view; a small forward projection, narrowly separating movable segments from orbit; first and second movable segments broader than eyestalk, but not massive and filling concavity between outer orbital angle and hepatic spine; third small; flagellum shorter than carapace, naked. Outer maxillipeds nearly smooth or covered with small flattened granules; sternum truncate anteriorly.

Chelipeds covered with small, flattened granules and long, scattered setae, hooked at their tips. Merus with a long, narrow tooth at distal end of anterior margin. Carpus short and stout, with one to four narrow, widely separated spines on anterior margin. Manus flattened, outer margin with a row of spines, the latter more pronounced in males, sometimes obsolescent in females. Fingers meeting for entire length or slightly gaping.

Walking legs rather short and stout, rugose; all segments with tufts and fringes of long non-plumose setae. Propodus subcylindrical. Dactylus with a row of small tubercles on posterior margin in place of movable spinules.

Telson of abdomen much longer than broad.

*Material examined*: See Table 58.

*Measurements*: Males, 5.1 to 8.0 mm; non-ovigerous females, 5.8

to 12.1 mm. The single ovigerous female examined, in the collections of the Museum of Comparative Zoology, was not measured. Lockington reported a length of 6 mm and width of 4 mm for one of his specimens; the male paratype and ovigerous female lectotype in the Paris Museum measure 11.5 by 6.7 mm and 6.7 by 4.4 mm, respectively. Glassell's female neotype is 8.3 by 6.1 mm, and his male neallotype 6.2 by 4.2 mm.

*Color:* Carapace dark pinkish buff and striated longitudinally with reddish brown. Chelae yellow cream buff with a large brown spot on merus and carpus. Fingers with a broad dark brown band around center. Ambulatory legs greenish white with touches of brilliant orange. Ventral side pinkish buff. A dark brown band runs from eye socket across center portion of maxillipeds. (Petersen, of a live specimen from the Gulf of California)

*Ecology:* S. A. Glassell collected specimens at Punta Peñasco, Gulf of California, at extreme low water, partly covered with sand and shell fragments at the base of gorgonian corals. A specimen was taken by him under similar conditions at San Felipe. Otherwise, all known material has been dredged in 2 to 34 fathoms on bottoms of sand, shell, sand and shell, sandy mud, and sand with corallines.

The only ovigerous females on record were taken by Lockington in September. The month of collecting was not indicated for the *Hassler* ovigerous female collected at Bahía de la Magdalena.

*Remarks:* Of the two extant syntypes in the Paris Museum, the smaller, an ovigerous female, is designated as the lectotype. The 11.5 mm male paratype lacks the chelipeds and many of the walking legs.

Not realizing that any of Lockington's porcellanid types remained extant, Glassell (1938a) designated a neotype for *Euceramus transversilineatus* from among specimens of his own collecting. An excellent illustration accompanies his account.

*Range:* Bahía de Santa María and Bahía de la Magdalena, Baja California; Punta Peñasco and San Felipe, Gulf of California, south to Isla Taboga, Panama. Shore to 34 fathoms.

**MINYOCERUS** Stimpson 1858

*Minyocerus* Stimpson, 1858, p. 229 (type species *Porcellana angusta* Dana, 1852, by original designation).

*Porcellina* Müller, 1862, p. 194 (type species *Porcellina stellicola* Müller, 1862, by monotypy).

Carapace longer than broad, markedly convex transversely; upper surface with distinct transverse striations. Front prominent, broad, tridentate. Orbits deep; outer orbital angles strongly produced; eyestalks stout, retractile.

Basal segment of antenna produced forward and broadly in contact with anterior margin of carapace; strongly produced inward, forming a partial suborbital margin. Movable segments minute and flagellum rudimentary, their total length less than or scarcely exceeding width of eye.

Basal segment of antennule longer than broad, anterior margin with strong teeth visible in dorsal view.

Chelipeds rather small; carpus short and stout; manus long and narrow, its margins subparallel, much longer than fingers, latter opening obliquely.

Walking legs subcylindrical; no posterior movable spinules on propodus; dactylus ending in a simple spine, without movable accessory spinules on posterior margin.

Telson of abdomen a little longer than broad, composed of seven plates.

Contains two species, one on either side of the American continents.

***Minyocerus kirki*** Glassell

Plate 37, fig. 1; text-fig. 8

*Minyocerus kirki* Glassell, 1938a, p. 430, pl. 31 (type locality, San Felipe, Gulf of California).

*Previous records:* Gulf of California. San Felipe: S. A. Glassell (Glassell).

*Diagnosis:* Carapace about one and a third times as long as broad, transversely striate; front tridentate, teeth approximately equal in length and breadth; movable segments of antenna minute and flagellum rudimentary, their total length less than or scarcely exceeding width of eye, visible only under magnification; carpus of cheliped with a strong spine at about center of anterior margin, often followed by several spinules.

*Description:* Carapace about one and a third times as long as broad, convex front to back as well as transversely; covered with flattened scalelike striations, larger and more distinct posterior to cervical groove; surface pubescent. Front distinctly tridentate, the teeth acute, approximately equal in length and breadth, or median one slightly longer. Outer orbital angle produced into a long, narrow, acute tooth. Epi-branchial spine strong.

Movable segments of antenna and flagellum less in their total length than width of cornea of eye, or slightly longer than width of eye; scarcely visible even under magnification. Outer maxillipeds lightly rugose.



Text-fig. 8. Basal segment of right antennule of *Minyocerus kirki*, x 38.

Chelipeds short, stout, lightly rugose. Merus with two strong, forward-pointing distal spines. Carpus with a similar, broad spine at about center of anterior margin, often followed by several spinules, and usually with two or three strong spinules on distal margin; surface lightly pubescent. Outer margin of manus with a finely granular crest, surface covered with long scattered setae. Fingers short, tips blunt, meeting for entire length or nearly so, dorsal surface and gape with long scattered setae.

Walking legs rather short and stout, all segments fringed with setae; merus obliquely rugose; carpus with two low longitudinal crests on dorsal surface; propodus and dactylus smooth.

*Variations:* The largest specimens examined, several of which were of greater size than any seen by Glassell, have antennae with total length somewhat greater than the width of the cornea of the eye, instead of less than the corneal width as indicated in the type description. There is considerable variation in the degree of spinulation on the carpus and merus of the chelipeds.

*Material examined:* See Table 59.

*Measurements:* Males, 2.2 to 3.8 mm; non-ovigerous females, 3.3 to 4.0 mm; ovigerous females, 2.0 to 5.5 mm. The male holotype measures 3.5 mm in length, 2.5 mm in breadth; an ovigerous female paratype, 4.0 by 2.8 mm.

*Color:* Carapace with median longitudinal area white with a yellow cast, branchial areas brown with a greenish cast. Antennules blue, flagellum yellow. Palp of maxillipeds light green. Chelipeds and ambulatory legs with a whitish ground banded with brown. The carapace colors extend onto the first two abdominal segments. (Glassell, from notes on a live specimen by W. A. Kirk)

Subcontrary triangular space of white covering frontal region and ending with distal point touching cardiac region. Cardiac and intestinal regions almost covered with white. Branchial regions closely netted with carmine red and yellow green. Chelae pale gray with a touch of red and green on merus. Carpus and hand with fine network of carmine and blue green. Fingers pale blue gray. Ambulatory legs white with two circular bands of carmine on merus and one on distal end of carpus. Eyestalk white with streak of carmine. Cornea of eye bright chrome yellow. Antennules pale blue with flagellum yellow. Visible portion of abdomen on dorsal side with two longitudinal broad stripes of red and green netting. Pterygostomian region and maxillipeds with a few blotches of red. No other color on ventral side. (Petersen, of a live specimen from the Gulf of California)

*Ecology:* "Found at extreme low water commensal on the sand starfish *Luidia columbia* (Gray). A pair of crabs was usually found on a single starfish, one on the dorsal, the other on the ventral side." (Glassell) *Velero III* specimens from Punta Peñasco, Gulf of California, were commensal on *Luidia phragma* H. L. Clark dredged in 3 to 10 fathoms. Specimens taken in Golfo de Fonseca by R. Paessler were from sea stars dredged in 4 fathoms; a few of those collected by the *Zaca* in the same area were from sea stars taken in 4 to 7 fathoms. *Luidia foliolata* Grube was "taken at various stations between Tenacatita Bay, Mexico, and Corinto, Nicaragua, in 2-30 fms." (Clark, 1940, p. 333) by the 1937-38 *Zaca* Expedition, and it was probably this sea star from which the *Minyocerus* of that expedition was recovered. The western Atlantic member of the genus, *Minyocerus angustus* (Dana), 1852, is a commensal with *Luidia clathrata* (Say).

Some of the *Zaca* specimens from La Unión and Punta Monypenny in Golfo de Fonseca were taken from serpent stars. Ophiurans from *Zaca* station 199 and dredge hauls corresponding to those of *Minyocerus* were *Amphipholis platydisca* Nielsen, *Ophiothrix spiculata* Leconte, and *Ophiolepis grisea* H. L. Clark (Clark, 1940).

Commensalism was not noted for *Velero III* specimens from Bahía de Tepoca, 11 to 13 fathoms, but very probably these specimens were also associated with echinoderms at the time of capture. The *Minyocerus* species would seem to be obligatory commensals on echinoderms, possibly confined to *Luidia* among the Asteroidea and to one genus or a very few genera in the Ophiuroidea.

Ovigerous females of *Minyocerus kirki* have been collected in May and December.

*Relationships*: In the closely related western Atlantic species, *Minyocerus angustus* (Dana), 1852, the anterior margin of the carpus sometimes lacks a spine, although one or two (rarely three) strong ones may be developed; when present they tend to be narrower in proportion to their length than the large carpal spine of *M. kirki*. The merus of the walking legs is more slender than in the Pacific species.

*Remarks*: *Minyocerus kirki* was previously known only from San Felipe, Gulf of California. The present study has revealed specimens from two other localities at the head of the Gulf, and from Golfo de Fonseca in Central America. Echinoderms from the intervening territory should be examined for specimens.

*Range*: Punta Peñasco and San Felipe, Gulf of California, south to Punta Monypenny, Nicaragua. Shore to 13 fathoms.

#### PORCELLANA Lamarck 1801

*Porcellana* Lamarck, 1801, p. 153 (type species *Cancer platy-cheles* Pennant, 1777, by monotypy).

*Platycheles* Billberg, 1820, p. 134 (type species *Cancer platy-cheles* Pennant, 1777, by tautonymy).

*Enostea* Gistel, 1848, pp. 159, 196 (substitute name for *Porcellana* Lamarck, 1801; taking the same type species, *Cancer platy-cheles* Pennant, 1777).

Carapace usually a little longer than broad; surface without spines or strong protuberances; lateral margins posterior to cervical groove entire, or with a few spines or tubercles on anterior portion of branchial

margins. Front prominent, strongly tridentate in dorsal view. Orbits deep; eyestalks stout, retractile.

Basal segment of antenna strongly produced inward, forming a partial suborbital margin and partly visible in dorsal view; produced forward and broadly in contact with anterior margin of carapace, with movable segments removed from orbit.

Basal segment of antennule with strong anterior projections, usually partially visible in dorsal view.

Chelipeds large, usually somewhat compressed; fingers normal, not twisted out of plane with palm. Propodus of walking legs usually with posterior spinules; dactylus ending in a simple spine, usually with several movable accessory spinules.

*Remarks:* The old genus *Porcellana* as restricted by Stimpson (1858) is a heterogeneous group which needs a thorough revision; the species currently included in it should probably be allocated to at least four distinct genera. In this report one group of species is transferred to *Pisidia*; aside from this no attempt is made to split *Porcellana* because the atypical species inhabit territory outside the scope of this paper. In the opinion of the writer, the genus should be limited to forms closely related to the type species, *Porcellana platycheles* (Pennant), 1777, and having the combination of characters enumerated above. In addition to the eastern Atlantic type species the genus would then include *Porcellana sayana* (Leach), 1820, *P. sigsbeiana* A. Milne Edwards, 1880, and *P. frontalis* Heller, 1862, western Atlantic; *P. pulchra* Stimpson, 1858, western Pacific; and *P. hancocki*, *P. paguriconviva*, and *P. cancrisocialis*, all eastern Pacific species described by Glassell.

*Porcellana corbicola*, described herein, has several atypical features including chelipeds much like those of *Porcellanella* White, 1852, and walking legs without movable spinules on the lower margins of propodus and dactylus. Nothing is known of its affinities at present, and until the Porcellanidae as a whole can be revised it is tentatively placed in *Porcellana*.

#### KEY TO THE EASTERN PACIFIC SPECIES

- 1a. Fingers opening vertically; telson of abdomen with 5 plates  
 . . . . . *corbicola*
- 1b. Fingers opening horizontally or somewhat obliquely; telson of  
 abdomen with 7 plates . . . . . 2
- 2a. Lateral margin with a deep, narrow notch at cervical groove;  
 manus slender, its surface somewhat swollen . . . *hancocki*

- 2b. No notch on lateral margin at cervical groove; manus broad, its surface flat . . . . . 3
- 3a. Epibranchial angle with two or three spinules; frontal teeth pointed at tips, median one spinulate on margins . . . . .  
 . . . . . *cancrisocialis*
- 3b. Epibranchial angle unarmed; frontal teeth rounded at tips, median one not spinulate . . . . . *paguriconviva*

### **Porcellana hancocki** Glassell

Plate 38, fig. 3; text-fig. 9(1)

*Porcellana hancocki* Glassell, 1937, p. 87 (listed only); 1938b, p. 5 (description; type locality, Bahía de los Angeles, Gulf of California).

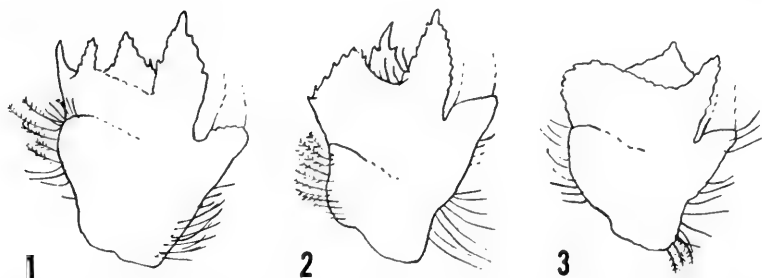
*Previous records:* Gulf of California. Bahía de los Angeles: *Velero III* (Glassell 1938). Bahía de Santa Inés; Arena Bank: *Zaca* (Glassell 1937).

*Diagnosis:* Carapace strongly convex transversely; frontal teeth narrow, pointed at tips, median tooth somewhat broader and more produced than other two; lateral margin with a deep, narrow notch at cervical groove, followed in smaller specimens by a small spine at epibranchial angle; carpus about one and a half times as long as wide, with a low rounded lobe on proximal third of anterior margin, the lobe spine-tipped in small specimens; fingers opening horizontally or somewhat obliquely; telson seven-plated.

*Description:* Carapace covered with faint plications and flattened fine granules; strongly convex transversely, highest at midline; regions not distinct except for protogastric lobes, the latter fringed with plumose hairs; carapace elsewhere faintly pubescent, especially on frontal region. Frontal teeth narrow, acute, directed forward, all extending beyond eyes; median tooth with a distinct longitudinal groove, somewhat more produced and broader than lateral teeth and separated from them by a wide V-shaped notch. Outer orbital angle sometimes with a small, short tooth. Lateral margin with a deep, narrow, V-shaped notch at cervical groove; epibranchial angle with a small spine in younger specimens, this spine obsolescent in adults.

Movable segments of antenna more or less smooth, without projections; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose, ischium covered with long plumose hairs.





Text-fig. 9. Basal segment of right antennule of 1, *Porcellana hancocki*, x 24; 2, *P. cancrisocialis*, x 24; 3, *P. paguriconviva*, x 23.

Chelipeds covered with small flattened granules. Merus with a broad, strongly projecting, triangular tooth or rounded lobe on anterior margin; anterior and posterior margins fringed with plumose hairs. Carpus about one and a half times as long as broad, with a low rounded lobe on proximal third of anterior margin; scattered plumose hairs near posterior margin. Palm (as well as fingers) lying in a nearly horizontal plane, rather slender, dorsal surface somewhat swollen; outer half of dorsal surface and surface of pollex with short plumose hairs, produced into a long fringe along outer margin. Gape of fingers without pubescence.

Walking legs long and slender, lightly rugose; merus of leg 3 not inflated; all segments with a distinct fringe of plumose hairs along anterior margin, surface covered with scattered plumose hairs.

Telson of abdomen with seven plates.

*Variations:* In small specimens the lateral margin of the carapace is more deeply notched at the cervical groove. The anterior carpal lobe is very low and not armed with a spine in the largest individuals examined; in smaller specimens it is somewhat more produced and bears a narrow, distally directed spine at its distal end.

*Material examined:* Entrance to Bahía de los Angeles, Gulf of California, 25 fathoms; March 3, 1936; *Velero III* station 538-36; male, holotype (Allan Hancock Foundation Cat. No. 363), and one ovigerous female paratype.

Entrance to Bahía de los Angeles, 25-40 fathoms; March 2, 1936; *Velero III* station 535-36; one male and one ovigerous female, paratypes.

Bahía de los Angeles, 32 fathoms; March 20, 1937; *Velero III* station 701-37; three males, two females.

*Measurements:* Males, 3.9 to 8.5 mm; non-ovigerous females, 4.7 and 5.8 mm; ovigerous females, 4.8 and *ca.* 8.0 mm. The male holotype is 6.3 mm in length, 5.8 mm in width; an ovigerous female paratype, 4.8 by 4.2 mm.

*Color:* In alcohol, carapace with orange-red blotches on a cream-colored ground. Propodi of ambulatories banded. Ventral surface slightly iridescent. (Glassell, 1938b)

*Ecology:* *Porcellana hancocki* has been taken in depths of 25 to 40 fathoms, from substrates of mud, sand, and sand and shell. Commensalism with pagurids or other organisms has not been noted.

Ovigerous females have been recorded for March only.

*Relationships:* *Porcellana hancocki* is closely related to the western Atlantic species *P. sigsbeiana* A. Milne Edwards, 1880. The latter form has a notch at the cervical groove, and a lobe and spine on the anterior margin of the carpus, much like those characteristic of *P. hancocki*. It differs in having the walking legs proportionately much shorter and stouter than in *P. hancocki*. *P. sigsbeiana* has been reported from depths of 27 to 215 fathoms.

*Remarks:* The holotype was given a U. S. National Museum catalog number by Glassell (1938b). However, the holotype belongs to the Allan Hancock Foundation and is deposited in that institution with catalog number 363. The specimens recovered by the *Velero III* at station 701-37 will be deposited in the U. S. National Museum.

*Range:* Known only from three localities in the Gulf of California: Bahía de los Angeles, Bahía de Santa Inés, and Arena Bank. 25 to 40 fathoms.

### *Porcellana cancrisocialis* Glassell

Plate 38, fig. 2; text-fig. 9(2)

*Porcellana cancrisocialis* Glassell, 1936, p. 292 (type locality, Punta Peñasco, Sonora, Gulf of California); 1937, p. 86. Steinbeck and Ricketts, 1941, p. 458. Haig, 1957b, p. 13.

#### *Previous records:*

Gulf of California. Punta Peñasco, Sonora; San Felipe: S. A. Glassell (Glassell 1936). Estero de la Luna: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Arena Bank: *Zaca* (Glassell 1937).

Ecuador. 3 mi W of Cabo de Santa Elena: *Askoy* (Haig).

*Diagnosis:* Carapace somewhat convex transversely, thickly covered with long plumose and non-plumose hairs; median frontal tooth broad, its margins spinulate, produced a little beyond narrow lateral teeth, all three pointed at tips; epibranchial angle rounded, bearing two or three minute spinules; carpus less than one and a half times as long as wide, proximal third of anterior margin with a broad, strongly projecting lobe tipped with a distally directed spine; fingers opening horizontally or somewhat obliquely; telson seven-plated.

*Description:* Carapace covered with faint plications and flattened fine granules; somewhat convex transversely; regions not distinct; covered with long, scattered plumose and non-plumose hairs, most thickly on frontal and protogastric regions. Frontal teeth acute, extending beyond eyes, lateral ones narrow, slightly converging; median one broad and slightly more produced, somewhat concave, its margins spinulate, separated from lateral teeth by a narrow U-shaped notch. Outer orbital angle produced into a broad tooth. Epibranchial angle rounded, distinct, bearing two or three minute spinules.

Movable segments of antenna more or less smooth, without projections; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose.

Chelipeds covered with small flattened granules. Merus with a broad, rugose, strongly projecting, spine-tipped lobe on anterior margin; surface with a few long, scattered plumose hairs, especially toward posterior margin. Carpus less than one and a half times as long as wide; a broad, strongly projecting lobe on proximal third of anterior margin, the lobe rounded on its proximal side, angled on its distal side, and tipped with a distally directed spine; surface covered with tufts of long, non-plumose setae. Palm (as well as fingers) lying in a nearly horizontal plane, broad, dorsal surface flat, outer margin strongly curved; thickly covered with tufts of long, non-plumose setae, becoming intermingled with plumose hairs toward outer margin, latter bearing a long, thick fringe of plumose hairs. Dactylus thickly covered with long non-plumose setae, outer margin of pollex with a long fringe of plumose hairs; gape without pubescence.

Walking legs rather stout, lightly rugose; merus with a fringe of plumose hairs along anterior margin, that of leg 3 inflated; all segments with tufts of long non-plumose setae.

Telson of abdomen with seven plates.

*Material examined:* See Table 60.

*Measurements:* Males, 2.9 to 7.5 mm; non-ovigerous females, 2.4 to 7.6 mm; ovigerous females, 3.4 to 8.1 mm. The male holotype measures 5.7 mm in length, 4.8 mm in breadth; a female paratype, 5.4 by 4.8 mm.

*Color:* Ground color in life an ivory yellow, overcast with lavender and blood red spots. Protogastric regions lighter. Chelipeds same as carapace. Ambulatory legs banded with white on propodus. (Glassell, 1936)

Carapace light aniline lilac with open irregular netting of dull cadmium orange, except on frontal regions where color is more red. Eyes dull mauve. Chela color as in carapace, but netting pale and broken. Fingers darker and slightly red. Ambulatory legs lighter than carapace and netting bright and distinct. A white band at distal end of propodus. Ventral side white. (Petersen, of a live specimen from Costa Rica)

*Ecology:* Glassell (1936) reported the species to be commensal with a large hermit crab, *Petrochirus californiensis* Bouvier; he noted that usually a pair of the porcellanid occupies a shell, but that one or three specimens may be present. Steinbeck and Ricketts (1941) found it "in container of hermit crabs from Estero de la Luna (where *Dardanus sinistripes* and *Pagurus albus* were taken)." At three Hancock Foundation stations (209-34, 480-35, 681-37) large shells were recovered which may have contained specimens of *Porcellana cancrisocialis*. The specimen taken by Dawson and Durham at Guaymas was from "mud flats," perhaps from shells.

The large number of stations for which no commensalism was noted indicates that crabs of this species are probably free-living most of the time, only occasionally seeking shelter in shells with hermit crabs. The species has been recovered free-living from shore to a depth of 54 fathoms. Analysis of 23 Hancock Foundation dredging stations for which bottom data are available shows the following: sand (9 stations), sand and shell (3), sand with kelp (2), sandy mud (2), mud (2), mud and shell (1), sand and nullipores (1), sand, gravel, and mud (1), corallines (1), corallines and nullipores (1). Substrates of sand and of mud were recorded for specimens from the *Askoy* Expedition and from Hamburg Museum collections, respectively. Glassell (1937) reported the species from sand with weed.

Ovigerous females have been encountered in every month from December through May, and in August.

*Relationships:* This species is very closely related to *Porcellana sayana* (Leach), 1820, from the western Atlantic. The latter form dif-

fers in having only one spinule at the epibranchial angle, this spinule disappearing entirely in larger specimens; in addition, in larger specimens the spinules on either side of the median frontal tooth take the form of small lobes projecting from the sides of the median tooth. Otherwise no significant differences were noted. More detailed studies of both species may be necessary to determine whether the east and west American populations should both be accorded full specific rank.

*Remarks:* *Porcellana cancrisocialis* was previously reported only from the Gulf of California and from Ecuador. Specimens are now known from many stations in the intervening territory.

*Range:* Bahía de Santa María and Punta Tosco, Baja California; Punta Peñasco, Gulf of California, south to Bahía de Santa Elena, Ecuador; Isla Isabel off the Mexican coast. Shore to 54 fathoms.

### *Porcellana paguriconviva* Glassell

Plate 38, fig. 1; text-fig. 9(3)

*Porcellana paguriconviva* Glassell, 1936, p. 293 (type locality, Punta Peñasco, Sonora, Gulf of California); 1937, p. 87. Steinbeck and Ricketts, 1941, p. 458.

*Previous records:* Gulf of California. Punta Peñasco, Sonora; S. A. Glassell (Glassell 1936). Bahía de Santa Inés: *Zaca* (Glassell 1937). Bahía Concepción: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts).

*Diagnosis:* Carapace nearly flat transversely; median frontal tooth broad, projecting far beyond narrow lateral teeth, all three rounded at tips; epibranchial angle rounded, unarmed; carpus only slightly longer than wide, anterior margin with a strongly projecting, rounded lobe, margins converging from its highest point; fingers opening horizontally or somewhat obliquely; telson seven-plated.

*Description:* Carapace covered with faint transverse plications and punctae; nearly flat transversely; regions not distinct; naked or with a faint pubescence on anterior regions. Median frontal tooth broad, rounded at tip, with a faint median groove, projecting far beyond lateral teeth, the latter narrow, rounded at tips, directed forward, and extending beyond eyes. Outer orbital angle produced into a broad rounded tooth. Epibranchial angle rounded, distinct, unarmed.

Movable segments of antenna more or less smooth, without projections; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose.

Chelipeds nearly smooth or lightly granular. Merus with a broad, rugose, strongly projecting lobe on anterior margin, this lobe not tipped with a spine; a few short scattered plumose hairs along posterior margin. Carpus only slightly longer than wide; anterior margin with a strongly projecting, rounded lobe, anterior and posterior margins converging from its highest point; naked or with traces of pubescence. Palm (as well as fingers) lying in a nearly horizontal plane, broad, dorsal surface flat; outer margin and outer margin of pollex with a long, thick fringe of plumose hairs, this fringe sometimes short and scattered or completely absent. Gape of fingers without pubescence.

Walking legs stout, lightly rugose; merus fringed on anterior margin with plumose hairs, that of leg 3 inflated; other segments with tufts of plumose and non-plumose hairs.

Telson of abdomen with seven plates.

*Material examined:* See Table 61.

*Measurements:* Males, 3.2 to 6.9 mm; non-ovigerous females, 3.3 to 6.0 mm; ovigerous females, 5.2 to 8.1 mm. The male holotype measures 5.8 mm in length, 5.1 mm in breadth; a female paratype, 5.6 by 5.1 mm.

*Color:* Ground color in life bright lavender, with uniform longitudinal stripes of bright orange. Chelipeds bright lavender; legs with a white spot on propodus. Ventral side iridescent, pinkish white; longitudinal stripes of carapace continued on first three segments of abdomen. (Glassell, 1936)

*Ecology:* "These little crabs are commensal with the large hermit crab, *Petrochirus californiensis* Bouvier, 1895. The usual association is: the Pagurid host, occupying the shell of *Phyllonotus nigrinus* (Philippi), accompanied by a large Pollonoid worm and a pair of these little Porcellanids. At times the inner face of the shell may have a *Crepidula nivea* Gould, attached, and this in turn may be commensalized with the Pinnotherid, *Fabia granti* Glassell." (Glassell, 1936) "Appeared in the trays wherein we preserved the large hermit crabs *Paguristes digueti*." (Steinbeck and Ricketts) Commensalism was not noted for specimens dredged by the *Velero III*, but shells were collected along with them at two stations (480-35, 481-35) and the organisms may have been associated.

The type series was collected by S. A. Glassell at low tide in the littoral; other specimens for which data are available were taken in depths of 2 to 50 fathoms. A substrate of sand and shell seems to be

the favored habitat; other bottoms recorded were sand; mud and sand; sand and kelp; and mud and shell.

Ovigerous females have been collected in January, February, March, May, and July.

*Relationships*: In the form of the carapace this species most closely resembles *Porcellana pulchra* Stimpson, 1858, known from Japan and China. In the western Pacific form the carpus, manus, and walking legs are considerably longer and more slender than in *P. paguriconviva*.

*Remarks*: *Porcellana paguriconviva* has been reported only from the Gulf of California. The range is now extended southward to Costa Rica.

*Range*: Bahía de la Magdalena, Baja California; Punta Peñasco, Gulf of California, south to Bahía Cocos, Costa Rica. Shore to 50 fathoms.

### *Porcellana corbicola*, new species

#### Plate 15

*Type*: Holotype, ovigerous female, Allan Hancock Foundation Cat. No. 375, from off Rocas Consag, Gulf of California, Mexico, 10-25 fathoms; March 24, 1937; collected during Allan Hancock Pacific Expedition of 1937 at *Velero III* station 719-37.

*Diagnosis*: Carapace strongly convex transversely; frontal teeth narrow, lateral teeth pointed at tips, median tooth rounded at tip, somewhat broader and more produced than other two; a strong spine at epibranchial angle; carpus about one and a half times as long as wide, anterior margin unarmed; fingers opening vertically; telson five-plated.

*Description*: Carapace strongly convex both transversely and front to back, covered with light transverse plications; regions not distinct; median frontal tooth covered with plumose hairs extending beyond the tooth in a long tuft, carapace elsewhere with slight traces of pubescence. Median frontal tooth rather narrow, rounded at tip, separated by a broad U-shaped notch from lateral teeth, the latter narrower, pointed at tips, directed forward, and less strongly produced. Outer orbital angle produced into a small, acute tooth. Epibranchial angle marked by a strong, spine-tipped tooth; lateral margins subparallel.

Movable segments of antenna more or less smooth, without projections; both flagella missing on only specimen seen. Outer maxillipeds lightly rugose.

Merus of chelipeds lightly striate on dorsal surface, anterior margin with a broad, very strongly produced, rounded lobe; ventral surface

lightly striate and thickly covered with short plumose hairs on lobe, rest of surface smooth and devoid of hairs. Carpus about one and a half times as long as wide, anterior margin forming a low curve; dorsal surface covered with small flattened granules, appearing almost smooth, and with traces of pubescence; ventral surface nearly smooth, proximal half with a tuft of plumose hairs, this tuft showing from dorsal side beyond anterior margin. Hand and fingers nearly smooth dorsally and ventrally as in carpus, lying on a vertical plane with inner margin of hand uppermost and fingers opening and closing vertically. Hand slender, dorsal surface swollen and with traces of pubescence; outer (lower) margin rounded. Fingers about half as long as palm, hooked and crossing at tips, dactylus strongly curved; gape with short plumose hairs, extending nearly to tips of fingers and onto ventral surface of palm, a few longer non-plumose hairs interspersed with plumose ones.

Walking legs long and slender, nearly smooth, covered with scattered, short non-plumose setae.

Telson of abdomen with five plates.

*Measurements:* Ovigerous female holotype: length 6.0 mm, breadth 4.7 mm.

*Color:* No traces of the original coloration remain in the unique specimen.

*Ecology:* The holotype was dredged in 10-25 fathoms, "with basket-stars" according to the accompanying label. The basket stars taken at station 719-37 were *Astrocanium spinosum* (Lyman). The crab was probably, although not certainly, attached to the ophiuran. Further collections will be necessary to determine whether a commensal relationship actually exists.

The type specimen, which was collected in late March, bears a large number of well-developed eggs.

*Remarks:* The type is unfortunately soft-shelled and consequently some of the normal characters of the species may be obscured. This is especially true of the propodus and dactylus of the walking legs, which do not appear, even under high magnification, to bear supplementary movable spinules on their lower margins. Structures resembling small spinules could be made out on some of the legs, but these may simply be setae. If *Porcellana corbicola* actually has such spinules they are greatly reduced in number and size, a feature uncharacteristic of the typical *Porcellana* species, as are the five-plated telson and the vertical position of the hand and fingers.



The specific name is from the Latin *corbis*, a basket, and *colere*, to dwell in, inhabit, in reference to the probable association of the species with basket stars.

*Range*: At present known only from the type locality, Rocas Consag, Gulf of California, 10 to 25 fathoms.

### PISIDIA Leach 1820

*Pisidia* Leach, 1820, p. 53. Type species: *Pisidia linnaeana* Leach, 1820 (present designation).

*Porcellanides* Czerniavsky, 1884, p. 109 (type species *Porcellanides kriczagini* Czerniavsky, 1884, by original designation).

*Streptochirus* Stimpson, 1907, p. 188. Type species: *Porcellana serratifrons* Stimpson, 1858 (present designation).

Carapace approximately as long as broad, or slightly longer. Lateral margins with spinules or strong spines posterior to cervical groove. Front prominent, strongly tridentate or trilobate. Eystalks short and stout, retractile.

Basal segment of antenna strongly produced inward, forming a partial suborbital margin; produced forward and broadly in contact with anterior margin of carapace, with movable segments removed from orbit.

Basal segment of antennule with several spines on anterior margin.

Chelipeds large, strong, subequal. Fingers of one or both chelipeds twisted out of plane with manus. Propodus of walking legs with spinules on posterior margin; dactylus ending in a simple spine, posterior margin with several movable accessory spinules.

Contains several species; a single representative in the eastern Pacific.

*Remarks*: The available but neglected name *Pisidia* is revived for the reception of a group of species usually included in *Porcellana*. Stimpson (1907) recognized the discrete nature of this group, but did not separate it from *Porcellana*. It is distinguished from all other porcellanid genera by the combination of characters given above; additional characters may become apparent when the species included in it are studied as a unit.

The name was originally proposed by Leach (1820, p. 53), who used it for several species distinguished from *Porcellana* (which at that time contained all known members of the Porcellanidae) on the basis of one character only, the shape of the outer maxillipeds: "Les deuxième,

troisième, quatrième et cinquième articles de la troisième paire de pattes [outer maxillipeds], comprimés et dilatés intérieurement; le sixième allongé en triangle; la quatrième paire de pattes [chelipeds] comprimée." In species belonging to *Porcellana*, according to Leach, the third article of the outer maxillipeds is cylindrical, the fourth and fifth dilated exteriorly. Desmarest (1825, p. 197) pointed out that Leach's characterization of *Porcellana* was in error, the form of the outer maxillipeds being not as described by the latter author but on the contrary as in *Pisidia*; while following Leach's classification, he believed that *Pisidia* should be suppressed since the two genera could not be separated on the basis of the characters given. The name *Pisidia* has been practically ignored by subsequent writers, including Stimpson (1858) in his synopsis of the porcellanid genera.

Leach designated no type for *Pisidia*, in which he included species now placed in at least three genera. In order that the name may be applied to the group of species here separated from *Porcellana*, *Pisidia linnaeana* Leach=*Porcellana longicornis* (Linnaeus), 1766, is hereby designated the type of *Pisidia*.

Czerniavsky (1884) characterized his new genus *Porcellanides* as having multiunguiculate dactyli as in *Polyonyx* Stimpson and *Porcellanella* White. From his illustrations of specimens from the Black Sea, however, it is evident that the dactyli do not have two or more strong fixed spines as in those genera, but rather a single spine and several small accessory spinules; from this character and others described by Czerniavsky, *Porcellanides* is clearly a synonym of *Pisidia* in the present sense.<sup>1</sup> (It should be noted that the type species, *Porcellanides kriczagini* Czerniavsky from Singapore, was very briefly described and was not figured. Judging from the short description it is perhaps a synonym of *Pisidia spinuligera* (Dana), 1853; but until its status can be determined, *Porcellanides* can only provisionally be considered a synonym of *Pisidia*.)

Stimpson (1907, p. 188), as mentioned above, recognized this group of species: "A group of small species [of *Porcellana*], with one of the hands much twisted and its fingers excavated, shows some other differences which serve to distinguish it from the typical group founded on the *P. platycheles* and similar forms. They might form a distinct genus (to which the name *Streptochirus* would be applicable), but they are so intimately connected with the others in the more essential characters that it is thought best not to separate them here." The name

<sup>1</sup> Cf. Makarov, 1938, pp. 106-107.

*Streptochirus* does not seem to have appeared subsequently in the literature. *Porcellana serratifrons* Stimpson, 1858, is hereby designated as its type species.

*Pisidia magdalenensis* (Glassell) is the sole eastern Pacific representative of this genus; among related species formerly included in *Porcellana* are *Pisidia longicornis* (Linnaeus), 1766, *P. bluteli* (Risso), 1816, *P. dehaanii* (Krauss), 1843, *P. suluensis* (Dana), 1852, *P. spinuligera* (Dana), 1853, and *P. streptocheles* and *serratifrons* (Stimpson), 1858.

***Pisidia magdalenensis* (Glassell), new combination**

Plate 38, fig. 4; text-fig. 10

*Porcellana magdalenensis* Glassell, 1936, p. 295 (type locality, Bahía de la Magdalena, Baja California, Mexico); 1938a, p. 431, pl. 32. Haig, 1957b, p. 14.

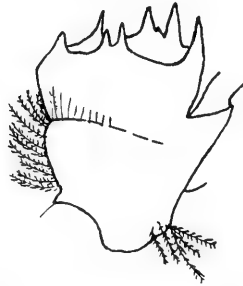
*Previous records:*

Baja California. Bahía de la Magdalena: S. A. Glassell (Glassell 1936). Mexico. Bahía de Acapulco: W. Williams on *Stranger* (Glassell 1938a). Panama. Isla Perico: *Albatross* (Glassell 1938a). Isla Contadora and Isla Saboga, Islas de las Perlas: *Askoy* (Haig). Colombia. Bahía Utría; Bahía Málaga: *Askoy* (Haig).

*Diagnosis:* Carapace spinulate on lateral and orbital margins; front with three rounded lobes, spinulate on their margins; carpus with anterior margin sinuous, spinulate; fingers of major cheliped straight, meeting entire length or nearly so; fingers of minor cheliped widely gaping, dactylus strongly curved and contorted.

*Description:* Carapace about as broad as long, covered with light or strong transverse plications; regions distinct; surface with a light pubescence, forming long tufts on protogastric regions and sometimes scattered tufts elsewhere anteriorly. Frontal lobes about equal in breadth, minutely spinulate on margins; lateral lobes rounded, median lobe considerably produced beyond them, with a strong median groove, tip pointed but slightly deflexed and appearing rounded in dorsal view. Orbits shallow, oblique, margined with spinules; outer orbital angle not strongly produced; hepatic margin with from three to five spinules, posterior one largest; epibranchial angle strongly projecting, sometimes margined with minute spinules. Lateral spinules posterior to cervical groove distinct.

Inward projection of basal segment of antenna spinulate on its anterior margin, the spinules visible in dorsal view; first movable seg-



Text-fig. 10. Basal segment of right antennule of *Pisidia magdalenensis*, x 40.

ment with a spinule or conical tubercle on anterior margin; second granular or with spinules on anterior margin; third more or less smooth; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds lightly rugose.

Chelipeds lightly granular or somewhat rugose, one a little larger than the other. Merus with a broad, strongly projecting rounded lobe on anterior margin, lobe edged with minute spinules and often with a distinct small spine; devoid of hairs or nearly so in males, pubescent in females. Carpus about one and a half times as long as wide, a little longer in large specimens, usually devoid of hairs in males, pubescent in females; anterior margin slightly sinuous, armed with one or two spinules in males, about three strong spinules and a number of smaller ones in females; dorsal surface with a longitudinal crest, another along posterior margin, these crests sometimes spinulate. Manus with a strong longitudinal crest on dorsal surface, the crest sometimes spinulate; a narrow crest along outer margin extending to tip of pollex, minutely granular or spinulate; in major cheliped, dorsal surface devoid of hairs or nearly so in males, pubescent and with a long fringe of plumose hairs along outer margin in females; in minor cheliped, outer half of upper surface in both sexes densely covered with long plumose hairs. Fingers in major cheliped shorter than palm, not contorted, meeting entire length or slightly gaping, gape with a short pubescence confined to their proximal ends. Fingers in minor cheliped as long as palm; dactylus strongly curved, twisted out of plane with manus, often spinulate along outer margin, surface pubescent; pollex covered with long plumose hairs; fingers strongly gaping, meeting only at tips, their inner surfaces covered with a dense, short pubescence extending nearly to tips, and with scattered long non-plumose setae.

Walking legs long and slender, lightly rugose, with scattered plumose and non-plumose hairs; no spines on anterior margins.

Telson of abdomen composed of seven plates.

*Variations:* The spinules on the frontal and lateral margins and on the anterior margins of the manus and carpus are usually stronger in females than in males. The crests on the dorsal surface and posterior margin of the carpus, and dorsal surface and outer margin of the manus, are sometimes spinulate and sometimes not; these spinules are more often present in females.

The dactylus of the minor cheliped is more markedly contorted in males than in females.

*Material examined:* See Table 62.

*Measurements:* Males, 2.1 to 4.9 mm; non-ovigerous females, 1.8 to 3.7 mm; ovigerous females, 2.4 to 4.7 mm. The ovigerous female holotype measures 4.5 mm in length, 4.6 mm in width.

*Color:* In alcohol, carapace cream; chelipeds orange-red; ambulatory legs cream, banded with red or orange. (Glassell, 1938a) The color in life has not been recorded.

*Ecology:* *Pisidia magdalenensis* has occasionally been taken under stones in the intertidal zone, probably at low tide. It occurs more commonly in deeper water, and has been dredged in depths to 25 fathoms. The types were taken "evidently among sponges and corallines" (Glassell); the *Zaca* dredged it from a bottom covered with mangrove leaves, and the *Askoy* from mud and sand and from coral. Analysis of substrates from which Hancock Foundation specimens were recovered showed the following: sand (7 stations); sand and shell (5); and rock; shell; rock, shell, and gorgonids; mud and shell; rock, coral, and nullipores; rock and sand; sand and mud; shells and vegetation, 1 station each. It was taken from sponge dredged by the *Velero IV* in 1-4 fathoms at Acapulco. Except for its occasional association with corals and sponges, it is apparently not a commensal species.

Ovigerous females have been collected in every month from December through May, and in July.

*Relationships:* This species is the sole New World representative of its genus. It seems to be most closely allied to the east Atlantic *Pisidia longicornis* (Linnaeus), 1766, and the Indo-Pacific *P. serratifrons* (Stimpson), 1858.

*Remarks:* *Pisidia magdalenensis* seems to be completely absent from the Gulf of California, although it appears commonly in shallow-water dredge hauls throughout the rest of the Panamic Province. Records are lacking for the region between the southern end of the Baja California peninsula and White Friars Islands, which lie at about 17° 31' north latitude.

*Range:* Bahía de Santa María, Baja California, south to Bahía de Santa Elena, Ecuador; absent from the Gulf of California. Shore to 25 fathoms.

### MEGALOBRACHIUM Stimpson 1858

*Megalobrachium* Stimpson, 1858, p. 228 (type species *Megalobrachium granuliferum* Stimpson, 1858, by original designation).

*Porcellanides* Nobili, 1901b, p. 21 (type species *Porcellanides festae* Nobili, 1901, by monotypy). Preoccupied by *Porcellanides Czerniawsky*, 1884.

*Porcellanopsis* Rathbun, 1910, p. 601 (type species *Porcellanides festae* Nobili, 1901, by monotypy).<sup>1</sup>

*Pisonella* Glassell, 1938a, p. 436 (type species *Petrolisthes (Pisosoma) sinuimanus* Lockington, 1878, by original designation).

Carapace approximately as long as broad, strongly convex front to back. Front prominent, trilobate to tridentate; strongly deflexed, the teeth or lobes usually not visible in dorsal view. Outer orbital angles not produced; eyes usually very small, often not visible in dorsal view.

Basal segment of antenna strongly produced forward and broadly in contact with anterior margin of carapace, with movable segments far removed from orbit; inner side truncate, not produced inward. Movable segments slender.

Basal segment of antennule very small, the two not meeting at the midline, recessed behind front, latter projecting over them like a shelf; a tooth sometimes present on inner side of anterior margin.

Chelipeds large, often robust; carpus and manus with longitudinal ridges or strong tubercular protuberances.

Walking legs variable in length, smooth to tuberculate; propodus with movable accessory spinules on posterior margin; dactylus ending

<sup>1</sup> "*Porcellanopsis*, new genus, for *Porcellanides* Nobili, 1901, preoccupied by *Porcellanides Czerniawsky*, 1884 . . .". If *Porcellanopsis* is taken to be a substitute name as Miss Rathbun apparently intended, rather than a new genus, the type species is still *Porcellanides festae* Nobili.

in a simple spine, with small movable accessory spinules on posterior margin.

Telson of abdomen composed of either seven or five plates.

Contains 10 known species, which are confined to the west and east American coasts.

*Remarks:* All species referred to *Megalobrachium* and *Porcellanopsis* were examined during this study. When they were considered as a series, ranging progressively from forms with rounded, shallow frontal lobes and slender, smooth walking legs to those with deeply cut frontal teeth and stout, tuberculate walking legs, it became apparent that there is no clear-cut distinction between the two groups as characterized by Chace (1942, pp. 99-101). It seems best, therefore, to combine all these forms in a single genus, even though the extremes of the series are very unlike in some respects. The following combination of characters is common to all these species and easily sets them apart from other genera: strongly deflexed front; basal segment of antennae broadly in contact with anterior margin of carapace; and small, recessed basal antennular segments.

#### KEY TO THE EASTERN PACIFIC SPECIES

- |  |                     |
|--|---------------------|
| 1a. Telson of abdomen with 7 plates . . . . .  | 2                   |
| 1b. Telson of abdomen with 5 plates . . . . .  | 6                   |
| 2a. Carapace and chelipeds heavily eroded . . . . .  | <i>erosum</i>       |
| 2b. Carapace and chelipeds smooth to roughened, but never heavily eroded . . . . .   | 3                   |
| 3a. Carpus with a narrow, blunt tooth on proximal third of anterior margin . . . . .   | <i>sinuimanus</i>   |
| 3b. Carpus unarmed, or at most with a slight projection at antero-proximal angle . . . . .                                   | 4                   |
| 4a. Carapace and chelipeds thickly covered with coarse hairs . . . . .   | <i>poeyi</i>        |
| 4b. Carapace and chelipeds naked or lightly pubescent . . . . .  | 5                   |
| 5a. Carapace roughened; front with three shallow lobes . . . . .   | <i>smithi</i>       |
| 5b. Carapace nearly smooth; front with three teeth separated by deep rounded notches . . . . .                               | <i>peruvianum</i>   |
| 6a. Carapace, chelipeds, and walking legs covered with small shallow pits . . . . .  | <i>garthi</i>       |
| 6b. Carapace, chelipeds, and walking legs tuberculate . . . . .  | 7                   |
| 7a. Antero- and posterolateral margins forming a distinct angle behind mid-branchial level; lateral margins entire . . . . . | <i>festai</i>       |
| 7b. Lateral margins rounded, dentate . . . . .   | <i>tuberculipes</i> |

**Megalobrachium poeyi** (Guérin)

Plate 16, fig. 4; plate 39, fig. 1

Restricted synonymy:

*Porcellana poeyi* Guérin, 1855, pl. 2, fig. 4 (type locality, Cuba).

*Megalobrachium granuliferum* Stimpson, 1858, p. 228 (listed only; type locality, Antilles); 1859, p. 76 (description; type localities restricted to Barbados and St. Thomas).

*Megalobrachium poeyi*, Benedict, 1901, p. 136, pl. 3, fig. 8. Boone, 1931, p. 150, text-fig. 5. Haig, 1956a, p. 34.

*Previous Pacific records:*

Costa Rica. Bahía de Salinas: *Velero III* (Haig).

Panama. Isla Taboguilla: W. G. Van Name (Boone).

*Diagnosis:* Carapace roughly granular, posterolateral regions plicate to rugose; lateral margins rounded; surface covered with long plumose and non-plumose hairs; front with three shallow lobes; carpus a little over one and a half times as long as wide, anterior margin unarmed, surface with longitudinal crests; manus with longitudinal crests, outer margin with a thick fringe of hairs; telson with seven plates.

*Description:* Carapace approximately as broad as long or slightly broader, lateral margins rounded; posterolateral regions plicate or sometimes rather strongly rugose, rest of surface with small rough granules; entire surface covered with scattered long plumose and non-plumose hairs, and frontal region with a short thick fringe of coarse clavate hairs. Front projecting a little beyond eyes, trilobate or nearly transverse in dorsal view; trilobate in frontal view, the lobes shallow, about equal in length and breadth, lateral ones rounded, median triangular. Eyes visible in dorsal view. Side walls and abdomen covered with long, coarse, clavate hairs.

Movable segments of antenna finely granular, without anterior projections, and bearing scattered, coarse clavate hairs; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds punctate.

Chelipeds covered with large, coarse granules. Merus with a low ridge on anterior margin; a few scattered, coarse clavate hairs on dorsal surface and a thick fringe on posterior margin. Carpus a little over one and a half times as long as wide, anterior margin unarmed; surface with two broad, low, longitudinal crests and a third along posterior margin, these crests defined by narrow grooves; posterior margin with a



fringe of coarse clavate hairs and slender setae. Manus with three low crests on dorsal surface and a fourth along outer margin, these crests defined by grooves; outer margin of manus and pollex with a thick fringe of coarse clavate hairs and scattered, long, slender setae. Gape with a pile of short, coarse clavate hairs extending nearly entire length of each finger.

Walking legs slender, faintly rugose, covered with thick, coarse clavate hairs and scattered, long, slender setae.

Telson of abdomen with seven plates.

*Material examined:* See Table 63.

*Measurements:* Measurements were taken on only four Pacific specimens: two males, 6.5 and 8.0 mm, and two non-ovigerous females, 7.6 and 8.4 mm. This is apparently the largest member of the genus.

*Color:* The color in life has not been recorded. Some of the examined preserved specimens were a dark brownish-orange, with hairs of about the same shade. These crabs often appear dark brown or black because the hairs covering them are coated with fine silt.

*Ecology:* The *Velero III* specimens and the one collected for the American Museum of Natural History and reported by Boone (1931) were taken in the intertidal zone under stones; no collecting data were available for the rest of the Pacific coast material. In the Atlantic, the species has been reported in the littoral among rocks and associated with corals, and to a depth of 25 fathoms.

No ovigerous females from the Pacific coast were examined.

*Remarks:* The six specimens listed in Table 63 are the only ones known from the Pacific coast, where the species is apparently uncommon.

*Range:* Bahía de Salinas, Costa Rica, south to San Francisco, Panama. Western Atlantic, throughout the Caribbean area.

### *Megalobrachium smithi* (Glassell)

Plate 16, fig. 5; plate 39, fig. 2

*Pisosoma smithi* Glassell, 1936, p. 286 (type locality, Miramar Beach near Guaymas, Sonora, Gulf of California).

*Pisonella smithi*, Glassell, 1938a, pp. 437, 442.

*Megalobrachium smithi*, Chace, 1942, p. 100.

*Previous records:* Gulf of California. Punta Peñasco, Sonora; Punta Sargent, Sonora; Miramar Beach near Guaymas, Sonora; Isla del Carmen; Isla Espiritu Santo: S. A. Glassell (Glassell 1936).

*Diagnosis:* Carapace roughened, granular near margins; lateral margins rounded; front with three shallow lobes; carpus about one and a half times as long as wide, anterior margin unarmed or with a small triangular projection at anteroproximal angle, surface with longitudinal crests defined by grooves, grooves with series of short transverse ridges; manus flattened, with similar crests and ridges; telson with seven plates.

*Description:* Carapace about as broad as long, lateral margins rounded, frontal region strongly deflexed; surface roughened, plicate, covered with fine punctae, and granular near margins; regions well marked; naked or with traces of hair on frontal region. Front strongly projecting beyond eyes, rounded in dorsal view; faintly trilobate in frontal view, lobes shallow, median lobe a little narrower than lateral ones. Eyes visible in dorsal view.

First and second movable segments of antenna granular, without anterior projections; third nearly smooth; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds punctate or lightly rugose.

Chelipeds covered with small, rough granules; devoid of hair. Merus with a high ridge or low lobe on anterior margin. Carpus about one and a half times as long as wide, anterior margin unarmed or with a small triangular projection at anteroproximal angle; surface flattened, uneven, with two or three low longitudinal crests and a fourth along posterior margin, these crests defined by grooves sometimes containing series of short transverse ridges. Manus flattened, with three crests on dorsal surface and a fourth along outer margin, these crests defined by broad grooves containing short transverse ridges as in carpus. Gape of fingers devoid of pubescence.

Walking legs slender, finely granular, with tufts of short plumose and non-plumose hairs.

Telson of abdomen with seven plates.

*Material examined:* See Table 64.

*Measurements:* Males, 3.1 to 6.3 mm; non-ovigerous females, 2.8 to 6.4 mm. The length of the non-ovigerous female holotype is 6.4 mm, its width 6.8 mm.

*Color:* In alcohol, carapace cream; ambulatory legs light pink; abdomen and sternum iridescent. (Glassell, 1936)

*Ecology:* *Megalobrachium smithi* commonly occurs in the intertidal

zone, concealed beneath stones. On a few occasions specimens were recovered from coral by Hancock Expeditions members.

No ovigerous females were taken in December, January, February, and March, the only months in which the species was collected.

*Remarks:* The U. S. National Museum paratype is a male, not a female as stated in the first paragraph of the original description (Glassell, 1936, p. 286). In paragraph 7 of the description this paratype is correctly noted as a male.

*Megalobrachium smithi* is often found in association with *M. sinuimanus* (Lockington). As noted by Glassell (1936), Lockington evidently had specimens of *M. smithi* but believed them to be variations of his *M. sinuimanus*.

*Range:* Restricted to the Gulf of California, from Punta Peñasco south to Isla Espíritu Santo.

### *Megalobrachium sinuimanus* (Lockington)<sup>1</sup>

Plate 16, fig. 6; plate 39, fig. 3

*Petrolisthes (Pisosoma) sinuimanus* Lockington, 1878, pp. 396, 401 (type localities, La Paz and Puerto Escondido, Gulf of California).

*Pisosoma sinuimanus*, Glassell, 1937, p. 83.

*Pisonella sinuimanus*, Glassell, 1938a, p. 437, pl. 34, fig. 2 (neotype designated; neotype locality, Puerto Escondido, Gulf of California). Steinbeck and Ricketts, 1941, p. 457.

*Megalobrachium sinuimanus*, Chace, 1942, p. 100.

Not *Petrolisthes sinuimanus*, Nobili, 1901b, p. 15; Rathbun, 1910, p. 599.

*Previous records:* Gulf of California. NE end Isla Tiburón: S. A. Glassell (Glassell 1938a). Puerto Escondido: (Lockington); S. A. Glassell (Glassell 1938a); J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). Punta Lobos; Bahía San Gabriel, Isla Espíritu Santo: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). La Paz: (Lockington). Off Arena Bank: W. Beebe on *Zaca* (Glassell 1937).

*Lectotype:* Female, 4.0 mm in length by 4.4 mm in width, in Paris Museum, labelled "*Pachycheles rotundus* Lockington. Californie—Lock-

<sup>1</sup> The International Rules of Zoological Nomenclature do not specify whether a compound noun when used as a specific name should be treated as a noun or as an adjective. The name *sinuimanus* is here considered a noun in apposition to the generic name.

ington 6-99 (Type)." This specimen, one of two so labelled, is hereby selected as the lectotype of the present species (see *Remarks*).

*Diagnosis*: Carapace nearly smooth; lateral margins rounded; front with three lobes separated by shallow rounded notches; carpus about one and a half times as long as wide, anterior margin with a narrow, blunt tooth on proximal third, surface with longitudinal crests; manus with longitudinal crests; telson with seven plates.

*Description*: Carapace about as broad as long, lateral margins rounded; surface covered with punctae and fine granules, the latter most distinct on ephibranchial regions; naked or with traces of hair anteriorly. Front strongly projecting beyond eyes, rounded in dorsal view; trilobate in frontal view, lateral lobes broad, rounded, median lobe narrow, triangular, lobes separated by shallow rounded notches. Eyes very small, partly visible in dorsal view.

Movable segments of antenna granular, first with a slight projection on anterior margin; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds punctate.

Chelipeds covered with coarse granules, naked or with traces of hair. Merus armed on anterior margin with a low granular lobe. Carpus about one and a half times as long as wide, anterior margin with a narrow, blunt tooth on proximal third; surface with three longitudinal crests, sometimes very strongly marked, and a fourth along posterior margin, these crests defined by broad grooves. Manus with three crests on dorsal surface, often strong as in carpus, and a fourth along outer margin, these crests defined by broad grooves. Gape of fingers devoid of pubescence.

Walking legs rather slender, finely granular, with scattered short plumose and non-plumose hairs.

Telson of abdomen with seven plates.

*Material examined*: See Table 65.

*Measurements*: Males, 1.9 to 5.9 mm; non-ovigerous females, 2.2 to 6.0 mm; ovigerous female, 4.5 mm. Lockington's largest specimen was said to measure 5.5 mm in length, but this specimen may have been *M. garthi* (see *Remarks*). The lectotype here selected is a female, 4.0 by 4.4 mm. Glassell's male neotype is 6 mm in length, 6 mm in width; his female neoallotype, 4.5 by 5.0 mm.

*Color*: The color in life varies from light cream to buff; ventral side slightly iridescent. (Glassell, 1937) "One of the vividly white crabs

taken on the coral sand which is also vividly white at this point [Bahía San Gabriel, Isla Espíritu Santo]." (Steinbeck and Ricketts)

*Ecology*: "Found under coral and stones at low tide." (Lockington) Hancock Expeditions collectors took them under stones at many intertidal stations, and also from coral heads in the tidal zone and to a depth of one fathom. Specimens were recovered by the *Zaca* Expedition from coral, *Pocillopora ligulata*, at 2½ fathoms (Glassell, 1937).

Of many females collected in January, February, and March, none were ovigerous. The single egg-bearing female seen or reported is in the Hancock Foundation collections, a specimen taken at Ensenada de San Francisco in May.

*Remarks*: Glassell (1938a, p. 440) noted that the present species is subject to very little variation, in spite of Lockington's statement that "This species varies considerably." Like Glassell, the present writer has examined a large series of specimens and found much less variation than is indicated in Lockington's description. Glassell (1936, p. 287) suggested that the Lockington account must have been based in part on *Megalobrachium smithi* (Glassell). From a careful analysis of Lockington's description it seems very probable that among the "several specimens" in his type series were examples of *M. garthi* Haig as well.

Of the four lots of Lockington types in the Paris Museum, one consists of two specimens labelled "*Pachycheles rotundus* Lockington. California—Lockington 6-99 (Type)." Mr. J. Forest informs the writer that the smaller of these specimens, a female 4.0 mm in length by 4.4 mm in width, belongs to the species with which *Petrolisthes (Pisosoma) sinuimanus* Lockington has been identified by Glassell; the larger specimen, a 5.2 x 5.5 mm female, fits the description of *Megalobrachium garthi* Haig. The reason for the name "*Pachycheles rotundus*" on the label is a mystery, for no species description was ever published under that name by Lockington or any other author. In any case, the evidence indicates that these two specimens are part of the series from which Lockington described *Petrolisthes (Pisosoma) sinuimanus*.

The smaller of these specimens is selected as the lectotype for three reasons: (1) the greater part of Lockington's description applies to the present species more closely than to *Megalobrachium garthi*; (2) Glassell applied Lockington's name to the present species and designated a neotype; (3) to affix the name *sinuimanus* to the other extant type specimen would result in reducing *M. garthi* to synonymy and would

necessitate choosing a new name for the better known and more common species.

Specimens from Isla Flamenco, Panama, identified by Nobili (1901b) with the present species, were re-examined by the writer and found to be *Petrolisthes lewisi austrinus*, a taxon proposed herein. With the correction of Nobili's record (which was repeated by Rathbun, 1910, and by Glassell, 1937 and 1938a, with the provenance given as Ecuador instead of Panama), the range of *Megalobrachium sinuimanus* becomes restricted to the Gulf of California and outlying islands.

*Range*: Gulf of California, from Isla Angel de la Guarda to Mazatlán; Isla Isabel and Islas Las Tres Marías. Shore to 2½ fathoms.

### ***Megalobrachium garthi* Haig**

Plate 16, fig. 7; plate 39, fig. 4

*Pachycheles rotundus* A. Milne Edwards and Bouvier, 1894, p. 291 (*nomen nudum*).

*Pachycheles rotundus*, A. Milne Edwards and Bouvier, 1894, p. 293, footnote.

*Megalobrachium garthi* Haig, 1957a, p. 39, pl. 10, figs. 1-5 (type locality, Isla Turner S of Isla Tiburón, Gulf of California); 1957b, p. 14.

#### *Previous records:*

Gulf of California. Isla Turner S of Isla Tiburón: *Velero III* (Haig 1957a). Puerto Escondido or La Paz [as *Petrolisthes (Pisosoma) sinuimanus*]: (Lockington 1878).

Mexico. Bahía Tangola-Tangola: (Haig 1957a).

Colombia. Bahía Humboldt: *Askoy* (Haig 1957b).

*Diagnosis*: Carapace covered with very small, shallow pits; lateral margins rounded; front with three lobes separated by shallow, rounded notches; carpus about one and a half times as long as wide, anterior margin with a narrow, blunt tooth a little proximad of center, surface with longitudinal crests; manus with longitudinal crests, defined by broad grooves containing rows of deep pits; telson with five plates.

*Description*: Carapace about as broad as long, very strongly convex front to back and sharply deflexed anterior to gastric region; lateral margins rounded; entire surface thickly covered with very small, shallow pits, visible only under magnification; lateral margins roughly granular; surface naked or with scattered plumose hairs. Front strongly

projecting beyond eyes, rounded in dorsal view; trilobate in frontal view, lateral lobes broad, truncate or very slightly rounded, median lobe narrow, triangular, separated by shallow, rounded notches from lateral lobes and slightly projecting beyond them. Eyes very small, partly visible in dorsal view.

Movable segments of antenna pitted and slightly granular; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds pitted like carapace.

Chelipeds covered with pits and coarse granules; naked or with scattered plumose hairs. Merus with a broad, granular, strongly projecting lobe on anterior margin. Carpus about one and a half times as long as wide, anterior margin with a narrow, blunt tooth or small rounded lobe a little proximad of the center; surface with two or three longitudinal crests defined by broad grooves, and another along posterior margin. Manus with three longitudinal crests and a fourth along outer margin, these crests defined by broad grooves, in each groove a row of deep pits. Gape of fingers without pubescence.

Walking legs rather stout, covered with pits like those of carapace; with scattered plumose and non-plumose hairs. Merus, carpus, and propodus with crests on anterior margins; carpus and propodus crested on dorsal surface.

Telson of abdomen with five plates.

*Material examined:* See Table 66.

*Measurements:* Males, 2.1 to 7.8 mm; non-ovigerous females, 2.5 to 6.6 mm; ovigerous females, 3.1 to 6.5 mm. The largest recorded specimen is the male holotype, which measures 7.8 mm in length, 7.9 mm in width.

*Color:* In alcohol, carapace pale orange brown with a broad longitudinal white stripe; tips of fingers white. The white stripe on the carapace is not visible in all specimens.

*Ecology:* Shore to 4 fathoms, under stones and in coral heads and sponges. The largest number of specimens came from masses of sponge dredged by the *Velero IV* at Bahía Santa Lucía, Acapulco, in 1-4 fathoms.

Ovigerous females were collected in February and March.

*Remarks:* The reference by A. Milne Edwards and Bouvier (1894) to *Pachycheles rotundus* (p. 291) and *rotundus* (p. 293, footnote) is apparently the only one in the literature for a porcellanid of that name. Two specimens bearing the name are in the collections of the Paris

Museum (see *Remarks* under the preceding species account) and were seen by A. Milne Edwards and Bouvier. In a discussion of the first maxillipeds of various porcellanids these authors referred to *Pachycheles rotundus* (p. 293, footnote); the specimen which they evidently studied, for it now lacks the mouthparts on the right-hand side, is an example of *Megalobrachium garthi*.

This species bears a superficial resemblance to *Megalobrachium sinuimanus* (Lockington) because of the blunt tooth on the anterior margin of the carpus. *M. garthi* may be readily distinguished by the shallow pits covering the carapace, chelipeds, and walking legs, and especially by the five-plated telson. Lockington failed to distinguish between the two forms, and based the original description of *M. sinuimanus* partly on specimens of *M. garthi* (see preceding account).

*Range*: Isla Turner, Gulf of California, south to Puerto Utría, Colombia; Islas Las Tres Marías, Mexico. Shore to 4 fathoms.

### *Megalobrachium erosum* (Glassell)

Plate 16, fig. 8; plate 40, fig. 2

*Pisosoma erosa* Glassell, 1936, p. 289 (type locality, Bahía de la Magdalena, Baja California, Mexico).

*Pisonella erosa*, Glassell, 1938a, pp. 437, 442.

*Megalobrachium erosa*, Chace, 1942, p. 100.

#### *Previous records:*

Baja California. Bahía de la Magdalena: S. A. Glassell (Glassell 1936).  
Gulf of California. N end Isla Tiburón: S. A. Glassell (Glassell 1936).

*Diagnosis*: Carapace heavily eroded, with strong, transverse ridges across posterior portion and large shallow pits along lateral margins; lateral margins rounded; front with three teeth separated by deep, rounded notches; carpus about one and a half times as long as wide, anterior margin with a broad, low, triangular tooth occupying proximal third, surface with longitudinal rows of pits; manus with longitudinal rows of pits; telson with seven plates.

*Description*: Carapace about as broad as long, lateral margins rounded; surface heavily eroded, with punctae and strong, transverse ridges across posterior regions, and large, shallow pits along lateral margins; anterior regions strongly marked; surface naked or with traces of pubescence. Front strongly projecting beyond eyes, rounded or faintly trilobate in dorsal view, with a deep median groove; tridentate



in frontal view, the lateral lobes narrow, truncate, median lobe narrow, triangular, rounded at tip, lobes separated by deep, rounded notches, the three about equally projecting. Eyes visible in dorsal view.

First and second movable segments of antenna roughly granular; third more or less smooth; flagellum naked or with vestigial hairs visible only under magnification. Outer maxillipeds roughly rugose.

Chelipeds covered with small, coarse granules, naked or lightly pubescent. Merus with a low, granular lobe on anterior margin; dorsal surface eroded, sometimes deeply so. Carpus about one and a half times as long as wide, with a broad, low, triangular tooth occupying proximal third of anterior margin; surface with four longitudinal rows of large, often deep pits, giving surface an eroded appearance. Manus with three longitudinal crests on dorsal surface and a fourth along outer margin, these crests defined by broad grooves containing rows of pits, usually less marked than those of carpus. Gape of fingers naked or lightly pubescent.

Walking legs slender, granular and pitted, and with scattered, short plumose and non-plumose hairs. Anterior margin of merus, carpus, and propodus with a high crest.

Telson of abdomen with seven plates.

*Material examined:* See Table 67.

*Measurements:* Males, 2.3 to 6.2 mm; non-ovigerous females, 2.4 to 5.9 mm. The female holotype measures 5 mm in length, 5.2 mm in width.

*Color:* The color in alcohol is light pink, according to Glassell (1936). Specimens examined by the writer were pale buff to nearly white.

*Ecology:* *Megalobrachium erosum* has been dredged in depths of 5 to 25 fathoms. Specimens taken by the *Velero III* and *IV* were from bottoms of sand and of sand with nullipores, two stations each; and shell and sand; rock and sand; coralline and nullipores, one station each. Glassell (1936) gave no information on substrates for the type series, but remarked: "The difficulty of obtaining undamaged specimens is due not only to its small size, but also to the hard materials which are brought up in the dredge with it."

No ovigerous females have been collected.

*Range:* Punta Malarrimo south to Bahía de la Magdalena, Baja California; Gulf of California, from Isla Angel de la Guarda south to Bahía de La Paz; Isla Isabel. 5 to 25 fathoms.

**Megalobrachium peruvianum**, new species

Plate 16, figs. 1-3, 9; plate 40, fig. 1

*Types*: Holotype, male, U. S. National Museum Cat. No. 102413, from Islas Lobos de Afuera, Peru, rocky shore; January 17, 1935; collected during Allan Hancock Pacific Expedition of 1935 at *Velero III* station 391-35. Paratypes: same data as holotype, one male, two ovigerous females (U. S. National Museum); one male, two females (one ovigerous) (Allan Hancock Foundation). Paratype: Junín, Chile, shore; December 10, 1904; collected by R. Paessler; one male (Hamburg Museum Cat. No. K7739).

*Diagnosis*: Carapace nearly smooth; lateral margins rounded; front with three teeth separated by deep, rounded notches; carpus less than one and a half times as long as wide, anterior margin with a small, triangular projection at anteroproximal angle, surface with longitudinal crests; manus with longitudinal crests; telson with seven plates.

*Description*: Carapace about as broad as long, very strongly convex front to back; covered with small, flattened granules and appearing nearly smooth, posterolateral regions with light plications and punctae, a few scattered, larger granules near lateral margins; regions not distinct; surface lightly pubescent. Front strongly produced beyond eyes, rounded or broadly triangular in dorsal view; tridentate or strongly trilobate in frontal view, lateral lobes rather broad, truncate, median lobe narrow, triangular, rounded at tip, lobes separated by deep, rounded notches, the three about equally projecting. Eyes very small, usually visible in dorsal view.

Movable segments of antenna smooth or lightly granular; flagellum with vestigial hairs visible only under magnification. Outer maxillipeds nearly smooth.

Dorsal surface of chelipeds covered with small granules, a little larger and more distinct than those of carapace, and particularly outstanding on crests; granules somewhat enlarged and flattened on ventral surface; dorsal surface naked or lightly pubescent. Merus with a low but distinct, rounded, granular lobe on anterior margin. Carpus less than one and a half times as long as wide, anterior margin unarmed, somewhat sinuous, with a slight triangular projection at anteroproximal angle; dorsal surface with three low, longitudinal crests, the first near anterior margin, second about center, third just posterior to it, second and third not extending to distal end of carpus; posterior margin markedly convex, with a low longitudinal crest, the latter and dorsal

crests all defined by broad grooves; first crest the lowest, sometimes obsolescent. Manus with three low longitudinal crests and a fourth along outer margin, these crests defined by light grooves. Fingers straight, lightly grooved in center, meeting for entire length or only slightly gaping; gape naked or with traces of pubescence.

Walking legs rather short and stout, covered with small, low granules. Merus with a short anterior fringe of plumose hairs; all segments with long, scattered non-plumose setae.

Telson of abdomen with seven plates.

*Measurements*: Holotype male: length 5.6 mm, width 5.4 mm. Paratypes: males, 4.9 to 5.3 mm; non-ovigerous female, 4.7 mm; ovigerous females, 4.2 to 4.8 mm.

*Color*: No trace of color remained in any of the specimens examined.

*Ecology*: All the material was taken in the intertidal zone, apparently under stones. Ovigerous females collected in January were included in the lot from Peru.

*Relationships*: *Megalobrachium peruvianum* is most closely allied to a western Atlantic species, *M. roseum* (Rathbun), 1900. In the latter form the posterolateral angles of the carapace are more posteriorly located, and the anterolateral margins diverge slightly to these angles, instead of being subparallel as in *M. peruvianum*; there are a few small tubercles on the carapace surface; the crests on the chelipeds are higher and tend to become tuberculate; and the walking legs are somewhat nodulate. The telson of the abdomen is seven-plated in both species.

*Remarks*: Among material examined by the writer during preparation of a report on the Anomura of Chile (Haig, 1955) was the Hamburg Museum specimen from Junín, listed above. This was recognized at the time as an undescribed species, but was not included in the report on Chilean Anomura; it was believed that the Junín record was erroneous, since *Megalobrachium* is typically a tropical genus. Subsequently the Hancock Foundation specimens from Peru have become available for examination. The Junín record may now be accepted as correct, and another species added to the Chilean anomuran fauna.

The name *peruvianum* was chosen for this species because of its surprising occurrence in the Peruvian faunal province.

*Range*: Known only from the two localities listed above, Islas Lobos de Afuera, Peru, and Junín, Chile.

**Megalobranchium festai** (Nobili), new combination

Plate 16, fig. 10; plate 40, fig. 3

*Porcellanides festae* Nobili, 1901b, p. 21 (type locality not designated).

*Porcellanopsis festae*, Rathbun, 1910, p. 601. Chace, 1942, p. 99.

*Porcellanopsis festai*, Haig, 1957b, p. 15 (type locality designated as Bahía de Santa Elena, Ecuador).

*Previous records:* Ecuador. Bahía de Santa Elena: E. Festa (Nobili).

*Diagnosis:* Carapace covered with small protuberances; broadly triangular, with anterolateral margins strongly diverging, antero- and posterolateral margins forming a distinct angle well behind mid-branchial level; front with three teeth separated by deep, rounded notches; carpus less than one and a half times as long as wide, anterior margin with a broad, strongly projecting tooth occupying proximal half, surface with large protuberances; manus with protuberances; telson with five plates.

*Description:* Carapace about as broad as long, broadly triangular, with anterolateral margins strongly diverging posterior to epibranchial angles, antero- and posterolateral margins forming a distinct angle well behind mid-branchial level; surface granular and punctate, covered with small protuberances defined by grooves; naked or with traces of hair anteriorly. Front strongly projecting beyond eyes, broadly triangular in dorsal view; tridentate or strongly trilobate in frontal view, lateral lobes broad, truncate, median lobe narrow, triangular, pointed at tip, lobes separated by deep, rounded notches, the three about equally projecting. Eyes very small, not visible in dorsal view.

Movable segments of antenna finely granular, without anterior projections; flagellum shorter than carapace, with short hairs. Outer maxillipeds smooth or punctate.

Chelipeds covered with coarse granules, naked or lightly pubescent. Merus with protuberances on anterior and posterior margins and on dorsal surface. Carpus less than one and a half times as long as wide, anterior margin with a broad, strongly projecting tooth occupying proximal half; surface with large protuberances. Manus covered with protuberances, outer margin with a series of large granules. Gape of fingers naked.

Walking legs short and stout, covered with protuberances; merus with a fringe of plumose hairs on anterior margin, other segments with scattered plumose and non-plumose hairs.

Telson of abdomen with five plates.

*Material examined*: See Table 68.

*Measurements*: Males, 2.8 to 4.0 mm; non-ovigerous females, 2.5 to 4.0 mm; ovigerous females, 2.9 to 4.8 mm. The male holotype is 4.0 mm in length and 3.8 mm in width.

*Color*: Not recorded. All the specimens examined were faded to a pale buff.

*Ecology*: 41 specimens were taken by the *Velero IV* at a single station, from sponges dredged in 1-4 fathoms. The material examined is otherwise represented by eight specimens from four stations; it was taken under stones in one case and from coral in another. The species may occur most commonly in sponges.

Ovigerous females have been collected in February, March, and April.

*Relationships*: This species, like *Megalobrachium peruvianum*, new species, is related to *M. roseum* (Rathbun), 1900, from the western Atlantic. The carapace of *M. festai* is more markedly triangular and tuberculate than that of the Atlantic form; the walking legs are somewhat stouter; and the telson of the abdomen has five plates instead of seven as in *M. roseum*.

*Remarks*: The specimens from southern Mexico and El Salvador are the first to be recorded since the holotype, which was taken in Ecuador. The spottiness of these records may be due to the fact that sponge masses have seldom been examined for specimens.

*Range*: Acapulco, Mexico, south to Bahía de Santa Elena, Ecuador.

### *Megalobrachium tuberculipes* (Lockington), new combination

Plate 16, fig. 11; plate 40, fig. 4

*Pachycheles tuberculipes* Lockington, 1878, pp. 396, 404 (type locality, La Paz, Gulf of California).

*Polyonyx tuberculipes*, Nobili, 1901b, p. 21. Rathbun, 1910, p. 601.

*Pisonella tuberculipes*, Glassell, 1938a, pp. 437, 440, pl. 34, fig. 1 (neotype designated; neotype locality, Punta Peñasco, Sonora, Gulf of California). Steinbeck and Ricketts, 1941, p. 457.

*Porcellanopsis tuberculipes*, Chace, 1942, p. 100. Haig, 1957b, p. 15.

*Previous records:*

Gulf of California. Punta Peñasco, Sonora; San Felipe: S. A. Glassell (Glassell). Isla Coronado; S end Isla Tiburón: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts). La Paz: (Lockington).

Panama. Isla Saboga, Islas de las Perlas: *Askoy* (Haig).

Colombia. Bahía Humboldt: *Askoy* (Haig).

Ecuador. Bahía de Santa Elena: E. Festa (Nobili).

*Diagnosis:* Carapace covered with tubercles; lateral margins dentate, rounded; front with three strong teeth separated by deep, rounded notches; carpus less than one and a half times as long as wide, anterior margin with a broad, very strongly projecting, proximal tooth followed by two or three denticles, surface with strongly projecting, scattered tubercles; manus covered with tubercles, outer margin with a fringe of long non-plumose setae; telson with five plates.

*Description:* Carapace approximately as broad as long or slightly broader, lateral margins rounded; surface with large flattened granules and tubercles, most projecting toward lateral margins, the latter bearing a row of about six teeth, these teeth often not very distinct; long plumose hairs along lateral margins, tufts on dorsal surface, longest on protogastric lobes. Front strongly projecting beyond eyes, below level of protogastric regions, flattened, not deflexed except near tip, transverse or faintly trilobate in dorsal view; deeply tridentate in frontal view, the lobes narrow, triangular, pointed at tips, separated by deep rounded notches, and about equally projecting. Eyes visible in dorsal view.

Movable segments of antenna lightly granular, with a few short plumose hairs; flagellum not much longer than carapace, with short hairs. Outer maxillipeds punctate.

Chelipeds covered with large, strongly projecting, scattered tubercles. Merus with a small lobe on anterior margin; dorsal surface with plumose hairs. Carpus less than one and a half times as long as wide, anterior margin with a broad, very strongly projecting proximal tooth followed by two or three denticles; surface covered with short plumose hairs. Manus and fingers covered with long plumose and non-plumose hairs, denticulate on margins; outer margin with long non-plumose setae. Gape of fingers with a light pubescence.

Walking legs covered with low tubercles, thickly covered with long plumose hairs.

Telson of abdomen with five plates.

*Material examined:* See Table 69.

*Measurements:* Males, 1.6 to 4.6 mm; non-ovigerous females, 1.9 to 3.6 mm; ovigerous females, 2.1 to 3.0 mm. Lockington reported specimens of about 3.5 by 3.5 mm. Glassell's male neotype measures 4.1 mm in length, 3.9 mm in breadth.

*Color:* In life, muddy gray with a dark patch on the central regions; in alcohol, light pink. (Glassell, 1938a)

*Ecology:* "This little crab is found on sponge incrustated sea-fans, but more frequently on the rough sponges themselves, at extreme low water. They are quite numerous, though obscure." (Glassell) Steinbeck and Ricketts reported it from a sponge mass, and most of the Hancock Foundation specimens were taken under similar circumstances. It was once dredged by the *Velero III* in 5-10 fathoms from a rock, coral, and nullipore bottom. It has also been taken in coral from shore to a depth of about two fathoms, and under stones in the intertidal zone.

Ovigerous females have been taken in February and in May.

*Relationships:* This species is very closely related to *Megalobrachium soriatum* (Say), 1818, which ranges from Cape Hatteras to the Florida Keys and is known from a few Caribbean localities. In the small amount of material seen by the writer, *M. soriatum* appears to have a less hairy carapace and walking legs than does the Pacific species. It is not known whether these differences are constant; the Pacific and Atlantic populations are perhaps not specifically distinct.

*Range:* Punta Peñasco and San Felipe, Gulf of California, south to Bahía de Santa Elena, Ecuador. Shore to 10 fathoms.

#### ULLOIA Glassell 1938

*Ulloaia* Glassell, 1938a, p. 434 (type species *Ulloaia perpusillia* Glassell, 1938, by original designation).

Carapace longer than broad, surface covered with large protuberances, lateral margins dentate. Front broad, sharply deflexed, with a rostral process, visible only in frontal view, consisting of a broad, rectangular lobe. Orbits deep; eyes small, not retractile.

Basal segment of antenna strongly produced forward and broadly in contact with anterior margin of carapace, with movable segments far removed from orbit; produced inward and, together with outer margin of antennule, forming a complete suborbital margin. Movable segments small; flagellum shorter than carapace, its articles elongate.

Basal segment of antennule large, produced anteriorly to fill notch between frontal lobe and inner orbital angle; anterior face flat, without spines or other projections.

Chelipeds short and stout; manus weak, flattened. Walking legs short and stout; propodus (apparently) without movable spinules on posterior margin; dactylus ending in a simple spine, with rudimentary, movable accessory spinules on posterior margin.

Telson of abdomen composed of seven plates.

Contains a single species.

*Remarks:* Glassell's description of the structure of the antennae in *Ulloaia* is not clear and may have been a typographical error: "First antennal peduncle removed from the eye, not joining the margin of the carapace" (1938a, p. 434). In reality, the antennal peduncle is removed from the eye by the strongly produced basal segment, which joins the margin of the carapace. Chace (1942, p. 101), who had not seen a specimen, misinterpreted Glassell's statement and in his key to the porcellanid genera placed *Ulloaia* among the forms with basal antennal segment small and movable segments having free access to the orbit.

### *Ulloaia perpusillia* Glassell

Plate 37, fig. 2; text-fig. 11

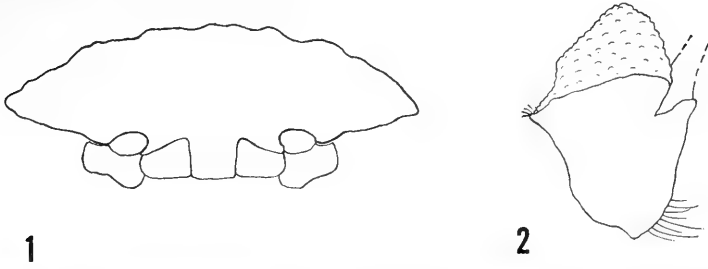
*Ulloaia perpusillia* Glassell, 1938a, p. 434, pl. 33, fig. 1 (type locality, Punta Peñasco, Sonora, Gulf of California).

*Previous records:* Gulf of California. Punta Peñasco, Sonora: S. A. Glassell (Glassell).

*Diagnosis:* Carapace a little longer than broad, lateral margins gradually and evenly diverging from hepatic to mid-branchial regions; surface covered with large granular protuberances; front appearing quadridentate in dorsal view, the two median teeth being on the outer margins of a large, rectangular rostral process, the latter sharply deflexed and visible only in frontal view; chelipeds roughly granular, manus weak, covered with long plumose hairs; walking legs short and stout, merus with a long, curved posterodistal process.

*Description:* Carapace a little longer than broad, lateral margins gradually and evenly diverging from hepatic to mid-branchial regions, epibranchial angle marked only by a small notch; surface uneven, covered with large protuberances, these protuberances lacking only on intestinal regions; latter regions, and grooves defining the **swollen areas**,





Text-fig. 11. *Ulloaia perpusillia*. 1, Frontal view of carapace, x 19; 2, Basal segment of right antennule, x 51.

punctate; upper surfaces of protuberances with numerous small scattered granules; a low, median longitudinal ridge extending length of carapace; lateral margins with a row of strongly granular lobes or blunt teeth, posterior ones largest. Surface lightly pubescent. Front quadridentate in dorsal view, the two median teeth broad, triangular, formed by outer rolling edges of the sharply deflexed rostral process, latter not visible from above; lateral teeth the strongly produced, triangular inner orbital angles. In frontal view, the deflexed rostral process broad, rectangular, separated by broad, deep triangular notches from inner orbital angles; these spaces completely filled by anterior faces of basal antennular segments. Eyes visible in dorsal view; outer orbital angles slightly produced.

Movable segments of antenna more or less smooth; flagellum a little over half carapace width, with long, sparse hairs. Outer maxillipeds lightly punctate.

Chelipeds covered with large, rough granules, some of them produced into spinules. Merus with a strongly projecting lobe on anterior margin. Carpus slightly longer than wide, armed on anterior margin with a median lobe or broad tooth; surface uneven, with two longitudinal grooves. Manus less uneven than carpus; outer margin with long plumose hairs. Gape of fingers with a long tuft of plumose hairs, similar hairs also covering the ventral surface of the manus.

Walking legs roughly granular to spinulate as in chelipeds, covered with long plumose hairs. Merus with a long, curved posterodistal process.

*Variations:* The female specimen from Costa Rica (see *Material Examined*) differed in some respects from the male holotype. The protuberances covering the carapace were less distinct, as were the grooves defining them; the median longitudinal ridge on the carapace was

scarcely visible, except very faintly on the intestinal region. The small scattered granules covering the protuberances were not clearly marked except toward the outer and frontal margins. The median notch of the front was less distinct than is shown in Glassell's illustration of the holotype. Some of these differences may be due to the soft-shelled condition of the type.

*Material examined:* Punta Peñasco, Sonora, Gulf of California, shore; April 12, 1937; collected by S. A. Glassell; male, holotype (San Diego Natural History Museum Cat. No. 1131).

Puntarenas, Costa Rica, 6-8 fathoms; May 6, 1912; collected by R. Paessler; one female (Hamburg Museum Cat. No. K26847).

*Measurements:* The male holotype measures 3.5 mm in length, 3.1 mm in width. The only other specimen seen, a non-ovigerous female, is 2.9 mm long.

*Color:* In alcohol, cream tipped with orange-red. (Glassell)

*Ecology:* Found among gorgonian corals, sponges and bryozoan growths, at extreme low tide. (Glassell) The Costa Rica specimen was taken in 6-8 fathoms, along with *Pisidia magdalenensis* (Glassell). The substrate at the latter station was not recorded.

Glassell (1938a) mentioned an ovigerous female, apparently taken with the holotype in the month of April. The whereabouts of this specimen is unknown.

*Remarks:* Because of its minute size, *Ulloaia perpusillia* is extremely difficult to examine in detail. Probably for the same reason, it is very rare in collections; the Costa Rica specimen listed above is only the third to be noted. It could be an abundant and wide-ranging form and still be overlooked by most collectors.

*Range:* Known only from the two localities listed above, Punta Peñasco, Gulf of California, and Puntarenas, Costa Rica. Shore to 8 fathoms.

#### POLYONYX Stimpson 1858

*Polyonyx* Stimpson, 1858, p. 229 (type species *Porcellana macrocheles* Gibbes, 1854, by original designation).

Carapace transversely ovate or subquadrate, usually markedly broader than long; strongly convex, surface usually smooth, shining. Front much deflexed, appearing nearly transverse in dorsal view. Eyes small, retractile.

Basal segment of antenna broad, elongate, produced inward and outward; strongly produced forward and broadly in contact with anterior margin of carapace, with movable segments far removed from orbit.

Basal segment of antennule large, truncate on anterior face, without spines or other projections.

Chelipeds large, subcylindrical, often unequal in size. Walking legs rather long and slender; propodus with movable accessory spinules on posterior margin; dactylus very short, with two or more large, strong, fixed spines, in addition to small posterior movable spinules.

About twenty-one described species, most of them from the Indo-Pacific region.

*Remarks:* A few Indo-Pacific *Polyonyx* with spines on the lateral margin of the carapace are close to certain species currently included in *Porcellana*, as pointed out by Johnson (1958). When the Porcellanidae as a whole are revised, such forms may prove to be referable to a distinct genus.

KEY TO THE EASTERN PACIFIC SPECIES

- 1a. Manus of major cheliped with a low longitudinal crest on dorsal surface; merus of walking leg 3 with five or six strong spinules on posterior margin; propodus of walking legs without movable spinules on posterior margin except for three at distal end . . . . . *confinis*
- 1b. Manus of major cheliped swollen on dorsal surface, without a longitudinal crest; merus of walking legs with about 12 small spinules on posterior margin; propodus with one or two movable spinules on posterior margin in addition to three at distal end . . . . . 2
- 2a. Propodus with two movable spinules on posterior margin in addition to three posterodistal spinules (Gulf of California) . . . . . *nitidus*
- 2b. Propodus with a single movable spinule on posterior margin in addition to three posterodistal spinules (California and west coast of Baja California) . . . . . *quadriungulatus*

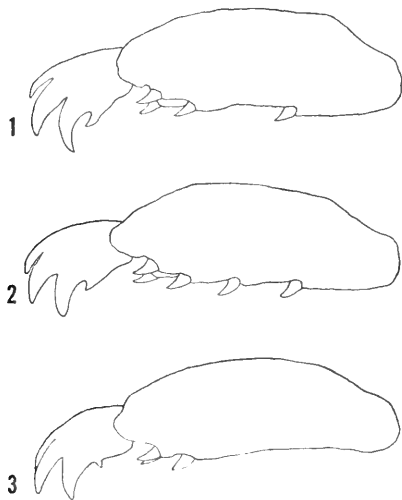
**Polyonyx confinis**, new species

Plate 17; text-fig. 12(3)

*Types*: Holotype, male, Allan Hancock Foundation Cat. No. 3817, from Corinto, Nicaragua, 3 fathoms; January 5, 1938; collected during Eastern Pacific *Zaca* Expedition of 1937-1938, New York Zoological Society, at *Zaca* station 200 D-14. Paratype: same data as holotype, one ovigerous female.

*Diagnosis*: Carapace subovate, distinctly broader than long; front transverse in frontal view; merus with a strong lobe on anterior margin; anterior margin of carpus with a convex crest, its proximal end subrectangular; outer margin of manus and pollex with a row of fine granules and a thick fringe of plumose hairs; manus of both chelipeds with a low longitudinal crest on dorsal surface; merus of walking leg 3 about twice as long as wide, its posterior margin with four or five strong spinules; propodus with three posterodistal movable spinules, that of leg 3 over twice as long as wide; dactylus with two strong fixed spines, the distal one composed of two nearly joined together, and with a minute proximal spinule.

*Description*: Carapace subovate, 1.3 to 1.5 times as broad as long, strongly convex front to back, nearly smooth with light plications on lateral regions, surface slightly uneven and regions well marked, lateral



Text-fig. 12. Propodus and dactylus of walking leg of 1, *Polyonyx quadriungulatus*, x 25; 2, *P. nitidus*, x 32½; 3, *P. confinis*, x 44½.

margins unarmed; widest at epibranchial regions. Surface without pubescence except for tuft on frontal margin. Side walls with distinct, scattered plumose hairs. Front transverse or slightly convex in dorsal view; transverse in frontal view, with a very slightly projecting median, obtusely triangular point. Orbits very shallow, scarcely showing a concavity in dorsal view; outer orbital angle not produced.

Movable segments of antenna smooth, without anterior projections; flagellum with short hairs. Outer maxillipeds smooth; surface of ischium with a few scattered hairs.

Chelipeds markedly unequal in size. Merus lightly rugose, with a broad, rounded, strongly projecting lobe on anterior margin; posterior margin with scattered hairs. Carpus 1.2 to 1.3 times as long as wide; anterior margin with a high, somewhat convex lamellar crest, its proximal end markedly subrectangular; anterior and posterior margins fringed with fine plumose hairs; posterior margin lightly rugose. Manus slender; surface smooth, inner margin lightly, obliquely rugose, outer margin and pollex with a sharp crest lined with a row of minute rounded granules, these granules becoming stronger and more projecting on pollex; outer margin with a fringe of long plumose hairs extending nearly to tip of pollex; pollex and outer half of dorsal surface of manus with shorter scattered hairs. Dactylus roughened by small granules in form of a crest along outer margin; surface with scattered long hairs. Gape with short scattered hairs. Major cheliped: manus somewhat swollen on dorsal surface, with a low longitudinal crest extending from articulation with dactyl; length of palm 1.7-1.8 times that of fingers; dactylus somewhat curved outward, crossing over pollex at tip, its cutting edge with a row of large granules and one or two tubercles. Minor cheliped: dorsal surface of manus less swollen than in major cheliped, with a low longitudinal crest; length of palm only slightly greater than that of fingers; dactylus straight, crossing under pollex at tip, its cutting edge with a double row of small granules.

Walking legs lightly rugose, all segments fringed with fine plumose hairs on anterior and posterior margins. Merus of third walking leg about twice as long as wide, its posterior margin with four or five strong spinules; merus of legs 1 and 2 unarmed. Propodus with a pair of movable spinules at distal end of posterior margin and a single spinule just behind them, that of leg 3 over twice as long as wide. Dactylus with two strong, incurving fixed spines, the distal one composed of two spines nearly joined together; proximad to them a minute spinule.

Telson of abdomen composed of seven plates.

*Measurements:* Holotype male: carapace length, 2.7 mm; width, 3.6 mm; carpus of major cheliped, 2.5 by 1.8 mm; of minor cheliped, 1.8 by 1.5 mm. Ovigerous female paratype: length of carapace, 2.4 mm; width, 3.6 mm; carpus of major cheliped, 2.2 by 1.8 mm; of minor cheliped, 1.8 by 1.5 mm.

*Color:* All traces of coloration are absent in both specimens.

*Ecology:* Specimens were dredged in 3 fathoms from a bottom covered with mangrove leaves. There was no indication of commensalism.

*Relationships:* This new species is closely allied to the other two west American *Polyonyx*. It differs in having shallower orbits; side walls of the carapace distinctly hairy; a longitudinal crest on the manus of the major cheliped; carpus broader in relation to its length; more hair on the manus and dactylus; a different size and arrangement of spinules on the merus of the walking legs; and no movable spinules on the propodus aside from the three posterodistal ones. From the very small sample available it is impossible to tell whether all of these characters are constant.

*Remarks:* This is the first *Polyonyx* to be reported from the west American coast south of the Gulf of California. It probably does not occur within the Gulf, an area which has been intensively collected.

The specific name is from the Latin *confinis*, closely related.

*Range:* Known only from the type locality, Corinto, Nicaragua.

### *Polyonyx quadriungulatus* Glassell

Plate 41, fig. 2; text-fig. 12(1)

*Polyonyx quadriungulatus* Glassell, 1935, p. 93, pl. 9 (type locality, Estero de la Punta Banda, S of Ensenada, Baja California, Mexico). Shen, 1936, p. 277. Haig, 1956b, p. 80. Probably not Steinbeck and Ricketts, 1941, p. 458.

#### *Previous records:*

California. Santa Rosa, Santa Cruz, and Santa Catalina Islands: *Velero III* and *Velero IV* (Haig).

Baja California. Estero de la Punta Banda, S of Ensenada: S. A. Glassell (Glassell).

*Diagnosis:* Carapace subovate, distinctly broader than long; front transverse in frontal view; merus with a strong lobe on anterior margin;

anterior margin of carpus with a convex crest, its proximal end subrectangular; outer margin of manus and pollex with a row of fine granules and a thick fringe of plumose hairs; manus of major cheliped swollen, without a crest on dorsal surface, that of minor cheliped with a low longitudinal crest; merus of walking legs with a row of about 12 minute spinules on posterior margin, that of leg 3 about twice as long as wide; propodus with three posterodistal movable spinules and one on middle or proximal third of posterior margin, that of leg 3 over twice as long as wide; dactylus with four fixed spines, distal three large, curving inward, proximal one small, curving outward.

*Description:* Carapace subovate, 1.2 to 1.4 times as broad as long, strongly convex front to back, smooth or lightly plicate, widest at epi-branchial regions, lateral margins unarmed; side walls naked or with vestigial hairs. Front transverse or very slightly convex or concave in dorsal view, with a short fringe of hairs; sinuously transverse in frontal view, with a very slightly projecting median triangular point. Orbits shallow; outer orbital angle not produced.

Movable segments of antenna smooth, without anterior projections; flagellum with short hairs. Outer maxillipeds smooth to lightly rugose.

Chelipeds smooth, unequal in size. Merus with a broad, rounded, strongly projecting lobe on anterior margin; posterior margin fringed with fine hairs. Carpus 1.4 to 1.8 times as long as wide; anterior margin with a high, somewhat convex lamellar crest, its proximal end markedly subrectangular; anterior and posterior margins fringed with fine plumose hairs. Manus slender, dorsal surface swollen and without a crest in major cheliped, flattened and with a longitudinal crest in minor cheliped; outer margin with a sharp crest lined with a row of minute rounded granules, becoming somewhat more projecting on pollex, and with a thick fringe of plumose hairs extending nearly to tip of pollex; gape of fingers with scattered short hairs. Major cheliped: length of palm about twice (1.8-2.2 times) that of fingers; dactylus crossing over pollex at tip, its cutting edge with a row of large granules and a tubercle near center. Minor cheliped: length of palm 1.2 to 1.4 times that of fingers; dactylus crossing under (rarely over) pollex at tip, its cutting edge with a double row of small granules.

Walking legs nearly smooth; all segments fringed with fine plumose hairs on anterior and posterior margins. Merus with a row of about 12 minute spinules along posterior margin, sometimes obsolescent on leg 1; that of leg 3 about twice as long as wide. Propodus with a pair of movable spinules at distal end of posterior margin, a single spinule

just behind them, and one on middle or proximal third of posterior margin; that of leg 3 over twice as long as wide. Dactylus with four fixed spines, distal three large, curving inward, proximal one small, curving outward.

Telson of abdomen composed of seven plates.

*Material examined*: See Table 70.

*Measurements*: Males, 3.4 to 8.4 mm; non-ovigerous female, 9.3 mm; ovigerous females, 7.0 to 10.4 mm. The ovigerous female holotype is 9.1 mm in length, 13.5 mm in breadth. Glassell recorded a measurement of 10.2 by 15.5 mm for a female specimen.

*Color*: In life, ground color of carapace and chelipeds dark brown, mottled with green and red; legs lighter and banded; abdomen mottled and opalescent. (Glassell)

*Ecology*: "This species is found commensal with the chaetopodous annelid, *Chaetopterus variopedatus* (Renier), which was found in a leathery double-ended tube, located at mean low water level, on an eel grass mud flat. Only the larger tubes were found to have crabs in them. These tubes are about a yard long by an inch in diameter." (Glassell) The *Velero III* and *Velero IV* have dredged it in 2-25 fathoms, on bottoms of mud and sand and of coralline and rock; it was taken once from kelp holdfasts in 12-15 fathoms and twice from worm tubes in 8 and 18 fathoms, the worm being specified as *Chaetopterus* in the former case. The U. S. National Museum specimens collected by the *Orca* in 11 fathoms were from *Chaetopterus* tubes.

Ovigerous females have been collected in January, June, and September.

*Relationships*: In a recent review of Indo-Pacific *Polyonyx*, Johnson (1958) noted that the species fall into three natural groups. All the known American species (*P. gibbesi* Haig<sup>1</sup> and the three treated in this report) clearly belong to Johnson's "*P. sinensis* group," characterized by him as follows: "Lateral margins of the carapace without spines. Carapace broader than long, transversely ovate, or rectangular with rounded corners. Front rather narrow, trilobate with the median lobe broad and rounded and projecting little beyond the lateral lobes, which are often scarcely developed so that the front is almost straight. Chelipeds with the anterior margins of the carpus and merus unarmed; a more or less marked development of hairs on their outer, and often

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<sup>1</sup> Substitute name for *P. macrocheles* (Gibbes); see Haig, 1956a, p. 29.



also on their inner surfaces. Legs hairy dorsally, and often the carapace also more or less hairy. Dactyli of the walking legs with the dorsal claw much smaller than the ventral claw, and bearing 2 or 3 accessory spinules."

Aside from *Polyonyx nitidus* Lockington, *P. quadriungulatus* is most closely related to the western Atlantic species *P. gibbesi* Haig. In the Atlantic form the orbits are very slightly deeper than in *P. quadriungulatus*; the outer margin of the manus of the minor cheliped is markedly outcurved, especially in males; on the same manus the dorsal longitudinal crest is obsolescent or absent; and movable spinules are lacking on the propodus of the walking legs, except for the three posterodistal ones. *P. utinomii* Miyake, 1943, which is known only from Honshu Island, Japan, appears to be very closely allied to *P. quadriungulatus*, *P. nitidus*, and *P. gibbesi*.

*Range*: Santa Rosa, Santa Cruz, and Santa Catalina Islands off the California coast; Estero de la Punta Banda south to Punta San Eugenio, Baja California. Shore to 26 fathoms.

### ***Polyonyx nitidus* Lockington**

Text-fig. 12(2)

*Polyonyx nitidus* Lockington, 1878, pp. 396, 405 (type locality, Baja California, Mexico, exact locality unknown). Shen, 1936, p. 276. Haig, 1956b, p. 81.

?*Polyonyx quadriungulatus*, Steinbeck and Ricketts, 1941, p. 458. Not *P. quadriungulatus* Glassell.

*Previous records*: Gulf of California. "Lower California" [probably Gulf]: Fisher (Lockington). El Mogote: J. Steinbeck and E. F. Ricketts (Steinbeck and Ricketts) [probably this species].

*Diagnosis*: Carapace subovate, distinctly broader than long; front transverse in frontal view; merus with a strong lobe on anterior margin; anterior margin of carpus with a convex crest, its proximal end subrectangular; outer margin of manus and pollex with a row of fine granules and a thick fringe of plumose hairs; manus of major cheliped swollen, without a crest on dorsal surface, that of minor cheliped with a low longitudinal crest; merus of walking legs with a row of about 12 spinules on posterior margin, that of leg 3 about twice as long as wide; propodus with three posterodistal movable spinules, one just behind them, and one on middle or proximal third of posterior margin, that of leg 3 over twice as long as wide; dactylus with three large, in-

curved fixed spines, the distal two very close together, and with a small, proximal, outcurving spine.

*Material examined:* Bahía de Tepoca, Sonora, Gulf of California, 11-13 fathoms; February 4, 1940; *Velero III* station 1078-40; one male, one ovigerous female.

West of Isla Coronados, Gulf of California, 3-10 fathoms; February 28, 1936; *Velero III* station 525-36; two males, two females (one ovigerous).

Off Isla Ceralvo, Gulf of California, 24°12' N x 190°55' W, 9.5 fathoms; April 30, 1888; *Albatross* station 2826; one female (U. S. National Museum Cat. No. 57657).

[Puerto Escondido, Gulf of California, 18-21 fathoms; February 11, 1940; *Velero III* station 1096-40; 1 young. This specimen, which is only 1.7 mm in length, has the spines on the walking legs only partially developed. Because of the locality it probably belongs to the present species.]

*Measurements:* Males, 2.6 to 4.4 mm; non-ovigerous females, 2.2 and 4.2 mm; ovigerous females, 3.7 and 3.9 mm. The type specimen, of unspecified sex, was reported to measure 7 mm in length, 10 mm in breadth.

*Color:* All traces of color had disappeared in the specimens examined.

*Ecology:* Dredged in 3-21 fathoms; taken from a shell bottom by the *Albatross* and from substrates of sand, sandy mud, and coralline by the *Velero III*. Depth of capture of the El Mogote specimen (Steinbeck and Ricketts) was not specified. The species has not been found associated with worm tubes.

Ovigerous females have been collected in February.

*Relationships:* The description of *Polyonyx quadriungulatus* applies to this species in all but a few particulars. From the small sample of *P. nitidus* the following measurements were obtained: carapace 1.3 to 1.5 times as broad as long; carpus 1.3 to 1.6 times as long as wide; length of palm in major cheliped 1.5 to 1.9 times that of fingers; in minor cheliped, 1.1 to 1.3 times that of fingers. The spinules on the posterior margin of the merus of the walking legs tend to be stronger than in *P. quadriungulatus*. In addition to three posterodistal movable spinules on the propodus and one on the middle or proximal third of the posterior margin, a constant character in the California-western Baja California species, *P. nitidus* has a fifth movable spinule located

just behind the three distal ones; in one specimen, the male from Bahía de Tepoca, the extra spinule was developed on one leg only and was much smaller than the other spinules on the same leg. The structure of the fixed spines on the dactylus is much as in *P. quadriungulatus*, except that the two distal ones are nearly conjoined.

The Gulf of California population may be readily separated from the California and western Baja California population on the basis of these characters, provided that they prove to be constant when larger samples become available for examination. The differences are so relatively slight that the two populations might better be considered subspecies of a single species. It seems advisable to retain them both as full species for the present, pending an analysis of the differences in several other very closely related forms.

*Remarks:* According to Lockington (1878), the single specimen of *Polyonyx nitidus* was collected by Fisher at an unspecified locality in Baja California; in the same paper he mentioned other porcellanids taken by Fisher on both sides of the peninsula. The type of *P. nitidus* is no longer extant and its identity with one population or the other can never be established. Therefore, the type locality is hereby restricted to "east coast of Baja California" so that the name *nitidus* may be applied to the Gulf of California population.

The original description of *Polyonyx nitidus* applies equally well to specimens of both populations. According to Lockington, the chelipeds in the type were "equal," but this is not the case in normal specimens of either *P. nitidus* or *P. quadriungulatus*. The type of *P. nitidus* may have been atypical, perhaps a specimen with a regenerating major cheliped.

*Range:* Gulf of California, from Bahía de Tepoca south to Isla Cerralvo. 3 to 21 fathoms.

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## APPENDIX I

## Tables of Material Examined

The following tables list the material examined in the course of this study, of each species represented by five or more collecting stations. In the case of forms represented by fewer than five stations, collecting data appear in the appropriate species account under the heading *Material Examined*.

General localities are listed in geographical order from north to south, according to the plan adopted for Previous Records. For latitude and longitude of Hancock Foundation stations up to and including 1502-42, the reader is referred to Fraser (1943). Precise positions of subsequent Hancock Foundation stations have not yet been published.

Depths are given in fathoms except where otherwise indicated.

Stations occupied by the Hancock Foundation's research vessels *Velero III* (1932-1941) and *Velero IV* (1948-1955) and by certain field collectors under Hancock Foundation sponsorship are consecutively numbered, the number in each case followed by a hyphen and by two digits denoting the year of collecting. In the tables such station numbers indicate that the material was collected for and is deposited in the Allan Hancock Foundation, and this information is not repeated in the Remarks column. In cases where Hancock Foundation material is deposited elsewhere (as certain holotypes in the U. S. National Museum), or where the Hancock Foundation station was occupied by a field party rather than by one of the *Veleros*, a notation to that effect appears under Remarks.

In all cases where specimens were not taken at a Hancock Foundation station, the collector and depository of the material are given.

Subsequent to the publication of this report, a first set of specimens, including types, of the material collected by the *Velero III* in the years 1933, 1934, and 1935 will be deposited in the U. S. National Museum.

The entry "figured" under Remarks indicates that the specimen is the one photographed.

Institutions are indicated by the following abbreviations:

AHF	Allan Hancock Foundation
AMNH	American Museum of Natural History
ANSP	Academy of Natural Sciences of Philadelphia
CAS	California Academy of Sciences
HM	Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg
MCZ	Museum of Comparative Zoology, Harvard University
NYZS	New York Zoological Society
OM	Universitetets Zoologisk Museum, Oslo
SDM	San Diego Natural History Museum
TM	Museo Civico i Naturali di Torino
USNM	United States National Museum



TABLE 1  
ORTHOCHELA PUMILA Glassell

Locality	Fms.	Date	Station	Number and Sex	Remarks
Baja California Bahía de la Magdalena	1	Dec. 2, 1931	1 ♂		S. A. Glassell; holotype, USNM 71545
Bahía de la Magdalena	1	Dec. 2, 1931		1 ♀ ov	S. A. Glassell; paratype, USNM
Bahía de la Magdalena	1	Dec. 2, 1931	1 ♂	1 ♀ ov	S. A. Glassell; paratypes, SDM 786 & 787
Isla Santa Margarita, Bahía de la Magdalena	1	Dec. 4, 1931	8 ♂	4 ♀ (3 ov)	S. A. Glassell; USNM; ♂ figured
Gulf of California Mazatlán, Sinaloa			7 specimens, dry		H. Edwards; MCZ 11853
Costa Rica Isla San Lucas		Jan. 15, 1930	3 ♂	2 ♀ (1 ov)	M. Valerio; USNM 89568
Panama Panama [City?]			17 ♂	26 ♀ (25 ov)	Sternbergh; MCZ 11826
Ecuador Bahía de Caráquez	4-5	June 23, 1910	23 ♂	35 ♀ (29 ov)	R. Paessler; HM K7669

TABLE 2  
LIOPETROLISTHES MITRA (Dana)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Peru off Isla de Frontón near Callao off Middle Chincha I., Islas de Chincha	5	Jan. 11, 1935	369-35	1 ♀ ov	
Bahía de San Juan	5 shore	Jan. 15, 1935	387-35	1 ♀	
		Feb. 8, 1938	828-38	1 ♀	
		Nov. 17, 1866		3 specimens, dry	H. Edwards; MCZ 11870

## LIOPETROLISTHES MITRA (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Chile Iquique				1 ♂	F. Ringe; from HM coll.; AHF; ♂ figured
Chañaral		Nov. 16, 1926		1 ♀ ov	W. L. Schmitt; USNM
Talcahuano		1872		3 ♂	Hassler; MCZ 8012
Puerto San Pedro, Isla Chiloe		Apr. 1872		1 ♂	Hassler; MCZ 8011

TABLE 3  
PETROLISTHES SANFELIPENSIS Glassell

Baja California Bahía de San Juanico	16	Mar. 2, 1937	616-37	1 ♂	
Marcy Channel, Bahía de la Magdalena	13	Mar. 9, 1949	1718-49	2 ♂	
Gulf of California off Punta Peñasco, Sonora	10-11	Feb. 2, 1940	1072-40	1 ♀	
off Punta Peñasco, Sonora	3-10	Feb. 3, 1940	1073-40	4 ♀	
Punta San Felipe	shore	Dec. 30, 1951		1 ♂	E. Y. Dawson; AHF
San Felipe	shore	June 8, 1933		1 ♂	S. A. Glassell; holotype, USNM 71535
San Felipe	shore	June 8, 1933		1 ♀ ov	S. A. Glassell; paratype, USNM
San Felipe	shore	June 8, 1933		1 ♂	S. A. Glassell; paratypes, SDM 767 & 768
off Rocas Consag	10-25	Mar. 24, 1937	719-37	3 ♀	
S shore Isla Tiburón	shore	Jan. 25, 1940	1045-40	3 ♀	
I. Turner, S of Isla Tiburón	shore	Jan. 24, 1940	1042-40	2 ♀	
Bahía de Kino, Sonora		Feb. 1935			♂ figured
outside Bahía Guaymas, Sonora	6-10	Jan. 23, 1940	1039-40	1 ♂	L. Huey; SDM

TABLE 4  
PETROLISTHES AGASSIZII Faxon

Gulf of California Mazatlán, Sinaloa	Dec. 8, 1931	1 ♂	CAS
Mexico Acapulco	Feb. 2, 1947	Dawson 123	1 ♂
Costa Rica Port Parker Playa Blanca	Jan. 1938 Feb. 8, 1935	465-35	1 ♂
Panama Changamé Venado	May 1, 1937 Feb. 5, 1939	1 ♂ 3 ♂	1 ♀
Panama [City?]	Mar. 12, 1891	1 ♂	1 ♂
Panama [City?] Panama [City?] Isla Perico Isla Naos	Oct. 26, 1904 1906	1 ♂ 2 ♂ 2 ♂ 1 ♂	1 ♀ ov 1 ♀ ov
Bella Vista Isla Saboga, Islas de las Perlas	Mar. 6, 1938 Mar. 13, 1926	1 ♂	1 ♀ 1 ♀

TABLE 5

PETROLISTHES EDWARDSII (Saussure)			
Baja California Bahía de Santa María Bahía de la Magdalena	Mar. 21, 1933 Dec. 2, 1931	127-33	1 ♀
Gulf of California Los Frailes Cabo San Lucas	Mar. 13, 1949	1734-49	4 ♂ ca. 215 specimens

CAS

E. Y. Dawson; AHF

Zaca; AMNH 11846

1 yg

Elinor D. Robson; USNM  
Elinor D. Robson; USNM;  
1 figured*Albatross*; holotype, MCZ  
4527

A. Agassiz; MCZ 862

*Hassler*; MCZ 8018*Albatross*; USNM 57650E. M. Keyser; USNM  
57658

Elinor D. Robson; USNM

W. G. Van Name, Mrs. S.

D. Sturgis; AMNH 6270

S. A. Glassell; USNM

1 yg

♂ figured

J. Xantus; MCZ 1370 &  
11860

PETROLISTHES EDWARDSII (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California (cont.)					
Cabo San Lucas	shore	Feb. 1, 1955	K-140	1 ♀	J. Knudsen; AHF
450 fathom bank off Mazatlán, Sinaloa		Mar. 17-18, 1954		1 ♀	B. Fukuzaki; AHF
Gulf of California or Mexico		1946 or 1947		1 ♂	E. Y. Dawson; AHF
Mexico					
Isla Isabel	shore	Mar. 22, 1956	KW-28	1 ♀	J. Knudsen; AHF
Islas Las Tres Mariás					
Isla María Madre		Mar. 1930		1 ♀	H. N. Lowe; USNM
Isla María Magdalena	13	May 9, 1939	970-39	4 ♂ ov	
Isla María Cleofas	shore	Feb. 7, 1954	2601-54	2 ♀	
Islas Revillagigedo					
Isla Socorro		Jan. 3, 1934		1 ♀ ov	USNM
Isla Clarión					
Sulphur Bay	shore	Jan. 5, 1934	140-34	1 ♂	
Sulphur Bay	shore	Jan. 5, 1934	141-34	1 ♂	
Sihuatlanejo		Feb. 28, 1938		1 ♂	S. A. Glassell; MCZ 10272 & 10269
W of Squall Pt, Bahía Tenacatita	shore	Feb. 5, 1954	2600-54	1 ♀	
E of White Friars Islands	5-10	Mar. 3, 1934	269-34	1 ♂	
Acapulco	shore	Feb. 2, 1947	Dawson	1 ♂	E. Y. Dawson; AHF
Bahía Santa Lucía, Acapulco	1-4	Feb. 1-2, 1954	2596-54	1 ♂	
Puerto del Marques near Acapulco	shore	Sept. 15, 1946	1562-46	2 ♂	
Bahía Tangola-Tangola	shore	Mar. 1, 1934	261-34	1 ♂	C. L. Hubbs
Costa Rica					
Port Parker	shore	Feb. 9, 1935	466-35	2 ♀ ov	
Port Parker		Jan. 1938		4 ♀ (3 ov)	Zaca; AMNH 11788
Playa Blanca	shore	Feb. 8, 1935	465-35	4 ♂	
				4 ♀ ov	1 yg

<b>Isla del Coco</b>									
Bahía de Chatham	shore	Jan. 14, 1938	778-38	1 ♂	2 ♀	1 yg			
Bahía de Wafer	shore	Mar. 2, 1933	107-33	3 ♂	(1 ov)				
<b>Panama</b>									
Islas Secas	15 shore	Feb. 22, 1934	251-34	2 ♂	1 ♀	1 yg			
Islas Secas	shore	Feb. 4, 1935	447-35	3 ♂	3 ♀				
Islas Secas	shore	Feb. 5, 1935	452-35		(1 ov)				
Islas Secas	shore	Feb. 6, 1935	454-35		1 ♀				
Islas Secas	shore	Mar. 2, 1938	867-38	3 ♂	1 ♀ ov				
Isla Jicarita	shore	Feb. 20, 1934	243-34	2 ♂	1 ♀	1 yg			
Bahía Honda	shore	Feb. 21, 1934	247-34			5 yg			
Panama [City?]				1 ♂					
Isla Flamenco	1	Oct. 31, 1904		1 ♂					
Isla Taboguilla		1906		1 ♂					
Isla Naos				1 ♂					
<b>Islas de las Perlas</b>									
Isla del Rey		Mar. 1926		1 ♂					
<b>Bahía Piñas</b>	shore	Jan. 28, 1935	437-35		1 ♀ ov				
Bahía Piñas	2-4	Jan. 29, 1935	444-35	1 ♂	1 ♀ ov				
<b>Colombia</b>									
Bahía Octavia	shore	Jan. 28, 1935	435-35	1 ♂	1 ♀ ov				
Puerto Utría	shore	Feb. 14, 1934	232-34			2 yg			
Puerto Utría	20	Feb. 14, 1934	234-34	1 ♂					
Puerto Utría	shore	Feb. 15, 1934	239-34	11 ♂	13 ♀				
Puerto Utría	shore				(9 ov)				
Puerto Utría	shore	Jan. 24, 1935	418-35	1 ♂					
Puerto Utría	shore	Jan. 24, 1935	419-35	1 ♂					
Puerto Utría	shore	Feb. 25, 1938	859-38	4 ♂	2 ♀ ov				
Isla Gorgona	shore	Feb. 12, 1934	222-34		1 ♀	1 yg			
Isla Gorgona	shore	Jan. 22, 1935	405-35	1 ♂		1 yg			
Isla Gorgona	1	Jan. 22, 1935	410-35			1 yg			
Isla Gorgona	shore	Jan. 22, 1935	411-35		2 ♀ ov	1 yg			

A. Agassiz; MCZ 428  
E. Festa; TM  
*Albatross*; USNM 55906  
E. M. Keyser; USNM  
57659

W. G. Van Name;  
AMNH 6272

+ 3 cheilipeds

PETROLISTHES EDWARDSII (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Colombia (cont.)					
Isla Gorgona	shore	Jan. 22, 1935	412-35	2 ♂ (1 ov)	3 yg
Galapagos Islands					
Isla Albemarle	shore	Feb. 10, 1933	68-33	3 ♀ (2 ov)	
S of Cabo Berkeley	shore	Jan. 15, 1934	154-34	4 ♀ (2 ov)	
N of Tagus Hill					
Isla James	shore	Feb. 12, 1933	71-33	3 ♀ (1 ov)	3 yg
Bahía de James	shore	Dec. 11, 1934	333-35	5 ♀ (2 ov)	1 yg
W coast Isla James	shore	Apr. 6, 1923		1 ♂ 1 ♀	1 yg Williams Galap. Exped.; USNM 70957
Isla Edén, off Isla Indefatigable					
Isla Charles	shore	Jan. 29, 1933	38-33	15 ♂	
SE of Punta Cormorant	shore	Jan. 27, 1933	33-33	6 ♂	
Black Beach	shore	Jan. 18, 1934	163-34	3 ♂	
Black Beach					
Isla Hood	shore	Jan. 25, 1933	27-33	2 ♀	
Bahía de Gardner	shore	Jan. 31, 1934	202-34	2 ♂	1 ♀ ov
Isla Osborn in Bahía de Gardner	shore	Dec. 19, 1934	359-35	11 ♂	13 ♀ (8 ov)
Isla Osborn					
TABLE 6					
PETROLISTHES GALATHINUS (Bosc)					
Costa Rica					
Isla San Lucas		Jan. 15, 1930		2 ♂	1 ♀ ov
					M. Valerio; USNM 64116



TABLE 7  
PETROLISTHES GASSELLI Haig

Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California Cabo San Lucas				1 ♀ ov	J. Xantus; MCZ 7975
Mexico					
Isla Isabel	shore	Mar. 19, 1933	125-33	1 yg	
Islas Las Tres Marias					
Isla Maria Cleofas	shore	Mar. 18, 1956	KW-17	1 ♂	J. Knudsen; AHF
Islas Revillagigedo					
Isla Socorro	shore	Jan. 3, 1934	131-34		1 cheliped only
Bahía de Braithwaite					
Isla Clarión	shore	Jan. 5, 1934	140-34	3 ♀ (2 ov)	
Sulphur Bay				5 ♀ ov	Zaca; AMNH 11836
Sulphur Bay		May 15, 1936		1 ♀ ov	Zaca; AMNH 11837
	1-4	May 13, 1936			1 cheliped only
Bahía Santa Lucía, Acapulco		Feb. 1-2, 1954	2596-54		S. A. Glassell; MCZ
Puerto Guatulco		Mar. 8, 1938		3 ♂	10271
Costa Rica					
Port Parker	shore	Feb. 9, 1935	466-35		Zaca; AMNH 11786
Port Parker		Jan. 1938		ca. 260 specimens	
near S Islas Viradores, Puerto Culebra	shore	Feb. 25, 1934	258-34	8 ♂ 3 ♀ (2 ov)	
Panama					
Islas Secas	shore	Feb. 22, 1934	252-34		1 yg
Islas Secas	shore	Feb. 4, 1935	447-35		1 yg
Islas Secas	shore	Mar. 2, 1938	867-38	1 ♂	1 ♀ ov
Bahía Honda	shore	Mar. 10, 1933	114-33	1 ♂	1 ♀
Bahía Honda	shore	Feb. 21, 1934	247-34	3 ♂	2 ♀



Colombia									holotype, USNM 102402
Bahía Octavia	shore	Jan. 28, 1935	435-35	1 ♂	6 ♀				paratypes; ♀ figured
Bahía Octavia	shore	Jan. 28, 1935	435-35	2 ♂	(3 ov)				
Bahía Octavia	shore	Jan. 28, 1935	435-35	1 ♂	1 ♀				
Puerto Utría	shore	Feb. 15, 1934	239-34	ca. 160 specimens					
Puerto Utría	shore	Jan. 24, 1935	419-35	6 specimens, fragmented					
Isla Gorgona	shore	Jan. 22, 1935	411-35	4 ♂					14 yg
Isla Gorgona	shore	Jan. 22, 1935	412-35						3 yg
Galapagos Islands									
Isla Tower	shore	Feb. 22, 1933	94-33	2 ♂	1 ♀ ov				
Bahía de Darwin	shore	Feb. 14, 1933	76-33	2 ♂	1 ♀ ov				
Isla Albermarle	shore	Dec. 12, 1934	344-35	2 ♂					
Bahía de Cartago	shore								
Isla Bartolomé, near Isla James	shore								

TABLE 8

## PETROLISTHES POLYXIMITUS Glassell

Gulf of California									
Isla Espiritu Santo	shore	Mar. 20, 1936	604-36		1 ♀				
Bahía San Gabriel	shore	Mar. 7, 1937	638-37	1 ♂					
Bahía San Gabriel	shore	May 2, 1936		1 ♂					W. Beebe on <i>Zaca</i> , NYZS; holotype, AMNH 11768 ♂ figured
off Arena Bank	2.5								
Los Frailes	shore	Mar. 13, 1949	1734-49	2 ♂	1 ♀ ov				
Mexico									
Islas Las Tres Marias									
Isla María Cleofas	shore	Mar. 18, 1956	KW-17	1 ♂					J. Knudsen; AHF
Bahía Santa Lucía, Acapulco	1-4	Feb. 1-2, 1954	2596-54	19 ♂	17 ♀ (11 ov)				11 yg
Bahía Tangola-Tangola	shore	Mar. 1, 1934	261-34	3 specimens, fragmented					
Costa Rica									
Playa Blanca	shore	Feb. 8, 1935	465-35	1 ♂	1 ♀ ov				

PETROLISTHES POLYMITUS (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Panama					
Islas Secas	shore	Feb. 4, 1935	446a-35	1 ♂	3 ♀ ov
Colombia					
Isla Gorgona	shore	Jan. 22, 1935	412-35		1 ♀ ov
Ecuador					
off beach at La Libertad	4	Jan. 19, 1933	12-33	1 ♂	
Galapagos Islands					
Isla Tower					
Bahía de Darwin	shore	Feb. 25, 1933	98-33		1 ♀ ov
Isla Albemarle					
Bahía de Cartago	shore	Feb. 14, 1933	76-33	1 ♂	2 ♀ (1 ov)
Bahía de Cartago	shore	Jan. 25, 1934	189-34	2 ♂	3 ♀ ov
Bahía de Cartago	shore	Jan. 22, 1938	800-38		1 ♀ ov
Isla James					
Bahía de Sullivan	shore	Dec. 12, 1934	343-35	1 ♂	1 ♀ ov
Isla Baltra [South Seymour]	shore	Jan. 19, 1938	789-38	1 ♂	1 ♀ ov
Isla Indefatigable					
opposite Rocas Gordon	shore	Dec. 8, 1934	315-35	1 ♂	
Isla Charles					
Black Beach	shore	Jan. 27, 1933	33-33	1 ♂	
Black Beach	shore	Jan. 19, 1934	166-34		1 ♀ ov
Isla Hood					
Bahía de Gardner	shore	Jan. 25, 1933	27-33		1 ♀ ov
Bahía de Gardner	shore	Jan. 26, 1933	30-33	1 ♂	

TABLE 9  
PETROLISTHES HIRTSPINOSUS Lockington

Location	Date	Specimen No.	Sex	Stage	Notes
Gulf of California					
Bahía de Tepoca, Sonora					
I. Willard, Bahía de San Luis					
Gonzaga					
Isla Angel de la Guarda					
Puerto Refugio	Mar. 3, 1936	540-36	2 ♀		
Puerto Refugio	Mar. 4, 1936	545-36	1 ♀		
Puerto Refugio	Mar. 20, 1937	707-37	1 ♀		
Puerto Refugio	Mar. 21, 1937	713-37	20 ♀		
Puerto Refugio	Jan. 27, 1940	1049-40	11 ♀	2 yg	
Puerto Refugio	Jan. 28, 1940	1053-40	9 ♂		
I. Pond, S of I. Angel de la Guarda	Feb. 4, 1940	1079-40	8 ♂		
S shore Isla Tiburón	Jan. 25, 1940	1045-40	13 ♂		
I. Turner, S of Isla Tiburón	Jan. 24, 1940	1042-40	6 ♂		
Isla de San Esteban	Feb. 5, 1940	1083-40	10 ♂		
S end Isla de San Esteban	Mar. 27, 1937	728-37	1 ♀		
vicinity of Puerto San Carlos, Sonora	Mar. 24, 1949	1767-49	9 ♂		
Bahía Catalina off Guaymas, Sonora	Feb. 9, 1940	1092-40	2 ♂		
Bahía Concepción	Jan. 20, 1932		1 ♂		
Pta. Aguja, Bahía Concepción	Mar. 26, 1949	1769-49	1 ♀		
W side Isla Bargo, Bahía					
Concepción	Mar. 27, 1949	1772-49	2 ♂		
Punta Perico, Isla del Carmen	Mar. 21, 1949	1757-49	7 ♂		
Puerto Escondido	Mar. 16, 1936	591-36	1 ♂		
Puerto Escondido	Mar. 12, 1937	670-37	3 ♂		
Puerto Escondido	Feb. 10, 1940	1094-40	1 ♂		
Puerto Escondido	Mar. 20, 1949	1752-49	3 ♂		
Puerto Escondido	Jan. 22, 1955	K-121	1 ♀		
Puerto Escondido	Jan. 23, 1955	K-123	2 ♀		
Bahía de Agua Verde	Feb. 12, 1940	1104-40	2 ♂		
San Marcial Reef, Bahía de					
Agua Verde	Mar. 11, 1937	664-37	7 ♂		
N of Isla San Francisco	Mar. 8, 1937	647-37	5 ♂		
Isla San Francisco	Mar. 9, 1937	652-37	2 ♂		

♂ figured

S. A. Glassell; MCZ 9789

J. Knudsen; AHF  
D. Burford; AHF

PETROLISTHES HIRTIPINOSUS (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California (cont.)					
North Bay, Isla San Francisco	shore	Feb. 25, 1936	518-36	3 ♂	
North Bay, Isla San Francisco	shore	Feb. 26, 1936	519-36	1 ♀	
E of Isla San Francisco	shore	Feb. 24, 1936	515-36	2 ♂	
Isla Espiritu Santo					L. G. Hertlein; CAS
Isthmus					
cove S of Bahía de Ballenas	shore	Feb. 20, 1932		1 ♂	
Bahía San Gabriel	shore	Feb. 22, 1936	510-36	3 ♂	
	shore	Mar. 6, 1937	634-37	7 ♂	
Bahía San Gabriel	shore	Mar. 7, 1937	638-37	21 ♂	
Bahía San Gabriel	shore	Feb. 14, 1940	1110-40	9 ♂	
Bahía San Gabriel	shore	Feb. 14, 1940	1112-40	12 ♀	
Bahía San Gabriel	shore	Mar. 15, 1949	1737-49	1 ♀	
				19 ♀	
				(4 ov)	
Bahía San Gabriel	shore	Mar. 15, 1949	1739-49	3 ♂	
Los Frailes	shore	Mar. 13, 1949	1734-49	1 ♂	
Cabo San Lucas				1 ♂	J. Xantus; MCZ 11865

TABLE 10  
PETROLISTHES MARGINATUS Stimpson

Gulf of California					
Bahía de Guaymas, Sonora	shore	Jan. 23, 1940	1040-40	1 ♂	
N of Isla San Francisco	22	Mar. 8, 1937	647-37	1 ♂	
Bahía San Gabriel, Isla Espiritu Santo	1-4	Feb. 22, 1936	506-36	1 ♂	
Los Frailes	shore	Mar. 13, 1949	1734-49	1 ♂	
Mazatlán, Sinaloa		Dec. 8, 1931		1 ♀ ov	CAS
				1 ♀ ov	



PETROLISTHES MARGINATUS (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Panama (cont.)					
"Panama" [City?]		Mar. 15, 1860		1 ♂	A. Agassiz; MCZ 1037
Isla Taboga	shore	May 2, 1939	957-39	1 ♂	
Isla Taboga	shore	May 2, 1939	958-39		
Isla Taboguilla	1	Oct. 31, 1904		ca. 35 specimens	1 yg Albatross; USNM 55901
Isla Taboguilla	1	Oct. 31, 1904			2 yg Albatross; USNM 98497
Islas de las Perlas					
Isla Saboga		Dec. 1, 1936		3 ♂	Elinor D. Robson; USNM
Isla Saboga		Feb. 9, 1948		1 ♀ ov	P. S. Galtsoff; USNM 86028
Islas Señora and Señorita	6	Mar. 1, 1948		1 ♀ ov	P. S. Galtsoff; USNM 86029
Isla del Rey		Mar. 1926		1 ♂	W. G. Van Name; AMNH 6272
—		Apr. 1875		1 ♂	S. W. Garman; MCZ 11878
Bahía Piñas	2-4	Jan. 29, 1935	444-35	ca. 95 specimens	
Colombia					
Bahía Octavia	shore	Jan. 28, 1935	435-35	ca. 80 specimens	
Bahía Cupica	shore	Jan. 26, 1935	427-35	1 ♀ ov	
Puerto Utría	shore	Feb. 15, 1934	239-34		1 yg
Puerto Utría	shore	Jan. 23, 1935	413-35		1 yg
Puerto Utría	shore	Jan. 24, 1935	419-35	ca. 50 specimens	
Puerto Utría	shore	Feb. 25, 1938	859-38	ca. 70 specimens	
Isla Gorgona	shore	Feb. 12, 1934	222-34		4 yg
Ecuador					
Bahía de Santa Elena				1 ♂	1 ♀ ov E. Festa; TM

Galapagos Islands						
Isla Tower	shore	Feb. 24, 1933	96-33	2 ♂	4 ♀ ov	
Bahia de Darwin	shore	Feb. 24, 1933	97-33	3 ♂	15 ♀	
Bahia de Darwin	shore	Feb. 26, 1933	101-33	7 specimens, fragmented	(13 ov)	
Isla Albemarle	shore	Feb. 11, 1933	69-33	5 ♂	12 ♀	1 YG
Punta Albemarle					(9 ov)	
Isla James	shore	Feb. 12, 1933	71-33	10 ♂	11 ♀	
Bahia de James	shore	Jan. 21, 1938	796-38		(9 ov)	
Bahia de Sullivan	shore	Jan. 22, 1934	175-34	1 ♂	3 ♀	(2 ov)
Isla Seymour [North Seymour]	shore	Dec. 8, 1934	315-34	5 ♂	11 ♀	
Isla Indefatigable	shore	Feb. 2, 1933	48-33		(9 ov)	
opposite Rocas Gordon	shore	Jan. 26, 1938	811-38	9 ♂	1 ♀	
Isla Barrington	shore	Jan. 27, 1934	194-34		16 ♀	(14 ov)
Isla Barrington	shore	Jan. 26, 1933	30-33	ca. 45 specimens	1 ♀	
Isla Onslow N of Isla Charles						
Isla Hood						
Bahia de Gardner						

TABLE 11

## PETROLISTHES ARMATUS (Gibbes)

Gulf of California						USNM
off Pelican Pt., Puerto Peñasco	shore	Oct. 20, 1956		1 ♂	1 ♀ ov	R. Hardy; AHF
San Felipe				14 ♂	17 ♀	
San Felipe and 1-2 mi N	shore	Apr. 12-13, 1954	2623-54	12 ♂	(10 ov)	AHF field party
S of San Felipe		Nov. 25, 1950		1 ♂	11 ♀	C. Limbaugh; AHF
					(6 ov)	

PETROLISTHES ARMATUS (cont.)								
Locality	Fms.	Date	Station	Number and Sex	Remarks			
Gulf of California (cont.)								
"San Luis, Gonzales Bay" [Isla de San Luis Gonzaga?]	shore	Jan. 25, 1940	1045-40	1 ♂				
S shore Isla Tiburón	shore	Jan. 23, 1940	1040-40	3 ♂				
Bahía Guaymas, Sonora				8 ♂				
Bahía Guaymas, Sonora	shore	Jan. 23, 1940	1041-40	(2 ov)				
				8 ♀				
				(6 ov)				
Puerto Escondido	shore	Mar. 16, 1936	591-36	1 ♀				
Puerto Escondido	shore	Mar. 12, 1937	670-37	3 ♀				
Puerto Escondido	shore	Feb. 10, 1940	1094-40	2 ♀				
				(1 ov)				
Puerto Escondido	7	Mar. 18, 1949	1747-49	1 ♀				
Puerto Escondido	shore	Jan. 21, 1955	K-116	1 ♀ ov	J. Knudsen; AHF			
Puerto Escondido	shore	Jan. 22, 1955	K-122	3 ♀	J. Knudsen; AHF			
				(1 ov)				
Punta Prieta, Bahía Topolobampo, Sinaloa								
Bahía de La Paz	shore	June 10, 1952	Dawson	1 ♀ ov	E. Y. Dawson; AHF			
		Nov. 10-11, 1946		2 ♀	E. Y. Dawson; AHF			
				(1 ov)				
La Paz	shore	Mar. 9, 1956	KW-2	1 ♂	J. Knudsen; AHF			
Mazatlán, Sinaloa	15 m	Aug. 20, 1906		1 ♂	R. Paessler; HM K26842			
Mexico								
Bahía Tenacatita	shore	Mar. 17, 1933	121-33	1 ♂				
[?] Honduras								
Golfo de Fonseca								
Golfo de Fonseca		May 1869		1 ♂	J. A. McNeil; USNM 53388			
				3 ♀	J. A. McNeil; MCZ 7941			
				(2 ov)				
Costa Rica								
Bahía de Salinas	shore	Feb. 10, 1935	474-35	ca. 160 specimens	♂ figured			
Puntarenas		Jan. 1907		3 ♂	P. Biolley; USNM 57661			
				1 ♀ ov				





PETROLISTHES ARMATUS (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Colombia					
Isla Gorgona	shore	Feb. 12, 1934	222-34		
Isla Gorgona	shore	Jan. 22, 1935	403-35	1 ♂	7 yg
Ecuador					
off La Libertad	10	Jan. 20, 1933	15-33		1 yg
Bahía de Santa Elena				1 ♀ ov	E. Festa; TM
S of Punta Santa Elena	shore	Jan. 18, 1933	10-33	1 ♂	
Salinas		Sept. 13, 1926		2 ♂	W. L. Schmitt; USNM
Salada, Guayaquil [Estero Salada?]	shore	Oct. 1-2, 1926		12 ♂	W. L. Schmitt; USNM
Estero Salada		Oct. 1954		5 ♂	M. Olalla; USNM 98021
Guayaquil		1902		2 ♂	F. von Buchwald; HM K7525
Isla Puná	shore	Dec. 19, 1934	363-35	ca. 60 specimens	
Peru					
Matapalo near Capon	shore	Jan. 23, 1908		38 specimens	R. E. Coker; USNM 40486
Las Vacas near Capon	shore	Jan. 23, 1908		1 ♂	R. E. Coker; USNM 40485
Paíta				1 ♂	Hasler; MCZ 7982
Bahía de la Independencia	5	Jan. 14, 1935	384-35	1 ♂	1 ♀ ov

TABLE 12

## PETROLISTHES NOBILII, new species

Gulf of California					
Cabeza Ballena	shore	Mar. 4, 1937	623-37	1 ♀	paratype
Cabo San Lucas				5 ♀	J. Xantus; MCZ 7966
Mazatlán				(3 ov)	P. Bartsch; paratype, USNM 57667
				1 ♂	



TABLE 13  
PETROLISTHES ROBSONAE Glassell

Locality	Fms.	Date	Station	Number and Sex	Remarks
"Mexico"					
—		1926		1 ♂	Sec. Agricultura y Fomento; USNM 62372
—		1927		1 ♂	Sec. Agricultura y Fomento; USNM 62422
—		1927		1 ♂	Sec. Agricultura y Fomento; USNM 62423
Panama					
Miraflores Locks, Panama Canal		Mar. 26, 1937		1 ♂	Elinor D. Robson; holotype, USNM 79396
Miraflores Locks, Panama Canal		Mar. 26, 1937		1 ♀	Elinor D. Robson; allotype, USNM
Miraflores Locks, Panama Canal		Mar. 26, 1937	14 ♂	17 ♀ (9 ov)	Elinor D. Robson; paratypes, USNM 79397
Miraflores Locks, Panama Canal		Mar. 26, 1937	2 ♂	1 ♀	S. F. Hildebrand; USNM 98498
Miraflores Locks, Panama Canal		Mar. 29, 1937		1 ♀ ov	S. F. Hildebrand; USNM 98495
Ecuador					
Guayaquil		1902	1 ♂		F. von Buchwald; HM K26843; figured

TABLE 14  
PETROLISTHES HIRTIPES Lockington

Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California					
Bahía Cholla, Sonora		Feb. 1 or 2, 1949		2 ♀	USNM
SE end Bahía Cholla, Sonora		Apr. 11, 1949		1 ♀	B. W. Halstead; AHF
Rocas Consag	shore	Jan. 31, 1940	1066-40	1 ♂	
off Isla San Jorge	10	Mar. 25, 1937	722-37	1 ♀	
San Felipe and 1-2 mi N	shore	Apr. 12-13, 1954	2623-54	1 ♂	AHF field party
I. Willard, Bahía de San Luis					
Gonzaga	shore	Jan. 30, 1940	1063-40	61 ♂	
				20 ♀	



TABLE 15  
PETROLISTHES NIGRUNGUICULATUS Glassell

Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California					
Puerto Refugio, Isla Angel de la Guarda	shore	Mar. 4, 1936	545-36	1 ♀	
Isla Pond, E of Isla Angel de la Guarda	shore	Mar. 8, 1936	553-36	1 ♂	
vicinity of Puerto San Carlos, Sonora Mangles Anchorage	shore	Mar. 24, 1949	1767-49	2 ♀ ov	
	shore	Feb. 28, 1936	527-36	3 ♀ (1 ov)	
Punta Perico, Isla del Carmen	shore	Mar. 21, 1949	1757-49	15 ♀ (12 ov)	
	shore	Mar. 16, 1936	591-36	2 ♀ ov	
Puerto Escondido	shore	Mar. 12, 1937	670-37	1 ♂	
Puerto Escondido	shore	Feb. 10, 1940	1094-40	8 ♂	
	shore	Mar. 20, 1949	1752-49	4 ♂	
Puerto Escondido	shore	Mar. 28, 1949	1774-49	1 ♂	
	shore	Dec. 14, 1931		1 ♂	
Isla Santa Catalina	shore	Dec. 14, 1931		2 ♀ ov	S. A. Glassell; holotype, USNM 71536
Isla Santa Catalina	shore	Dec. 14, 1931		1 ♀ ov	S. A. Glassell; paratypes, USNM
	shore	Dec. 14, 1931		1 ♂	S. A. Glassell; paratypes, SDM 769 & 770
Bahía de Agua Verde	shore	Feb. 27, 1936	522-36	12 ♂	
	shore	Mar. 18, 1936	602-36	7 ♀ (3 ov)	
Bahía de Agua Verde	shore	Feb. 12, 1940	1104-40	1 ♀ ov	
	shore	Mar. 17, 1949	1744-49	3 ♀	
San Marcial Reef	shore	Mar. 11, 1937	664-37	4 ♀	
	shore	Mar. 9, 1937	652-37	1 ♂	
North Bay, Isla San Francisco	shore	Mar. 9, 1937	652-37	1 ♀ ov	
	shore	Feb. 26, 1936	519-36	5 ♀ (2 ov)	
Isla Espíritu Santo	shore	Feb. 23, 1936	512-36	4 ♂	
	shore	Feb. 23, 1936	512-36	3 ♂	
Bahía de Ballenas	shore	Feb. 23, 1936	512-36	3 ♀ ov	

Bahía San Gabriel  
Bahía San Gabriel  
Ensenada de los Muertos  
Bahía de San Lucas  
Bahía de San Lucas  
Cabo San Lucas  
Colombia  
Puerto Utría

Feb. 14, 1940 1112-40 2 ♂  
Mar. 15, 1949 1737-49 1 ♂  
Mar. 5, 1937 626-37 2 ♀  
(1 ov)  
Apr. 1, 1949 1784-49 4 ♂  
4 ♀  
Mar. 13, 1956 KW-10 14 ♂  
16 ♀  
(9 ov)  
4 ♂  
8 ♀  
(2 ov)

♂ figured

J. Knudsen; AHF

J. Xantus; MCZ 1371

extralimital

TABLE 16  
PETROLISTHES TUBERCULATUS (Guérin)

Peru									
Bahía de la Independencia	shore	Jan. 14, 1935	380-35	3 ♂	1 ♀ ov			1 yg	
Bahía de la Independencia	shore	Feb. 9, 1938	831-38		1 ♂ ov				
E of Isla de las Viejas	shore	Jan. 13, 1935	375-35	6 ♂	9 ♀				♂ figured
					(8 ov)				
Bahía de San Nicolás	shore	Feb. 6, 1938	821-38		1 ♀ ov				
Bahía de San Juan	shore	Feb. 8, 1938	828-38	3 ♂	5 ♀				
					(4 ov)				
				1 specimen, dry					U.S. Expl. Exped.; ANSP 4130
Chile									
Caleta Buena		Nov. 17, 1909			1 ♀ ov				R. Paessler; from HM coll.; AHF
Tocopilla		Nov. 14, 1926		1 ♂	2 ♀				W. L. Schmitt; USNM
Antofagasta		Nov. 15, 1926		1 ♂				2 yg	W. L. Schmitt; USNM
Antofagasta		Feb. 1955			1 ♀ ov				E. R. Guiler; USNM
Taltal		1903		1 ♂	2 ♀				98291 R. Paessler; from HM coll.; AHF

## PETROLISTHES TUBERCULATUS (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Chile (cont.)					
Chañaral	shore	Nov. 16, 1926		3 ♀ (2 ov) 1 ♀	W. L. Schmitt; USNM
Coquimbo	shore	Feb. 1955			E. R. Guiler; USNM 98292
Valparaíso				3 specimens, dry	Guérin collection; [syn?]- type, ANSP 4116
Valparaíso	shore	1872		1 ♀	Hasler; MCZ 8017
San Antonio	shore	Dec. 29, 1948	L.U.C.E. M161	1 ♂	Lund Univ. Chile Exped.; AHF
Talcahuano		1872		8 ♂	Hasler; MCZ 7956
SE of Punta Gualpén, Bahía de San Vicente	shore	June 8, 1949	L.U.C.E. M120	1 ♀	Lund Univ. Chile Exped.; AHF

TABLE 17

## PETROLISTHES TIBURONENSIS Glassell

Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California					
San Felipe					
Bahía de Tepoca, Sonora	shore	Feb. 4, 1940	1077-40	5 ♀ (3 ov) 3 ♀ ov	H. N. Lowe; SDM
Isla Angel de la Guarda	shore	Jan. 6, 1932		1 ♀	
N end	shore	Mar. 3, 1936	540-36	3 ♀ (2 ov)	S. A. Glassell; USNM
Puerto Refugio	shore	Mar. 4, 1936	545-36	1 ♂	
Puerto Refugio	shore	Mar. 20, 1937	707-37	1 ♀ ov	
Puerto Refugio	shore	Jan. 27, 1940	1049-40	16 ♀ ov 6 ♀ (3 ov)	
Puerto Refugio	shore	Jan. 28, 1940	1053-40	4 ♂	
Pond I., S of Isla Angel de la Guarda	shore	Feb. 4, 1940	1079-40	1 ♀ ov	♂, ♀ figured



S end Isla Tiburón	shore	Dec. 31, 1931	1 ♀	S. A. Glassell; holotype, USNM 71537
S end Isla Tiburón	shore	Dec. 31, 1931	1 ♂	S. A. Glassell; paratype, USNM
S end Isla Tiburón	shore	Dec. 31, 1931	1 ♀ ov	S. A. Glassell; paratypes, SDM 771 & 772
S end Isla Tiburón	shore	Dec. 31, 1931	3 ♂	S. A. Glassell; USNM
I. Turner, S of Isla Tiburón	shore	Jan. 24, 1940	6 ♂	
Isla de San Esteban	shore	Feb. 5, 1940	5 ♀ ov	
S end Isla de San Esteban	shore	Mar. 27, 1937	2 ♀ ov	
Ensenada Bocochibampo, Guaymas, Sonora	shore	May 16, 1946	7 ♀ ov	
Bahía Catalina, Guaymas, Sonora	shore	May 16, 1946	1 ♀	E. Y. Dawson, F. E. Durham
Punta Trinidad	shore	Feb. 9, 1940	11 ♂	
		Dec. 31, 1953	(6 ov)	
			1 ♀ ov	R. J. Menzies, G. Ewing; AHF

TABLE 18

## PETROLISTHES RATHBUNAE Schmitt

California				
Santa Cruz Island	shore	Jan. 30, 1949	1 ♀	S. A. Glassell; MCZ 10275
Smugglers Cove		Oct. 29, 1940	2 ♂	AHF
—		Nov. 10, 1931	1 ♂	AHF field party
between Redondo and San Pedro			1 specimen, dry	
Portuguese Bend	shore	Nov. 9, 1946	1 ♂	
Corona del Mar				
Santa Catalina Island				
Cherry Cove	shore	Oct. 30, 1948	1 ♂	
Fourth of July Cove	shore	Mar. 4, 1950	1 ♂	
Catalina Harbor		Dec. 28, 1912	2 specimens, dry	<i>Anton Dolbrn</i> ; AHF
—		Apr. 25, 1916	1 ♀ ov	AHF
			2 yg	

Locality	Fms.	Date	Station	Number and Sex	Remarks
PETROLISTHES RATHBUNAE (cont.)					
California (cont.)					
San Clemente Island					
W end of Northwest Harbor		Jan. 5, 1947	H47-5a	1 ♀	C. L. Hubbs; AHF
—				1 ♂	H. N. Lowe; holotype, USNM 49176
—				2 ♀	H. N. Lowe; paratypes, USNM
Baja California					
Isla de Guadalupe					
Barracks Beach, 200 yds N	shore	Dec. 18, 1949	1917-49	2 ♀	1 figured
2.25 mi N of South Bluff	shore	Dec. 19, 1949	1923-49	1 ♀ ov	
2.25 mi N of South Bluff	shore	Dec. 20, 1949	1928-49	2 ♀	
Melpomene Cove	shore	Dec. 17, 1949	1912-49	2 ♀	
Melpomene Cove	shore	Dec. 18, 1949	1916-49	1 ♂	
TABLE 19					
PETROLISTHES ERIOMERUS STIMPSON					
British Columbia					
False Narrows near Nanaimo,					
Vancouver Island		July 18, 1940		6 ♀ (5 ov)	G. E. and N. MacGinitie; AHF
Washington					
Brown's Island, Friday Harbor,					
San Juan Island		Aug. 3, 1940		1 ♀	G. E. MacGinitie; AHF
Langley Bay	shore	July 22, 1949		2 ♂	H. G. Coffin; AHF
Anico Beach	shore	Aug. 22, 1949		1 ♀	H. G. Coffin; AHF
Oregon					
Boiler Bay N of Depoe Bay	shore	July 14, 1942	1479-42	1 ♂	AHF field party
Agate Beach under Yaquina Head	shore	July 13, 1942	1477-42	4 ♀ ov	AHF field party
light	shore	June 27, 1942	1463-42	2 yg	AHF field party; old submerged jetty
Fossil Point, Coos Bay					

Cape Arago lighthouse, reef and bight	shore	July 29, 1942	1490-42	11 ♂	4 ♀ ov	7 yg	AHF field party
Cape Arago lighthouse, reef and bight	shore	July 29, 1942	1491-42		1 yg		AHF field party; from eelgrass roots
Squaw I., off Cape Arago light	shore	July 27, 1942	1488-42	1 ♂			AHF field party
N side Sunset Bay	shore	June 29, 1942	1466-42	7 ♂	1 ♀		AHF field party
S side Sunset Bay	shore	June 28, 1942	1464-42	6 ♂	7 ♀ (4 ov)		AHF field party
Cape Arago State Park North Bay	shore	July 28, 1942	1489-42	7 ♂	5 ♀ ov	1 yg	AHF field party; ♂ figured
Middle Bay	shore	July 1, 1942	1468-42	29 ♂	19 ♀ (16 ov)		AHF field party
Middle Bay	shore	July 26, 1942	1487-42	8 ♂	3 ♀ (1 ov)		AHF field party
South Cove	shore	June 30, 1942	1467-42	11 ♂	4 ♀ (3 ov)		AHF field party
South Bay	shore	July 30, 1942	1492-42	15 ♂	9 ♀ (7 ov)		AHF field party
California Salmon Point	shore	June 10, 1949	EB-7	2 ♂	2 ♀ (1 ov)		W. K. Emerson, J. L. Barnard; AHF
Point Arena	shore	July 1949	EB-41		2 ♀ ov		W. K. Emerson, J. L. Barnard; AHF
Stewart's Point E Beach 1 mi N of mouth of Russian River	shore	Nov. 9, 1950			1 ♀		AHF
0.5 mi N of mouth of Salmon Creek	shore	Dec. 28, 1948	1673-49	1 ♂	1 ♀		R. J. Menzies
Horseshoe Cove 2 mi N of Bodega Head	shore	Jan. 11, 1949	1675-49			2 yg	R. J. Menzies
North Jetty, Bodega Lagoon	shore	Dec. 29, 1948	1674-49	1 ♂	1 ♀		R. J. Menzies
Campbell's Cove, Bodega Lagoon	shore	Mar. 11, 1949	1808-49	1 ♂			R. J. Menzies
Bodega Head	shore	Feb. 11, 1949	1798-49	2 ♂	1 ♀ ov		R. J. Menzies
North Jetty, Bodega Bay	shore	Aug. 6, 1948	1609-48	2 ♂	1 ♀ ov		R. J. Menzies
South Jetty, Bodega Bay	shore	Feb. 25, 1949	1802-49		1 ♀ ov		R. J. Menzies
Second Sled Road, Dillon Beach	shore	Mar. 25, 1949	1818-49	2 ♂			R. J. Menzies
		Nov. 15, 1948	1653-48	2 ♂			R. J. Menzies

## PETROLISTHES ERIOMERUS (cont.)

Locality	Fms.	Date	Station	Station	Number and Sex	Remarks
California (cont.)						
Tomales Point	shore	Nov. 28, 1948	1656-48	1 ♂	2 ♀	L. O. Miles, R. J. Menzies
Tomales Bluff, bay side	shore	Nov. 2, 1948	1628-48	1 ♂	1 ♀ ov	R. J. Menzies
Point Pinos, Monterey Bay	shore	Feb. 4, 1947	1588-47	1 ♂	1 ♀	AHF field party
Point Pinos, Monterey Bay	shore	Dec. 26, 1947	1604-47	1 ♂		J. L. Barnard, J. Worden
near Point Pinos	shore	Mar. 15, 1954		1 ♂	1 ♀ ov	kelp holdfasts, E. P. Chace; USNM 96329
Leffingwell Landing near Cambria	shore	Jan. 5, 1947	1581-47		1 ♀	J. L. Mohr
S of San Miguel Island	5-15	Aug. 10, 1938	894-38	3 ♂	2 ♀ ov	
2.5 mi E of South Point, Santa Rosa Island	15-21	Apr. 10, 1941	1280-41	1 ♂	4 ♀ (3 ov)	
2.5 mi E of South Point, Santa Rosa Island	17-18	Apr. 10, 1941	1282-41	1 ♂		
Santa Cruz Channel	23-30	June 14, 1949	1855-49	9 ♂	12 ♀ (10 ov)	
1 mi N of W end Anacapa Island	45-47	Sept. 17, 1941	1419-41	1 ♂		kelp beds, C. Limbaugh;
La Jolla		Mar. 16, 1954		1 ♂	3 ♀ ov	USNM 96423

TABLE 20

## PETROLISTHES MANIMACULIS Glassell

California						
Horseshoe Cove, 2 mi N of Bodega Head	shore	Dec. 29, 1948	1674-49	5 ♂	2 ♀ (1 ov)	1 yg R. J. Menzies
Bodega Head	shore	Jan. 24, 1949	1684-49		2 ♀ ov	R. J. Menzies
North Jetty, Bodega Bay	shore	Feb. 24, 1949	1801-49	9 ♂	9 ♀ (6 ov)	1 yg R. J. Menzies
North Jetty, Bodega Bay	shore	Mar. 11, 1949	1808-49	3 ♂	1 ♀ ov	R. J. Menzies
North Jetty, Bodega Bay	shore	Mar. 12, 1949	1809-49		1 ♀	R. J. Menzies
Second Sled Road, Dillon Beach	shore	Oct. 20, 1948	1626-48	5 ♂	1 ♀ ov	R. J. Menzies

Tomales Bluff, bay side	Nov. 2, 1948	1628-48	3 ♂	3 ♀ ov	R. J. Menzies
Moss Beach	Nov. 10, 1935		1 ♂		F. E. Christensen; AHF
Half Moon Bay	May 11, 1913		7 ♂		W. L. Schmitt; USNM 52644
Monterey			1 ♂	2 ♀ ov	H. Hemphill; USNM 5310
Point Pinos, Monterey Bay	1880		3 ♂		D. S. Jordan; USNM 5309
Piedras Blancas	Feb. 4, 1947	1588-47	1 ♂		AHF field party
Lefingwell Landing near Cambria	Mar. 31, 1947	1598-47	4 ♂	1 ♀	AHF field party
	Jan. 5, 1947	1581-47	5 ♂	3 ♀	J. L. Mohr; ♂ figured
				(2 ov)	
0.5 mi N of Cayucos	Dec. 8, 1946	1576-46	26 ♂	23 ♀	J. S. Garth
				(5 ov)	
0.5 mi W of Cayucos	Jan. 3, 1947	1579-47	5 ♂	2 ♀	J. L. Mohr
0.75 mi W of Cayucos	Jan. 4, 1947	1580-47	2 ♂	2 ♀ ov	J. L. Mohr
4.5 mi W to Cayucos, mouth of Villa Creek	Jan. 7, 1947	1583-47	1 ♂	1 ♀	J. L. Mohr
Morro Rock, Morro Bay	Feb. 1, 1939				S. A. Glassell; holotype, USNM 79393
Morro Rock, Morro Bay	Feb. 1, 1939				S. A. Glassell; allotype, USNM
Morro Rock, Morro Bay	Feb. 2, 1939		10 ♂	9 ♀	S. A. Glassell; paratypes, USNM 79394
				(8 ov)	
6.7 mi S of Surf (Pedernales Point)	Dec. 7, 1946	1575-46	1 ♂	1 ♀ ov	J. S. Garth
USCG Life Boat Station, Point Arguello	Mar. 13, 1942	1447-42	4 ♂	3 ♀ ov	AHF field party
12 mi N of Ventura	Dec. 9, 1946	1577-46	1 ♂		J. S. Garth
Point Dume	Jan. 25, 1937		2 ♂		S. A. Glassell; MCZ 10279
foot of Topanga Canyon	Dec. 18, 1945	1503-45	1 ♂	1 ♀ ov	E. Y. Dawson, F. E. Durham
Palos Verdes	Dec. 24, 1939	Burch 3962		1 ♀ ov	T. Burch; AHF
Portuguese Bend	May	1948	1 ♂		B. C. Walton; AHF
Long Beach			1 specimen		H. N. Lowe; USNM 57670
W shore Anaheim Landing	Feb. 12, 1942	1445-42	1 ♂		AHF field party
Corona del Mar	June 2, 1942	1451-42	1 ♂		AHF field party
Corona del Mar	June 2, 1954	2805-54	2 ♂	1 ♀ ov	

## PETROLISTHES MANIMACULIS (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
California (cont.)					
Laguna Beach	shore	Nov. 29, 1940	1209-40	5 ♂	
La Jolla	shore	Nov. 28, 1940	1210-40	2 ♂	
Bird Rock S of La Jolla	shore	Dec. 27, 1947		1 ♂	T. A. and Anne Stephenson; USNM 89802
Baja California					
N of Punta Descanso, 2 mi S of Rosarito	shore	Mar. 6, 1947	1597-47	15 ♂	AHF field party
7 mi N of Halfway House, Punta Descanso	shore	Mar. 3, 1947	1594-47	3 ♂	AHF field party
near Punta Descanso	shore	Jan. 14, 1946	1505-46	2 ♂	E. Y. Dawson, F. E. Durham
Cabo Colnett	shore	Jan. 13, 1946	1504-46	3 ♂	E. Y. Dawson, F. E. Durham
Punta Camalú, Bahía de San Ramón		June 19, 1939		7 ♂	+ 1 fragmented specimen; Harbison and Bilderback; SDM
N end Isla Cedros	shore	Oct. 30, 1951	2063-51	1 ♂	
Punta Eugenia	shore	Nov. 1, 1951	2066-51	1 ♂	

## TABLE 21

## PETROLISTHES GRACILIS Stimpson

Baja California	18-25	Jan. 19, 1940	1031-40	1 ♀ ov	
off Bahía de Santa María					
Gulf of California					
Punta Peñasco, Sonora		Apr. 12, 1937		3 ♀	S. A. Glassell; USNM 98512 & 98513
off Pelican Point, Punta Peñasco, Sonora				(2 ov)	
SE end Cholla Bay, Sonora	shore	Apr. 28, 1954		1 ♀ ov	Orca; USNM
Rocas Consag	shore	Apr. 11, 1949		1 ♂	B. W. Halstead; AHF
	shore	Jan. 31, 1940	1066-40	21 ♂	

off Isla de San Jorge San Felipe and 1-2 mi N	10 shore	Mar. 25, 1937 Apr. 12-13, 1954	722-37 2623-54	1 specimen 9 ♂ 6 ♀ (5 ov)	abdomen missing AHF field party
San Felipe	shore	June 8, 1933		6 ♂ 3 ♀ (2 ov)	S. A. Glassell; USNM 98515
Bahía de Tepoca, Sonora	shore	Feb. 3, 1940	1076-40	9 ♂ 8 ♀	
Bahía de Tepoca, Sonora	shore	Feb. 4, 1940	1077-40	13 ♂ 14 ♀	1 YG
I. Willard, Bahía de San Luis Gonzaga	shore	Jan. 30, 1940	1063-40	1 ♂ 2 ♀	
Isla Angel de la Guarda	shore	Mar. 20, 1937	707-37	1 ♂ 1 ♀	1 YG
Puerto Refugio	shore	Jan. 26, 1940	1047-40	14 ♂ 10 ♀	
Puerto Refugio	shore	Jan. 27, 1940	1049-40	5 ♂ 3 ♀	
Puerto Refugio	shore	Jan. 28, 1940	1053-40	1 ♂ 1 ♀	
Bahía de los Angeles	shore	Mar. 2, 1936	537-36	11 ♂ 1 ♀	
Bahía de los Angeles	shore	Apr. 17, 1940		6 ♂ 7 ♀	SDM
I. Pond, S of Isla Angel de la Guarda	shore	Mar. 8, 1936	553-36	5 ♂ 4 ♀	
Isla Pond	shore	Feb. 4, 1940	1079-40	3 ♂ 4 ♀	S. A. Glassell; MCZ 10277 & 10278
Bahía de las Animas	shore	Jan. 3, 1932		8 ♂ (2 ov)	S. A. Glassell; USNM 98508
Isla Tiburón	shore	Dec. 28, 1931		2 ♂	
S end Isla de San Esteban	shore	Mar. 27, 1937	728-37		1 YG
Puerto San Carlos, Sonora	shore	Feb. 8, 1940	1091-40	31 ♂ 9 ♀ (3 ov)	8 YG
Puerto San Carlos, Sonora	shore	Mar. 24, 1949	1766-49	21 ♂	♂ figured
vicinity of Puerto San Carlos	shore	Mar. 24, 1949	1767-49	4 ♀ ov 1 ♀ ov	
Ensenada de San Francisco, Sonora	shore	Mar. 30, 1937	739-37	ca. 165 specimens	
Ensenada de San Francisco, Sonora	shore	May 17, 1946	1516-46	3 ♂ 3 ♀ ov	E. Y. Dawson, F. E. Durham
Bahía de Guaymas, Sonora	shore	Jan. 23, 1940	1040-40	1 ♀	E. Y. Dawson, F. E. Durham
inner harbor, Guaymas, Sonora	shore	May 15, 1946	1512-46	2 ♂	S. A. Glassell; USNM 98509
Guaymas, Sonora	shore	Feb. 22, 1933		7 ♂ 3 ♀	USNM
Guaymas, Sonora	shore	Feb. 13, 1953		1 ♀	

PETROLISTHES GRACILIS (cont.)							
Locality	Fms.	Date	Station	Number and Sex	Remarks		
Gulf of California (cont.)							
Ensenada Bocochoibampo, Guaymas, Sonora	shore	May 16, 1946	1514-46	1 ♂		E. Y. Dawson, F. E. Durham	
Ensenada Bocochoibampo	shore	May 17, 1946	1515-46	1 ♂		E. Y. Dawson, F. E. Durham	
Bahía Concepción	shore	Mar. 15, 1937	684-37	3 ♂	2 ♀		
Punta Aguja	shore	Mar. 26, 1949	1769-49	2 ♂	2 ♀ (1 ov)		
W side Isla Bargo	shore	Mar. 27, 1949	1772-49	1 ♂			
Mangles Anchorage	shore	Feb. 28, 1936	527-36	1 ♂			
Punta Perico, Isla del Carmen	shore	Mar. 21, 1949	1757-49	3 ♂	3 ♀ (1 ov)		
Puerto Escondido	shore	Mar. 12, 1937	670-37	9 ♂	3 ♀		
Puerto Escondido	shore	Feb. 10, 1940	1094-40	4 ♂			
Puerto Escondido	shore	Mar. 18, 1949	1749-49	2 ♂	2 ♀		
Puerto Escondido	shore	Mar. 28, 1949	1774-49	3 ♂	2 ♀		
Bahía de Agua Verde	shore	Feb. 27, 1936	522-36	8 ♂	4 ♀		
Bahía de Agua Verde	shore	Feb. 12, 1940	1103-40				1 yg
Bahía de Agua Verde	shore	Feb. 12, 1940	1104-40	4 ♂	2 ♀ ov		
Bahía de Agua Verde	shore	Mar. 17, 1949	1744-49	4 ♂	3 ♀ (2 ov)		
North Bay, Isla de San Francisco	shore	Feb. 26, 1936	519-36	7 ♂	3 ♀		
E of Isla de San Francisco	shore	Feb. 24, 1936	515-36	2 ♂	(2 ov) 4 ♀ (3 ov)		
Isla Espíritu Santo							
Bahía San Gabriel	shore	Feb. 20, 1936	500-36	2 ♂	1 ♀ ov		
Bahía San Gabriel	shore	Mar. 7, 1937	638-37	1 ♂			
La Paz		May 2, 1921		1 ♂			L. G. Rubio; AMNH 4650



		TABLE 22			
		PETROLISTHES TRIDENTATUS Stimpson			
Mexico					
Islas Las Tres Marias		Mar. 18, 1956	KW-17	1 ♂	J. Knudsen; AHF
Isla Maria Cleofas	shore	Mar. 1, 1934	260-34	1 ♂	extralimital
Bahia Tangola-Tangola	shore				
Costa Rica					
Bahia de Salinas	shore	Feb. 10, 1935	474-35	1 ♂	
Port Parker	shore	Feb. 9, 1935	466-35	4 ♂	14 ♀ (12 ov)
Port Parker	shore	Jan. 1938		1 ♂	♂ figured
S of Punta Mala, Puerto Culebra	shore	Feb. 24, 1934	256-34	1 ♂	Zaca; AMNH 11834
Panama					
Bahia Honda	shore	Mar. 9, 1933	111-33	7 ♂	15 ♀ (8 ov)
Isla Taboguilla	shore	Oct. 31, 1904		3 ♂	9 ♀ (5 ov)
Isla Taboguilla	shore	Mar. 4-5, 1926		2 ♂	W. G. Van Name, Mrs. S. E. Brewster; AMNH 6201
Islas de las Perlas		Apr. 1875		1 ♀	+ 2 specimens, fragmented S. W. Garman; MCZ 11874
Colombia					
Bahia de Cupica	shore	Jan. 26, 1935	427-35		3 ♀ ov
Puerto Utria	shore	Feb. 14, 1934	232-34	1 ♂	1 ♀
Puerto Utria	shore	Jan. 23, 1935	413-35	2 ♂	
Bahia Cabita (Cabo Corrientes)	shore	Feb. 13, 1934	229-34	2 ♂	1 ♀ ov
Ecuador					
Bahia de Santa Elena	shore	Jan. 18, 1933	10-33	1 ♂	E. Festa; TM
S of Punta Santa Elena	shore	Dec. 23, 1934	363-35		1 ♀ ov 1 ♀ ov

TABLE 23  
PETROLISTHES GALAPAGENSIS, new species

Locality	Fms.	Date	Station	Number and Sex	Remarks
Galapagos Islands					
Isla Albemarle					
S of Cabo Berkeley	shore	Feb. 10, 1933	68-33	1 ♂	
Black Bight	shore	Feb. 8, 1933	62-33	1 ♂	
Black Bight	shore	Feb. 8, 1933	62-33	4 ♂	holotype, USNM 102403
Isla Bartolomé near Isla James	shore	Jan. 23, 1934	179-34	1 ♀ ov (2 ov) 1 ♀ ov	
Isla James	shore	Jan. 24, 1934	184-34	1 ♀ ov	
Isla Indefatigable	shore	Feb. 17, 1933	82-33	2 ♂	
Bahía de Conway	shore	Dec. 7, 1934	314-35	13 ♀ (8 ov)	
Bahía de Academia					
Isla Charles	shore	Feb. 6, 1933	58-33	1 ♂	
Cormorant Bay	shore	Feb. 5, 1933	56-33	11 ♀ (5 ov)	1 yg ♂ figured
Flemingo Bay off Cormorant Bay					

TABLE 24  
PETROLISTHES TONSORIOUS, new species

Gulf of California					
Cabo San Lucas				4 ♂	J. Xantus; MCZ 7976
Mexico					
Islas Revillagigedo					
Isla Socorro	shore	Mar. 18, 1938		2 ♂	S. A. Glassell; USNM 98517
Acapulco	shore	Feb. 4, 1947	Dawson 131	5 ♀ (4 ov) 1 ♀	E. Y. Dawson; AHF
Bahía Tenacatita	shore	Mar. 17, 1933	121-33	1 ♀ ov	
Escondido (Oaxaca)	shore	Mar. 3, 1938		3 ♀ (2 ov)	S. A. Glassell; USNM 98516

Costa Rica									
Port Parker	shore	Feb. 9, 1935	466-35	1 ♂					
off S Islas Viradores, Puerto Culebra	10	Feb. 25, 1934	257-34	1 ♂					
Isla del Coco	shore	Mar. 1, 1933	105-33		4 ♀ (3 ov) 7 ♀ ov				
Bahía de Wafer	shore	Mar. 2, 1933	107-33	10 ♂					
Bahía de Wafer	shore	Jan. 16, 1933	7-33	7 ♂	7 ♀ (3 ov)	5 yg			
Colombia									
Isla Malpelo	shore	Sept. 17, 1926		1 ♂					W. L. Schmitt; USNM
Ecuador									
Punta Santa Elena	shore	Jan. 18, 1933	10-33						
S of Punta Santa Elena	shore								
Galapagos Islands									
Isla Albemarle	shore	Feb. 10, 1933	68-33	1 ♂					
S of Cabo Berkeley	shore	Feb. 10, 1933	68-33	37 ♂					holotype, USNM 102404
S of Cabo Berkeley	shore	Feb. 8, 1933	62-33	7 ♂	36 ♀ (25 ov) 5 ♀ (3 ov)	3 yg			
Black Bight	shore	Jan. 23, 1934	179-34	1 ♂					
Isla Bartolomé near Isla James	shore	Jan. 31, 1933	42-33						figured
Isla Chatham	shore	Jan. 29, 1933	38-33	12 ♂	7 ♀ (4 ov)	1 yg			
Bahía de Stephens	shore								
Isla Charles	shore								
SE of Punta Cormorant	shore								

TABLE 25

## PETROLISTHES CABRILLOI Glassell

California									
Piedras Blancas	shore	Mar. 31, 1947	1598-47		1 ♀				AHF field party
0.5 mi. W of Cayucos	shore	Dec. 8, 1946	1576-46						J. S. Garth
USCG Life Boat Station, Point Arguello	shore	Mar. 13, 1942	1447-42		1 ♀				AHF field party

PETROLISTHES CABRILLOI (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
California (cont.)					
Stevens Wharf, Santa Barbara	shore	Apr. 25, 1947	H47-74	2 ♂	C. L. Hubbs; AHF
Olive Mill Road, Montecito	shore	May 15, 1941	1315-41	7 ♂ (3 ov)	
3 mi S of Sealiff	shore	Dec. 6, 1946	1574-46	1 yg	J. S. Garth
Santa Cruz Island	shore	Oct. 29, 1940	1189-40	4 ♂	E. P. Chace; USNM 53584
N of Santa Monica		Nov. 17, 1918		ca. 50 specimens	AHF
Venice, under aquarium		Jan. 3, 1912		82 specimens	J. R. Beck; AHF
Venice, under aquarium		Jan. 24, 1913		ca. 400 specimens	USNM 54722
Venice breakwater				1 ♂	<i>Anton Dohrn</i> ; USNM
Venice breakwater		Oct. 29, 1913		1 ♂	50149
Hermosa Beach	shore	Feb. 10, 1947	1593-47	2 ♂	1 yg pilings from wrecked pier; J. L. Mohr
Bluff Cove S of Redondo old pier, Playa del Rey	shore shore	Dec. 9, 1938 Nov. 27, 1940	907-38 1208-40	2 ♂ 28 ♂	
Point Vicente	shore	Feb. 1918		1 ♂	H. N. Lowe; USNM 51122
Portuguese Bend	shore	Dec. 8, 1938	906-38	1 ♂	
Portuguese Bend	shore	Nov. 10, 1939	1013-39	1 ♂	
Portuguese Bend	shore	Mar. 11, 1949		1 ♀	AHF
Point Fermin	shore	Feb. 22, 1913		6 ♂	P. S. Barnhart; AHF
Point Fermin	shore	Nov. 30, 1940	1216-40	6 ♂	
Point Fermin	shore	Nov. 30, 1940	1217-40	3 ♂	
San Pedro breakwater	shore	Jan. 26, 1941	1230-41	5 ♂	
vicinity of San Pedro	shore	1917		3 ♂	E. P. Chace; USNM 53586
Alamitos Bay to White's Point		Apr. 1, 1913		3 ♂	<i>Anton Dohrn</i> ; USNM 50164
Anaheim Bay	shore	Feb. 1918		ca. 100 specimens	H. N. Lowe; USNM 51126
Anaheim Landing	shore	Oct. 11, 1939		1 ♂	W. A. Kirk; holotype, USNM 79391
Anaheim Landing	shore	Oct. 11, 1939		1 ♀ ov	W. A. Kirk; allotype, USNM

Anaheim Landing	shore	Feb. 12, 1942	1445-42	18 ♂	9 ♀ (7 ov) 3 ♀	1 yg	AHF field party
SE of Newport breakwater	shore	Jan. 25, 1941	1225-41	10 ♂			
Newport Channel	shore	Jan. 24, 1941	1222-41	2 ♂			J. Knudsen; AHF
Newport Channel	shore	Feb. 21, 1956		5 ♂			
Balboa, Newport Channel	shore	Jan. 25, 1941	1224-41	13 ♂	14 ♀	26 yg	S. A. Glassell; paratypes, USNM 79392
Corona del Mar	shore	Dec. 9, 1938		40 specimens			
Corona del Mar	shore	Dec. 18, 1941	1440-41	1 ♂		2 yg	AHF field party
Corona del Mar	shore	Nov. 9, 1946	1572-46	3 ♂	1 ♀		
Corona del Mar	shore	Jan. 18, 1950	1930-50	1 ♂			
Corona del Mar	shore	June 2, 1954	2805-54	1 ♂			
Abalone Cove	shore	Mar. 13, 1949				5 yg	AHF
Laguna Beach	shore	Dec. 6, 1938	904-38	1 specimen			
Laguna Beach	shore	Nov. 29, 1940	1209-40	3 ♂	1 ♀	3 yg	
Laguna Beach	shore	Nov. 30, 1940	1218-40	2 ♂		2 yg	
Laguna Beach	shore			3 ♂			W. A. Hilton; USNM 52757
Dana Point	shore	Feb. 26, 1956		30 ♂	17 ♀ (1 ov)		J. Haig, M. E. Pippin; AHF; ♂ figured
Santa Catalina Island							
Bird Rock and Cherry Cove	shore	May 23, 1954	2796-54	7 ♂	1 ♀ ov 1 ♀	2 yg	Anton Dohrn; USNM 50150
Catalina Harbor	shore	Dec. 28, 1912					AHF
Catalina Harbor	shore	Nov. 28, 1913		4 ♂			
Catalina Harbor	shore	Dec. 1, 1948	1652-48		2 ♀		W. L. Schmitt; USNM 53926
La Jolla		Sept. 22, 1918		ca. 20 specimens			
La Jolla	shore	Jan. 15, 1946	1506-46	4 ♂	4 ♀	2 yg	E. Y. Dawson, F. E. Dur- ham
La Jolla	shore	Nov. 1, 1947	1603-47		1 ♀		AHF field party
La Jolla	shore	Feb. 25, 1956		6 ♂	2 ♀ ov		J. Haig, M. E. Pippin; AHF
La Jolla				1 ♂	2 ♀ ov		Scripps Inst.; USNM 53952
Mission Bay		1929		2 specimens			AHF

PETROLISTHES CABRILLOI (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
California (cont.)					
Cabrillo Beach	shore	Nov. 18, 1948	1639-48	2 ♂ 1 ♀	Scripps Inst.; USNM 53953
San Diego Bay					
San Diego				2 ♀ ov	<i>Hasler</i> ; MCZ 7972
Baja California					
7 mi N of Halfway House,					
Punta Descanso	shore	Mar. 3, 1947	1594-47	1 ♀	AHF field party
Punta Camalú, Bahía de San Ramón		June 19, 1939		2 ♂	Harbison and Bildtback; SDM
12 mi E of Punta Eugenia	shore	Oct. 31, 1951	2064-51	1 ♂	
"Hancock Cove," 20 mi E of	shore	Nov. 2, 1951	2080-51	2 ♂	
Punta Eugenia				3 ♀ (2 ov)	2 yg
1.1 mi NNE of Kelp Pt., Punta					
San Bartolomé	shore	Feb. 11, 1954	2603-54		
Punta Asunción	shore	Apr. 28, 1950	1950-50	1 ♂	
Punta Abreojos to NE Point	shore	Apr. 30, 1950	1956-50	1 ♀ 11 ♀ (10 ov)	1 yg
N shore Bahía de San Juanico	shore	Feb. 7, 1955	K-143	5 ♀ 2 ♀	J. Knudsen; AHF
Bahía de la Magdalena		1917		2 ♂ (1 ov)	C. R. Orcutt; USNM 50648
TABLE 26					
PETROLISTHES CINCTIPES (Randall)					
Oregon					
Agate Beach under Yaquina Head	shore	July 13, 1942	1477-42	1 ♂	AHF field party
light	35	June 30, 1942	1470-42		<i>Rio Janeiro</i>
Fossil Point, Coos Bay	shore	June 27, 1942	1463-42	15 ♂	old submerged jetty; AHF field party; ♂ figured

	shore	July 12, 1942	1476-42	5 ♂	3 ♀ (2 ov)	AHF field party
Fossil Point, Coos Bay	shore	July 12, 1942	1476-42	5 ♂	3 ♀ (2 ov)	AHF field party
Cape Arago lighthouse, reef and bight	shore	July 29, 1942	1490-42	14 ♂	3 ♀	AHF field party
Squaw I. off Cape Arago light	shore	July 27, 1942	1488-42	3 ♂		AHF field party
N side Sunset Bay	shore	June 29, 1942	1466-42	16 ♂	15 ♀ (5 ov)	AHF field party
S side Sunset Bay	shore	June 28, 1942	1464-42	4 ♂	3 ♀	AHF field party
Coos Head at Coast Guard station	shore	July 25, 1942	1486-42	1 ♂	1 ♀	AHF field party
Cape Arago State Park North Bay	shore	July 28, 1942	1489-42	8 ♂	6 ♀ (1 ov)	AHF field party
North Beach	shore	July 31, 1942	1493-42	1 ♂	1 ♀	AHF field party
Middle Bay	shore	July 1, 1942	1468-42	17 ♂	4 ♀	AHF field party
Middle Bay	shore	July 26, 1942	1487-42	14 ♂	4 ♀ (2 ov)	AHF field party
South Cove	shore	June 30, 1942	1467-42	29 ♂	12 ♀	AHF field party
South Bay	shore	July 30, 1942	1492-42	2 ♂	1 ♀	AHF field party
California						
Del Norte County				11 ♂	15 ♀ ov	A. Agassiz; MCZ
Crescent City	shore	June 25, 1949	EB-20	4 ♂	1 ♀	W. K. Emerson, J. L. Barnard; AHF
Mendocino County	shore	June 29, 1949	EB-24	2 ♂	1 ♀	W. K. Emerson, J. L. Barnard; AHF
Cormorant Cove	shore	July 14, 1949	EB-42	1 ♂		W. K. Emerson, J. L. Barnard; AHF
Albion Bay at mouth of Albion River	shore	June 10, 1949	EB-7	7 ♂	3 ♀	W. K. Emerson, J. L. Barnard; AHF
Salmon Point	shore	June 14, 1949	EB-12	13 ♂	11 ♀ (2 ov)	W. K. Emerson, J. L. Barnard; AHF
Salmon Point	shore	June 15, 1949	EB-15	6 ♂	5 ♀ (1 ov)	W. K. Emerson, J. L. Barnard; AHF

PETROLISTHES CINCTIPES (cont.)						Remarks
Locality	Fms.	Date	Station	Number and Sex	Remarks	
California (cont.)						
N of Whitesboro Cove	shore	July 9, 1949	EB-37	1 ♂	W. K. Emerson, J. L. Barnard; AHF	
Point Arena	shore	July 1949	EB-41	6 ♀ (1 ov)	W. K. Emerson, J. L. Barnard; AHF	
Sonoma County						
E Beach, 1 mi N of mouth of Russian River	shore	Jan. 12, 1949	1676-49	1 ♀	R. J. Menzies	
Carmet, 1 mi N of Salmon Creek	shore	Oct. 31, 1948	1627-48	1 ♂	R. J. Menzies	
0.5 mi N of mouth of Salmon Creek	shore	Jan. 11, 1949	1675-49	14 ♀ (6 ov)	R. J. Menzies	
Horseshoe Cove, 2 mi N of Bodega Head	shore	Jan. 13, 1949	1677-49	24 ♀ (17 ov)	R. J. Menzies	
Bodega Head	shore	Aug. 6, 1948	1609-48	2 ♂	R. J. Menzies	
North Jetty, Bodega Lagoon	shore	Mar. 11, 1949	1808-49	1 ♀ ov	R. J. Menzies	
Campbell's Cove, Bodega Lagoon	shore	Feb. 8, 1949	1795-49	2 ♂	R. J. Menzies	
Bodega Bay						
North Jetty	shore	Feb. 24, 1949	1801-49	3 ♀ ov	R. J. Menzies	
North Jetty	shore	Feb. 25, 1949	1802-49	17 ♀ (15 ov)	R. J. Menzies	
North Jetty	shore	Mar. 20, 1949	1813-49	1 ♂	R. J. Menzies	
South Jetty	shore	Mar. 23, 1949	1816-49	1 ♂	R. J. Menzies	
South Jetty	shore	Mar. 24, 1949	1817-49	1 ♂	R. J. Menzies	
South Jetty	shore	Aug. 8, 1949	M71-49	7 ♂	L. O. Miles, W. K. Emerson; AHF	
W side	shore	Nov. 30, 1948	1658-48	3 ♂	L. O. Miles, R. J. Menzies	
Marin County						
Second Sled Road, Dillon Beach	shore	Nov. 15, 1948	1653-48	5 ♀ (1 ov)	R. J. Menzies	
Tomales Point, bay side	shore	Nov. 28, 1948	1656-48	3 ♂	L. O. Miles, R. J. Menzies	



Blakes Landing, Tomales Bay	shore	Aug. 7, 1948	1610-48	1 ♂		R. J. Menzies
Nick's Cove, Tomales Bay	shore	Nov. 3, 1948	1629-48	2 ♂	3 ♀	R. J. Menzies
Monterey County						
Monterey						A. S. Taylor; syntypes of <i>Porcellana rufipicola</i> , MCZ 1391
Point Pinos	shore	Feb. 4, 1947	1588-47	3 ♂	3 ♀ ov	AHF field party
Point Pinos	shore	Dec. 26, 1947	1604-47		1 ♀ ov	J. L. Barnard, J. Worden
Kasler Point between Point Sur and Point Lobos	shore	Feb. 3, 1947	1587-47	2 ♂	1 ♀ ov	AHF field party
Big Sur, S side of lighthouse rock	shore	Feb. 6, 1947	1592-47	5 ♂	4 ♀ (2 ov)	AHF field party
San Luis Obispo County						
Piedras Blancas	shore	Mar. 31, 1947	1598-47	16 ♂	9 ♀ (6 ov)	AHF field party
Breaker Point near Piedras Blancas						
Leffingwell Landing near Cambria	shore	Apr. 1, 1947	1599-47	1 ♂		AHF field party
0.5 mi W of Cayucos	shore	Jan. 5, 1947	1581-47	6 ♂	1 ♀	J. L. Mohr
4.5 mi W to Cayucos, mouth of Villa Creek	shore	Jan. 3, 1947	1579-47	6 ♂	1 ♀	J. L. Mohr
San Miguel Island	shore	Jan. 7, 1947	1583-47	2 ♂	5 ♀ (4 ov) 1 ♀	J. L. Mohr 1 yg
Santa Rosa Island	shore			4 ♂	7 ♀ (2 ov)	W. S. W. Harford; MCZ 7981 USNM 2550
West coast of America ["Sandwich Islands," by error]				1 specimen, dry		T. Nuttall; [syn?] type, ANSP 4167

TABLE 27  
PETROLISTHES GRANULOSUS (Guérin)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Peru					
Bahía de Paracas	shore	Jan. 14, 1935	34 ♂	21 ♀ (17 ov)	<i>Hasler</i> ; MCZ 7873
Bahía de la Independencia	shore	Jan. 13, 1935	380-35	8 ♂ (3 ov)	2 yg
E of Isla de las Viejas	shore	Jan. 13, 1935	375-35	17 ♀ (8 ov)	♂ figured
Bahía de San Nicolás	shore	Feb. 6, 1938	821-38	30 ♀ (13 ov)	
Bahía de San Juan	shore	Feb. 8, 1938	828-38	2 ♀ (1 ov)	
Chile					
Tocopilla		Nov. 14, 1926		6 specimens, dry	W. L. Schmitt; USNM
Mejillones				5 ♂	Putnam; MCZ 8008
Antofagasta				3 ♂	A. H. Verrill; AMNH
Antofagasta		Nov. 15, 1926		1 ♂	5270
Caldera		1872		12 ♂	W. L. Schmitt; USNM
Chañaral		Nov. 16, 1926		8 ♀ (5 ov)	<i>Hasler</i> ; MCZ 7961
Bahía Herradura de Guayaacán	shore	June 22, 1949	L. U. C. E. M125	1 ♂	W. L. Schmitt; USNM
Islas Juan Fernández		Apr.-May 1872		10 ♂	Lund Univ. Chile Exped.; AHF
—				4 ♀ (2 ov)	<i>Hasler</i> ; MCZ 7876
—				2 specimens, dry	U. S. Expl. Exped.; ANSP 4147

TABLE 28  
PETROLISTHES LAEVIGATUS (Guérin)

Chile					
Valparaiso				1 ♂	U. S. Expl. Exped.; MCZ 1398

Talcahuano	Apr. 1872	22 ♂	16 ♀	<i>Hasler</i> ; MCZ 7872
Lota	Jan. 16, 1927	7 ♂	6 ♀	W. L. Schmitt; USNM
Isla Pullinque N of Punta Rangui, Golfo de Quetalmahué	Nov. 17, 1948	1 ♂	1 ♀ ov	Lund Univ. Chile Exped.; AHF; ♂ figured
—		1 specimen, fragmented		Guérin collection; [syn?]-type, ANSP 648
—		2 specimens, dry		Guérin collection; types?, ANSP 4145
—		1 specimen, dry		U. S. Expl. Exped.; type of <i>Porcellana validata</i> ?, ANSP 4115
—		2 specimens, dry		U. S. Expl. Exped.; types of <i>Porcellana validata</i> ?, ANSP 4146

TABLE 29

## PETROLISTHES VIOLACEUS (Guérin)

Peru				
Callao	1865	1 ♂		W. Vierau; HM K7516
Isla San Lorenzo near Callao		1 ♂		R. Paessler; HM K7682
Isla San Lorenzo	Jan. 17, 1884	2 ♂	1 ♀ ov	W. H. Jones; USNM 10077
Isla San Lorenzo	Jan. 1884	3 ♂	1 ♀ ov	W. H. Jones; USNM 10076
Bahía de Paracas			1 ♀ ov	<i>Hasler</i> ; MCZ 7874
E of Isla de las Viejas, Bahía de la Independencia	Jan. 13, 1935	ca. 160 specimens		
Bahía de San Nicolás	Feb. 6, 1938	821-38	1 ♀ ov	
Bahía de San Juan	Feb. 8, 1938	828-38	1 ♀ ov	♂ figured
Chile				
Tocopilla	Nov. 14, 1926	1 ♂		W. L. Schmitt; USNM
Bahía Herradura de Guayaacán	June 22, 1949	1 ♂	1 ♀ ov	Lund Univ. Chile Exped.; AHF

## PETROLISTHES VIOLACEUS (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Chile (cont.)					
Valparaiso				1 specimen, dry	<i>Coquille</i> ; type?, ANSP 4119
Valparaiso				10 ♂	U.S. Expl. Exped.; MCZ 1394
Valparaiso				7 ♀	
Valparaiso				(6 ov)	
Valparaiso				1 ♂	<i>Magenta</i> ; USNM 19536
Valparaiso		Jan. 6, 1927		1 ♂	W. L. Schmitt; USNM
Talcahuano		1872		1 ♂	<i>Haister</i> ; MCZ 11876
-----				2 ♀	U.S. Expl. Exped.; ANSP 3582
-----				2 specimens, dry	
"Galapagos Islands" [probably in error]				2 specimens, dry	ANSP 4118

TABLE 30

## PETROLISTHES HOLOTRICHUS Nobili

Costa Rica					
Bahia de Salinas	shore	Feb. 10, 1935	474-35	2 ♂	2 ♀ ov
Port Parker	shore	Feb. 9, 1935	466-35	10 ♂	5 ♀ (4 ov)
Golfo Dulce	shore	Mar. 26, 1939	940-39		1 ♀
Panama					
Isla Flamenco				1 ♂	E. Festa; syntypes, TM
Bahia Piñas	shore	Jan. 28, 1935	436-35	+ 1 specimen, fragmented	1 ♀
Colombia					
Bahia Octavia	shore	Jan. 27, 1935	433-35	1 ♂	1 ♀ ov
Bahia de Cupica	shore	Jan. 26, 1935	427-35	1 ♂	2 ♀ ov

W. Williams; MCZ 10270

TABLE 31

## PETROLISTHES SCHMITTI Glassell

Puerto Utría	shore	Feb. 14, 1934	232-34	4 ♂	2 ♀ (1 ov)	
Puerto Utría	shore	Jan. 23, 1935	413-35	2 ♂	3 ♀ ov	
Puerto Utría	shore	Jan. 24, 1935	418-35		1 ♀ ov	
Bahía Cabita (Cabo Corrientes)	shore	Feb. 13, 1934	229-34	6 ♂	4 ♀ ov	1 yg
Ecuador La Libertad		Mar. 24, 1937			2 ♀ ov	
Gulf of California San Felipe and 1-2 mi N	shore	Apr. 12-13, 1954	2623-54	48 ♂	77 ♀ (50 ov)	AHF field party
San Felipe	shore	June 8, 1933			1 ♀ ov	S. A. Glassell; holotype, USNM 71534
San Felipe	shore	June 8, 1933		1 ♂		S. A. Glassell; paratype, USNM
San Felipe	shore	June 8, 1933			1 ♀ ov	S. A. Glassell; paratype, MCZ 10276
San Felipe	shore	June 8, 1933		1 ♂	1 ♀	S. A. Glassell; paratypes, SDM 765 & 766
Bahía de Tepoca, Sonora Isla Angel de la Guarda	shore	Feb. 4, 1940	1077-40		1 ♀	
Puerto Refugio	shore	Mar. 20, 1937	707-37		1 ♀	
Puerto Refugio	shore	Jan. 27, 1940	1049-40		1 ♀	
Isla Pond S of Isla Angel de la Guarda	shore	Feb. 4, 1940	1079-40	1 ♂		
Ensenada de San Francisco, Sonora	shore	May 17, 1946	1516-46	1 ♂		E. Y. Dawson, F. E. Dur- ham
W side Isla Bargo, Bahía						
Concepción	shore	Mar. 27, 1949	1772-49	2 ♂		
Puerto Escondido	shore	Mar. 12, 1937	670-37	1 ♂		1 yg
Bahía de Agua Verde	shore	Feb. 27, 1936	522-36	1 ♂	1 ♀	
North Bay, Isla San Francisco	shore	Feb. 26, 1936	519-36		3 ♀	1 figured

TABLE 32  
PETROLISTHES BRACHYCARPUS Sivertsen

Locality	Fms.	Date	Station	Number and Sex	Remarks
Panama					
Bahía Honda	shore	Mar. 9, 1933	111-33	3 ♀ (1 ov)	extralimital
Galapagos Islands					
Isla Bindloe	shore	Dec. 2, 1934	306-35	6 ♀ (5 ov)	
Isla Tower					
Bahía de Darwin	shore	Feb. 22, 1933	93-33	2 ♀	
Bahía de Darwin	shore	Feb. 24, 1933	96-33	1 ♀ 1 ♀ ov	1 cheiliped only
Bahía de Darwin	shore	Feb. 24, 1933	97-33		
Isla Narborough, NE point	shore	Jan. 14, 1934	153-34	1 ♂	
Isla James					
Bahía de James	shore	Feb. 12, 1933	71-33	1 ♂	
Bahía de Sulivan	shore	Dec. 12, 1934	343-35	1 ♀ ov	
Isla Seymour [North Seymour]	shore	Jan. 22, 1934	175-34	3 ♀	
Isla Baltra [South Seymour]	shore	Feb. 19, 1933	88-33	3 ♀ ov	2 yg
Isla Baltra	shore	Jan. 22, 1934	174-34	1 ♂	
Isla Baltra	shore	Dec. 13, 1934	350-35	2 ♀ ov	
Isla Indefatigable					
Bahía de Conway	shore	Feb. 17, 1933	82-33	8 ♂	♂ figured
Bahía de Academia	shore	Feb. 3, 1933	49-33	12 ♀ (10 ov)	
Bahía de Academia	4-10	Feb. 4, 1933	51-33	1 ♀	
Bahía de Academia	shore	Feb. 3 or 4, 1933		1 ♂	
Bahía de Academia	shore	Dec. 7, 1934	314-35	5 ♂	<i>Vetulo III</i>
Isla Barrington	shore	Feb. 2, 1933	48-33	1 ♂	2 ♀ ov 5 ♀ (4 ov)
Isla Chatham					
Bahía de Stephens	shore	Jan. 31, 1933	42-33	4 ♂	3 ♀ (2 ov)
Wreck Bay	shore	Dec. 15, 1934	354-35		1 ♀ ov

Isla Charles Post Office Bay	shore	Sept. 7, 1925	4 ♂	11 ♀ (5 ov) 1 ♀ ov	1 yg	A. Wollebaek; syntypes, OM F.55
Cormorant Bay Flamingo Bay off Cormorant Bay	shore	Feb. 6, 1933	58-33	1 ♀ ov 1 ♀ ov	1 yg	
SE of Punta Cormorant Isla Hood	shore	Feb. 5, 1933	56-33	10 ♀ ov 25 ♀		
Bahía de Gardner Bahía de Gardner	shore	Jan. 29, 1933	38-33	(21 ov) 1 ♀ ov		
Isla Osborn in Bahía de Gardner	shore	Jan. 26, 1933	30-33			
Isla Osborn	shore	Dec. 17, 1934	358-35			
	shore	Jan. 24, 1933	24-33			
	shore	Dec. 19, 1934	359-35			

TABLE 33

## PETROLISTHES CRENULATUS Lockington

Baja California Bahía de la Magdalena E shore Isla Santa Margarita	shore	1917 Mar. 9, 1949	1719-49	1 ♂	1 yg	C. R. Orcutt; USNM
Gulf of California Puerto Refugio, I. Angel de la Guarda	shore	Mar. 4, 1936	545-36	1 ♀		
Bahía de los Angeles S shore Isla Tiburón	shore	Mar. 2, 1936	537-36	1 ♀		
I. Turner S of Isla Tiburón	shore	Jan. 25, 1940	1045-40	6 ♀		
Puerto Libertad, Sonora	shore	Jan. 24, 1940	1042-40	3 ♀		
	shore	Feb. 7, 1950		1 ♂		
vicinity of Puerto San Carlos, Sonora	shore	Mar. 24, 1949	1767-49	2 ♂		
Bahía de Guaymas, Sonora Bahía Catalina off Guaymas, Sonora	shore	Jan. 23, 1940	1041-40	2 ♀		
Puerto Escondido Puerto Escondido	shore	Feb. 9, 1940	1092-40	4 ♀		
	shore	Feb. 10, 1940	1094-40	1 ♂		
	shore	Mar. 20, 1949	1752-49	1 ♀		

B. W. Walker and party;  
USNM

PETROLISTHES CRENLATUS (cont.)		Fms.	Date	Station	Number and Sex	Remarks
Locality						
Gulf of California (cont.)						
North Bay, Isla San Francisco	shore	Feb. 25, 1936	518-36		2 ♀	
North Bay, Isla San Francisco	shore	Feb. 26, 1936	519-36	1 ♂		
E of Isla San Francisco	shore	Feb. 24, 1936	515-36		1 ♀	
Isla Espiritu Santo						
Bahía de Ballenas	shore	Feb. 23, 1936	512-36	1 ♂		
Cove S of Bahía de Ballenas	shore	Feb. 22, 1936	510-36	1 ♂		
Bahía San Gabriel	shore	Feb. 20, 1936	500-36	2 ♂	1 yg	
Bahía San Gabriel	shore	Feb. 14, 1940	1112-40	2 ♂	2 yg	♂ figured
Bahía San Gabriel	shore	Mar. 15, 1949	1737-49	1 ♂		
Bahía San Gabriel	shore	Mar. 15, 1949	1739-49	2 ♂		
La Paz	shore	Mar. 13, 1949	1734-49	1 ♂		L. Belding; USNM 4632
Los Frailes	shore	Mar. 11, 1949	1727-49	1 ♂		
1 mi N of Cabeza Ballena	shore	Dec. 6, 1946	Dawson	1 ♂		E. Y. Dawson; AHF; 1 cheliped only
Mazatlán, Sinaloa	shore		68			
Mexico						
Isla Isabel	10-15	Mar. 8, 1938	870-38	1 ♂		
Islas Las Tres Marias						
Isla María Madre	shore	Mar. 1930		2 ♂		
Isla María Cleofas	shore	Mar. 18, 1956	KW-17	2 ♂	2 ♀ ov	H. N. Lowe; USNM J. Knudsen; AHF
TABLE 34						
PETROLISTHES ORTMANNI Nobili						
Gulf of California						
vicinity of Puerto San Carlos,	shore	Mar. 24, 1949	1767-49		1 ♀	
Sonora	shore	Feb. 9, 1940	1092-40	1 ♂	2 ♀	
Bahía Catalina off Guaymas,	shore	Mar. 11, 1937	664-37	3 ♂	3 ♀	
Sonora					(1 ov)	
San Marcial Reef, Bahía de						
Agua Verde						





PETROLISTHES ORTMANNI (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Ecuador Bahía de Santa Elena				1 ♂	
Peru Islas Lobos de Afuera	shore	Jan. 17, 1935	391-35	2 ♀ (1 ov)	E. Festa; syntypes, TM
TABLE 35 PETROLISTHES LEWISI LEWISI (Glassell)					
Gulf of California E rim Bahía Salinas, Isla del Carmen	shore	Jan. 20, 1955	K-114	1 ♀ ov	J. Knudsen; AHF
Puerto Escondido San Marcial Reef, Bahía de Agua Verde	shore	Feb. 10, 1940	1094-40	1 ♂	
Bahía de San Lucas	shore	Mar. 11, 1937	664-37	1 ♀	
	shore	Apr. 1, 1949	1784-49	2 ♀ (1 ov)	
Cabo San Lucas				8 ♀	J. Xantus; MCZ 1377
				(6 ov)	
				3 ♀	S. A. Glassell; USNM
				(1 ov)	
Cabo San Lucas		Dec. 7, 1931		4 ♂	
Mexico Isla Isabel	shore	Feb. 16, 1932	19-32	1 ♀ ov	
Isla Isabel	shore	Apr. 3, 1937	749-37	6 ♀ (4 ov)	
Isla Isabel	shore	Mar. 8, 1938	869-38	2 ♀	
Isla Isabel	0-3	Jan. 26, 1954	2588-54	(1 ov)	
				2 ♀	
				(1 ov)	
Islas Las Tres Marias Isla María Magdalena	shore	May 9, 1939	972-39	4 ♂	1 ♀
Isla María Cleofas	shore	Feb. 7, 1954	2601-54	1 specimen, fragmented	

TABLE 36  
 PETROLISTHES LEWISI AUSTRINUS, new subspecies

Isla María Cleofas	shore	Mar. 17, 1956	KW-14	9 ♂	3 ♀ ov	J. Knudsen; AHF
Isla María Cleofas	shore	Mar. 18, 1956	KW-17	7 ♂	4 ♀ ov	J. Knudsen; AHF; ♀ figured
Bahía Tenacatita	shore	Dec. 1932			1 ♀ ov	F. O. Lewis; holotype, SDM 774
Bahía Tenacatita	shore	Dec. 1932		1 ♂		F. O. Lewis; paratype, SDM 775
Costa Rica						
Bahía de Salinas	shore	Feb. 10, 1935	474-35	1 ♂		holotype, USNM 102406
Port Parker	shore	Feb. 9, 1935	466-35	1 ♂		
Port Parker	shore	Feb. 9, 1935	466-35	21 ♂	22 ♀ (20 ov)	
Panama						
Isla Jicarita	shore	Feb. 20, 1934	243-34	1 ♂		
Isla Flamenco				1 ♂	1 ♀ ov	E. Festa; TM
Isla Taboga		Dec. 31, 1937		1 ♂	2 ♀ ov	Elinor D. Robson; USNM
Isla Otoque		Jan. 30, 1938		2 ♂		Elinor D. Robson; USNM
Isla Contadora, Islas de las Perlas		Apr. 14, 1938		1 ♂		Elinor D. Robson; USNM
Guayabo Chiquito	shore	Mar. 4, 1941	Askoy 30	5 ♂	1 ♀ ov	Askoy; AMNH 11844
Guayabo Chiquito	24-64 m [probably in error]	Mar. 4, 1941	Askoy 30	1 ♂		Askoy; AMNH 11779
Colombia						
Bahía de Cupica	shore	Jan. 26, 1935	427-35	1 ♂	4 ♀ ov	
Puerto Utría	shore	Feb. 14, 1934	232-34	6 ♂	7 ♀ (6 ov)	
Puerto Utría	shore	Jan. 23, 1935	413-35		1 ♀ ov	
Puerto Utría	shore	Jan. 24, 1935	418-35	2 ♂	1 ♀ ov	
Puerto Utría	shore	Feb. 25, 1938	858-38	1 ♂		
Bahía Cabita (Cabo Corrientes)	shore	Feb. 13, 1934	229-34	2 ♂	8 ♀ (6 ov)	

## PETROLISTHES LEWISI AUSTRINUS (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Ecuador					
Cabo de San Francisco	shore	Feb. 23, 1938	848-38	4 ♂ (2 ov)	♀ figured
W of Manta	shore	Jan. 20, 1935	403-35	2 ♂	
Punta Santa Elena	shore	Sept. 17, 1926		7 ♂ 11 ♀ (9 ov)	W. L. Schmitt; USNM
S of Punta Santa Elena	shore	Jan. 18, 1933	10-33	1 ♂ 6 ♀ ov	
TABLE 37					
PETROLISTHES ARTIFRONS, new species					
Costa Rica					
Port Parker	shore	Feb. 9, 1935	466-35	2 ♂ 5 ♀ (4 ov)	6 yg
Panama					
Isla Otoque		Jan. 30, 1938		1 ♂	Elinor D. Robson; USNM
San Francisco		Apr. 1, 1939		1 ♂	Elinor D. Robson; USNM
Guayabo Chiquito	shore	Mar. 4, 1941	Askoy 30	19 ♂ 21 ♀ (20 ov)	Askoy; AMNH 11777
				+ 1 fragmented	
Colombia					
Bahía de Cupica	shore	Jan. 26, 1935	427-35	1 ♂	
Bahía Limón, Golfo de Cupica	shore	May 17, 1941	Askoy 102	8 ♂ 19 ♀ (11 ov)	Askoy; AMNH 11778
				+ 1 fragmented	
Puerto Utría	shore	Feb. 14, 1934	232-34	5 ♂ 4 ♀ (3 ov)	9 yg
Puerto Utría	shore	Jan. 23, 1935	413-35		
Puerto Utría	shore	Jan. 24, 1935	418-35	1 ♀ ov	
Bahía Cabita (Cabo Corrientes)	shore	Feb. 13, 1934	229-34	3 ♂ 4 ♀ ov	
Ecuador					
Cabo de San Francisco	shore	Feb. 23, 1938	848-38		2 ♀ ov

Bahía de Manta  
W of Manta  
off La Libertad  
Punta Santa Elena  
S of Punta Santa Elena  
S of Punta Santa Elena

shore  
shore  
10  
shore  
shore  
shore  
shore

Jan. 19, 1935  
Jan. 20, 1935  
Jan. 20, 1933  
Sept. 17, 1926  
Jan. 18, 1933  
Jan. 18, 1933

400-35  
403-35  
15-33  
10-33  
10-33

13 specimens, fragmented  
2 ♀  
(1 ov)  
1 ♂  
25 ♂  
33 ♀  
(28 ov)  
1 ♂  
5 ♂  
(4 ov)

W. L. Schmitt; USNM

holotype, USNM 102407  
♂ figured

TABLE 38  
PETROLISTHES HIANS Nobili

Baja California  
Bahía de Santa Maria  
Gulf of California  
Bahía Catalina off Guaymas,  
Sonora  
off Arena Bank  
off Arena Bank  
Pulmo Reef  
Cabo San Lucas  
Mazatlán, Sinaloa  
Mexico  
Isla Isabel  
Isla Isabel

shore  
shore  
shore  
2.5  
2.5  
shore  
shore  
shore  
shore  
shore

Mar. 21, 1933  
Feb. 9, 1940  
May 2, 1936  
May 2, 1936  
Mar. 19, 1940  
Dec. 8, 1946  
Mar. 19, 1933  
Mar. 22, 1956

127-33  
1092-40  
1092-40  
Dawson  
125-33  
KW-28

9 ♂  
6 ♂  
4 ♂  
4 ♂  
ca. 650 specimens  
1 ♀  
3 ♂  
1 ♂

9 ♀  
(5 ov)  
1 ♀ ov  
4 ♀  
(1 ov)  
6 ♀ ov  
6 ♀  
(5 ov)  
2 ♀ ov

W. Beebe on *Zaca*, NYZS;  
holotype of *Pisosoma fla-*  
*graciliata*, AMNH  
11766  
W. Beebe on *Zaca*, NYZS;  
paratypes of *P. flagra-*  
*ciliata*, AMNH 11767  
E. F. Ricketts; USNM  
81893  
J. Xantus; MCZ 1372  
E. Y. Dawson; AHF  
J. Knudsen; AHF

## PETROLISTHES HIANS (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Mexico (cont.)					
Islas Las Tres Marias	shore	Feb. 7, 1954	2601-54	1 ♀ ov	
Isla María Cleofas	shore	Mar. 18, 1956	KW-17	4 ♀ ov	J. Knudsen; AHF
Isla María Cleofas				10 ♂	
Islas Las Tres Marietas, Bahía de Las Banderas	shore	Mar. 21, 1956	KW-25	1 ♂	J. Knudsen; AHF
Islas Revillagigedo					
Isla Socorro	14-18	Jan. 3, 1934	129-34	6 specimens, fragmented	
Bahía de Braithwaite	shore	Jan. 3, 1934	131-34	9 specimens, fragmented	
Bahía de Braithwaite		June 9, 1934	297-34	1 ♂	
E of Cabo Rule					
Isla Clarión	shore	Jan. 5, 1934	140-34	3 ♂	
Sulphur Bay	shore	Jan. 5, 1934	141-34	1 ♂	
Sulphur Bay	shore	June 10, 1934	298-34	3 ♀ ov	
Sulphur Bay	shore	May 15, 1936		2 ♀ ov	Zaca; AMNH 11839
Sulphur Bay	shore	Dec. 25, 1946	Dawson	1 ♀ ov	E. Y. Dawson; AHF
Barra Navidad			85		
Acapulco	shore	Feb. 2, 1947	Dawson	1 ♀ ov	E. Y. Dawson; AHF
			123		
San Lorenzo Rocks, Acapulco	shore	Jan. 30, 1954	2591-54	48 ♂	2 yg
				44 ♀	(39 ov)
Bahía Santa Lucia, Acapulco	1-4	Feb. 1-2, 1954	2596-54	39 ♂	6 yg
				44 ♀	(25 ov)
Salina Cruz	shore	Jan. 9, 1947	Dawson	1 ♂	♂ figured
			94		
Bahía Tangola-Tangola	shore	Mar. 1, 1934	261-34	5 ♂	E. Y. Dawson; AHF
Guatemala					
San José		1893		1 ♂	R. Paessler; HM K26839
				8 ♀	(6 ov)
El Salvador					
Acajutla		Apr. 23, 1912		2 ♂	R. Paessler; HM K26840

Costa Rica Port Parker	Jan. 1938	7 ♂	3 ♀ (2 ov)	Zaca; AMNH 11835
near S Islas Viradores, Puerto Culebra	Feb. 25, 1934	5 ♂	7 ♀ ov	
Panama				
Islas Secas	Feb. 4, 1935	8 ♂	8 ♀ ov	6 yg
Islas Secas	Feb. 4, 1935	2 ♂		
Bahía Piñas	Jan. 28, 1935	4 ♂	4 ♀ ov	+ ca. 6 specimens, fragmented
Bahía Piñas	Jan. 29, 1935	44 ♂	36 ♀ ov	4 yg
Colombia				
Puerto Utría	Feb. 15, 1934	19 ♂	11 ♀ (10 ov)	
Puerto Utría	Jan. 23, 1935	2 ♂		
Puerto Utría	Jan. 24, 1935	4 ♂	6 ♀ ov	1 yg
Puerto Utría	Feb. 25, 1938	859-38 2 ♂	1 ♀ ov	
Ecuador				
Bahía de Santa Elena		1 ♂	1 ♀ ov	E. Festa; syntypes, TM
TABLE 39				
NEOPISOSOMA BICAPILLATUM, new species				
Colombia				
Puerto Utría	Jan. 23, 1935	413-35 2 ♂	1 ♀ ov	
Ecuador				
La Libertad	Jan. 21, 1933	18-33 2 ♂	1 ♀ ov	♂ figured
Galapagos Islands				
Isla Albemarle				
Reef N of Tagus Hill	Feb. 9, 1933	65-33 1 ♂		holotype, USNM 102409
Reef N of Tagus Hill	Feb. 9, 1933	65-33 2 ♂	2 ♀ ov	

NEOPIPOSOMA BICAPILLATUM (cont.)		Date	Station	Number and Sex	Remarks
Locality	Fms.				
Galapagos Islands (cont.)					
Isla James					
Bahía de Sullivan	shore	Dec. 12, 1934	343-35	1 ♀ ov	
Isla Charles					
Black Beach	shore	Jan. 27, 1933	33-33	1 ♂	1 ♀ ov
MEXICO					
TABLE 40					
NEOPIPOSOMA MEXICANUM (Streets)					
Gulf of California					
Mazatlán, Sinaloa	shore	Dec. 6, 1946	Dawson 68	1 ♂	E. Y. Dawson; AHF
Mazatlán, Sinaloa	shore	Dec. 8, 1946	Dawson 71		E. Y. Dawson; AHF; 3 chelipeds only
Mexico					
Bahía Tenacatita	shore	Mar. 17, 1933	121-33	5 ♂	7 ♀ (6 ov)
Barra Navidad	shore	Dec. 25, 1946	Dawson 85	1 ♂	E. Y. Dawson; AHF
Acapulco	shore	Feb. 4, 1947	Dawson 131	1 ♂	E. Y. Dawson; AHF
San Lorenzo Rocks, Acapulco	shore	Jan. 30, 1954	2591-54	15 ♂	2 ♀ 28 ♀ (15 ov)
Golfo de Tehuantepec					
Salina Cruz	shore	Jan. 9, 1947	Dawson 94		1 yg holotype, ANSP 4139 E. Y. Dawson; AHF
Ecuador					
Bahía de Manta	shore	Jan. 19, 1935	400-35	3 ♂	4 ♀ (3 ov)
La Libertad	2	Jan. 21, 1933	18-33	1 ♂	1 ♀ ov
off La Libertad	10	Jan. 20, 1933	15-33	2 ♂	2 ♀ (1 ov)

♂ figured





PACHYCHELES CHACEI (cont.)						
Locality	Fms.	Date	Station	Number and Sex	Remarks	
Panama						
Isla Verde		Jan. 9, 1939		1 ♀ ov	Elinor D. Robson; USNM	
Bahía Piñas	2-4	Jan. 29, 1935	444-35	2 ♀ ov 1 ♂	♂ figured	
Ecuador						
La Libertad	2	Jan. 21, 1933	18-33	1 ♀	1 YG	
Bahía de Santa Elena				1 ♀ ov 1 ♂	E. Festa; TM	
TABLE 43						
PACHYCHELES CALCULOSUS, new species						
Mexico						
Bahía Santa Lucía, Acapulco	1-4	Feb. 1-2, 1934	2596-54	1 ♀		
Bahía Tangola-Tangola	shore	Mar. 1, 1934	261-34	2 ♀ ov 8 ♂	♂ figured	
Costa Rica						
Bahía de Salinas	shore	Feb. 10, 1935	474-35	1 ♂		
Panama						
Changamé		May 1, 1938		1 ♂	Elinor D. Robson; USNM	
Balboa, Canal Zone	shore			1 ♀ ov	M. Ward; USNM	
Panama City	shore	Feb. 2, 1935	445-35	1 ♀		
San Francisco		Apr. 1, 1939		1 ♀ ov 2 ♂	Elinor D. Robson; USNM	
Colombia						
Bahía Cabita (Cabo Corrientes)	shore	Feb. 13, 1934	229-34	2 ♂	2 ♀ ov	
Ecuador						
W of Manta	shore	Jan. 20, 1935	403-35	5 ♂		
S of La Libertad	shore	Jan. 20, 1933	16-33	1 ♂		
S of La Libertad	shore	Jan. 20, 1933	16-33	2 ♂		holotype, USNM 102410

TABLE 44  
PACHYCHELES SETIMANUS (Lockington)

Gulf of California	shore	Apr. 12-13, 1954 1921	2623-54	1 ♂	1 ♀ ov	AHF field party F. Baker; USNM 58108
San Felipe and 1-2 mi N Bahía de Tepoca, Sonora	shore	Jan. 30, 1940	1063-40		1 ♀	
Isla Willard, Bahía de San Luis Gonzaga	shore	Jan. 27, 1940	1049-40	3 ♂	3 ♀ ov	
Isla Angel de la Guarda	shore	Jan. 28, 1940	1053-40	2 ♂	4 ♀ (2 ov)	
Puerto Refugio	shore	Jan. 25, 1940	1045-40		1 ♀ ov	<i>Albatross</i> ; USNM 57156
Puerto Refugio	shore	Apr. 1, 1911			1 ♀ ov	
S shore Isla Tiburón	shore	Feb. 8, 1940	1091-40	3 ♂	6 ♀ (4 ov)	
Bahía San Francisquito	shore	May 17, 1946	1516-46		4 ♀ (3 ov)	E. Y. Dawson, F. E. Dur- ham
Puerto San Carlos, Sonora	shore	Jan. 23, 1940	1040-40	18 ♂	19 ♀	
Ensenada de San Francisco, Sonora	shore	Jan. 23, 1940	1041-40	24 ♂	(12 ov) 20 ♀ (11 ov)	♂ figured
Bahía de Guaymas, Sonora	shore	Feb. 9, 1940	1092-40		1 ♀ ov	H. T. Emeric; USNM 57675
Bahía de Guaymas, Sonora	shore	Mar. 27, 1949	1772-49	2 ♂		
Bahía Catalina off Guaymas, Sonora	shore	Mar. 20, 1949	1753-49		1 ♀ ov	
W side Isla Bargo, Bahía Concepción	shore	Mar. 16, 1936	591-36	1 ♂	1 ♀ ov	
N of Punta Coyote	shore	Mar. 12, 1937	670-37		1 ♀ ov	
Puerto Escondido	shore	Feb. 10, 1940	1094-40	5 ♂	5 ♀ (2 ov)	
Puerto Escondido	7	Mar. 18, 1949	1747-49	4 ♂	4 ♀ ov	
Puerto Escondido	shore	Mar. 18, 1949	1749-49		1 ♀	
Puerto Escondido	shore	Mar. 20, 1949	1752-49		1 ♀	
Puerto Escondido	shore	Jan. 21, 1955	K-116	2 ♂	1 ♀ ov	J. Knudsen; AHF

TABLE 45  
PACHYCHELES BIOCELLATUS (Lockington)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California					
Isla Espiritu Santo	shore	Feb. 14, 1940	1110-40	2 ♀ ov	
Bahia San Gabriel	1	Mar. 15, 1949	1737-49	1 ♂	
Bahia San Gabriel	2.5	May 2, 1936		1 ♂	
Arena Bank				1 ♀	
Arena Bank	2.5	May 2, 1936		1 ♂	W. Beebe on <i>Zaca</i> , NYZS; neotype, AMNH 11769
Los Frailes	shore	Mar. 13, 1949	1734-49	2 ♂	W. Beebe on <i>Zaca</i> , NYZS; [neo] allotype, AMNH 11770
Cabo San Lucas				4 ♀	J. Xantus; MCZ 1374
				(2 ov)	
Mexico					
Isla Isabel	shore	Mar. 22, 1956	KW-28	1 ♂	J. Knudsen; AHF
Islas Las Tres Marias				2 ♀	
Isla María Madre				(1 ov)	
Isla María Cleofas	shore	Mar. 1930		1 ♂	H. N. Lowe; USNM
Islas Revillagigedo		Mar. 18, 1956	KW-17	4 ♂	J. Knudsen; AHF
Isla Socorro		June 30, 1948		1 ♀	Exped. Esc. Sup. de Guerra; USNM 95521
Bahía de Braithwaite	shore	Jan. 2, 1934	128-34	1 ♀ ov	
Bahía de Braithwaite	shore	Jan. 3, 1934	131-34	ca. 100 specimens	
Isla Clarión					
Sulphur Bay	shore	June 10, 1934	298-34	3 ♂	
Sulphur Bay		May 15, 1936		1 ♀ ov	2 pairs chelipeds only <i>Zaca</i> ; AMNH 11833
Bahía Santa Lucía, Acapulco	1-4	Feb. 1-2, 1954	2596-54	1 ♂	
Bahía Tangola-Tangola	shore	Mar. 1, 1934	261-34		
Clipperton Island	shore	July 21, 1938		11 ♂	1 cheliped only
				8 ♀ ov	Pres. Cruise of 1938; USNM 98460

	Jan.	1938		16 ♂	11 ♀ (10 ov)	5 yg	Zaca; AMNH 11830
Costa Rica							
Port Parker							
near S Islas Viradores, Puerto Culebra	shores	Feb. 25, 1934	258-34	39 ♂	24 ♀ (21 ov)		
Panama							
Islas Secas	shores	Mar. 2, 1938	867-38	ca. 60 specimens			
Isla Taboguilla	1	Oct. 31, 1904		1 ♂			<i>Albatross</i> ; USNM 92792
Bahía Piñas	2-4	Jan. 29, 1935	444-35	ca. 100 specimens			
Colombia							
Bahía Octavia	shores	Jan. 28, 1935	435-35	ca. 60 specimens			
Puerto Utría	shores	Feb. 15, 1934	239-34	ca. 140 specimens			
Puerto Utría	3	Jan. 23, 1935	414-35	1 ♂	2 ♀ ov		
Puerto Utría	shores	Jan. 24, 1935	419-35	ca. 90 specimens			♂ figured
Puerto Utría	shores	Feb. 25, 1938	859-38	1 ♂			
off Isla Gorgona	3	Jan. 21, 1935	404-35	1 ♂			
Galapagos Islands							
Isla Tower							
Bahía de Darwin	shores	Feb. 22, 1933	94-33	19 ♂	24 ♀ (21 ov)		
Bahía de Darwin	shores	Feb. 24, 1933	96-33	2 ♂			
Bahía de Darwin	shores	Feb. 24, 1933	97-33	16 ♂	11 ♀ (10 ov)		
Bahía de Darwin	shores	Feb. 26, 1933	101-33	12 ♂	5 ♀ (3 ov)	3 yg	
Isla Albebarie							
Punta Albebarie	shores	Feb. 11, 1933	69-33	1 ♂	1 ♀ ov		
Tagus Cove	shores	Jan. 14, 1934	152-34	18 ♂	7 ♀ ov	3 yg	
Bahía de Cartago	shores	Feb. 14, 1933	76-33	26 ♂	28 ♀ (24 ov)		
Isla Bartolomé near Isla James	shores	Dec. 12, 1934	344-35	8 ♂	7 ♀ ov		
Isla Duncan	shores	Feb. 15, 1933	80-33	12 ♂	13 ♀ (12 ov)	5 yg	

PACHYCHELES BIOCELLATUS (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Galapagos Islands (cont.)					
Isla Indefatigable opposite Rocas Gordon	shore	Dec. 8, 1934	315-35	38 ♂ (34 ov)	
Isla Barrington	shore	Feb. 2, 1933	48-33	19 ♀ (17 ov)	
Isla Barrington	shore	Jan. 26, 1938	811-38	2 ♀ (1 ov)	
Isla Onslow N of Isla Charles	shore	Jan. 27, 1934	194-34	18 ♀ (16 ov)	2 YG
Isla Onslow	shore	Jan. 23, 1938	804-38	24 ♀ (22 ov)	2 YG
Isla Charles SE of Punta Cormorant	shore	Jan. 29, 1933	38-33	4 ♀ (3 ov)	
Isla Hood Bahia de Gardner	2.5	1925		1 ♂	W. Beebe on <i>Arcturus</i> , NYZS; holotype of <i>Pisosoma aphrodita</i> , AMNH 11771
Bahia de Gardner	2.5	1925		5 ♂	W. Beebe on <i>Arcturus</i> , NYZS; paratypes of <i>P. aphrodita</i> , AMNH 11772 & 11773
Bahia de Gardner	shore	Jan. 25, 1933	27-33	2 ♂	
Bahia de Gardner	2	Jan. 25, 1933	28-33	16 ♀ (14 ov)	
Bahia de Gardner	shore	Jan. 26, 1933	30-33	1 ♀ ov	
TABLE 46					
PACHYCHELES VICARIUS Nobili					
El Salvador Acajucla		Apr. 23, 1912		1 ♀ ov	R. Paessler; HM K26835







Bahía Santa Lucía, Acapulco	1-4	Feb. 1-2, 1954	2596-54	2 ♂	R. Paessler; HM K7646
Bahía Tangola-Tangola	shore	Mar. 1, 1934	261-34	1 ♂	
Guatemala					
San José		1893			3 ♀ (2 ov)
Costa Rica					
near S Islas Viradores, Puerto	shore	Feb. 25, 1934	258-34	1 ♂	
Culebra					
Panama					
Islas Secas	shore	Feb. 4, 1935	446a-35	1 ♂	
Islas Secas	shore	Feb. 4, 1935	447-35	1 ♂	
Islas de las Perlas		Apr. 1875			1 ♀ ov
Bahía Piñas	2-4	Jan. 29, 1935	444-35	16 ♂	13 ♀ (9 ov)
Colombia					
Puerto Utría	3	Jan. 23, 1935	414-35		1 ♀

TABLE 49

## PACHYCHELES PANAMENSIS Faxon

Gulf of California					
S shore Isla Tiburón	shore	Jan. 25, 1940	1045-40	7 ♂	♂ figured
Isla Turner S of Isla Tiburón	shore	Jan. 24, 1940	1042-40	1 ♂	
vicinity of Puerto San Carlos, Sonora	shore	Mar. 24, 1949	1767-49		1 ♀
Bahía Catalina off Guaymas, Sonora	shore	Feb. 9, 1940	1092-40	3 ♂	5 ♀ (3 ov)
Bahía Miramar near Guaymas, Sonora		Dec. 23, 1931		1 ♂	
Bahía Miramar near Guaymas, Sonora		Dec. 23, 1931			1 ♀ ov
Cabo San Lucas					4 ♀ (3 ov)
Mazatlán, Sinaloa		Dec. 8, 1931			1 ♀

S. A. Glassell; holotype of  
*Pachycheles sonorenensis*,  
USNM 71541

S. A. Glassell; paratype  
of *P. sonorenensis*, USNM

J. Xantus; MCZ 11847

CAS

## PACHYCHELES PANAMENSIS (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Mexico					
Isla Isabel	shore	Mar. 5, 1934	278-34	1 ♂	
Bahía Tenacatita	shore	Mar. 18, 1933	123-33	1 ♀ ov	
San Lorenzo Rocks, Acapulco	shore	Feb. 2, 1947	Dawson 123	1 ♂	E. Y. Dawson; AHF
San Lorenzo Rocks, Acapulco	shore	Jan. 30, 1954	2591-54	3 ♂	
Bahía Santa Lucía, Acapulco	1-4	Feb. 1-2, 1954	2596-54	8 ♂	7 yg
Bahía Tangola-Tangola	shore	Mar. 1, 1934	261-34	2 ♂	1 yg
El Salvador					
Acajutla		Apr. 23, 1912		1 ♂	R. Paessler; HM K7741
Panama					
Isla Verde		Jan. 9, 1939		5 ♀	Elinor D. Robson; USNM
Venado		Feb. 4, 1939		(4 ov)	
"Panama" [City?]		Mar. 12, 1891		2 ♀ ov	Elinor D. Robson; USNM
				1 ♀ ov	<i>Albatross</i> ; holotype, MCZ 4528
San Francisco		Apr. 1, 1939		1 ♀ ov	Elinor D. Robson; USNM
Ecuador					
off beach at La Libertad	+	Jan. 19, 1933	12-33	4 ♂	
Bahía de Santa Elena				1 ♂	E. Festa; TM

TABLE 50

## PACHYCHELES PUBESCENS Holmes

Oregon					
Boiler Bay N of Depoe Bay	shore	July 14, 1942	1479-42	1 ♂	AHF field party
RR bridge, Coos Bay	2-4	July 21, 1942	1482-42	2 ♂	<i>Rio Janeiro</i>
Fossil Point, Coos Bay	shore	June 27, 1942	1463-42		old submerged jetty; AHF field party
Hallmark Dock, Charleston	shore	July 24, 1942	1485-42	5 yg	AHF field party

Cape Arago lighthouse, reef and bight	shore	July 29, 1942	1490-42	1 ♂	1 ♀ ov	AHF field party
S side Sunset Bay	shore	June 28, 1942	1464-42	2 ♂	4 ♀ (2 ov)	AHF field party
Cape Arago State Park						
North Bay	shore	July 28, 1942	1489-42	1 ♂	1 ♀	AHF field party
Middle Bay	shore	July 1, 1942	1468-42			AHF field party
South Bay	shore	July 30, 1942				AHF field party
California						
Horseshoe Cove 2 mi N of Bodega Head	shore	Dec. 29, 1948	1674-49	1 ♂	1 ♀ ov	R. J. Menzies
North Jetty, Bodega Lagoon	shore	Mar. 11, 1949	1808-49	1 ♂	1 ♀ ov	R. J. Menzies
Campbell's Cove, Bodega Lagoon	shore	Feb. 9, 1949	1796-49	1 ♂	1 ♀ ov	R. J. Menzies
North Jetty, Bodega Bay	shore	Mar. 20, 1949	1813-49	1 ♂	2 ♀ (1 ov)	R. J. Menzies; ♀ figured
South Jetty, Bodega Bay	shore	Mar. 25, 1949	1818-49	1 ♂		R. J. Menzies
0.5 mi N of Cayucos	shore	Dec. 8, 1946	1576-46	1 ♂		J. S. Garth
0.5 mi W of Cayucos	shore	Jan. 3, 1947	1579-47			J. L. Mohr
0.75 mi W of Cayucos	shore	Jan. 4, 1947	1580-47		1 ♀	J. L. Mohr
San Miguel Island						
2.5 mi NE of Cardwell Point	23-30	Sept. 16, 1941	1416-41	1 ♂	1 ♀	
S of San Miguel Island	5-15	Aug. 10, 1938	894-38		2 ♀ (1 ov)	
Santa Rosa Island						
Bechers Bay	13-16	Aug. 18, 1939	1004-39	1 ♂	5 ♀ (1 ov)	
1 mi S of East Point	15-16	Apr. 10, 1941	1284-41	2 ♂	7 ♀	
2.5 mi E of South Point	15-21	Apr. 10, 1941	1280-41	1 ♂	2 ♀	1 YG
2.5 mi E of South Point	17-18	Apr. 10, 1941	1282-41		1 ♀	2 YG
3 mi E of South Point	17-20	Sept. 15, 1941	1410-41	1 ♂	1 ♀	
1.25 mi off S coast near E end		Apr. 27, 1947	H47-84			1 YG
Santa Cruz Channel	23-30	June 14, 1949	1855-49	4 ♂	1 ♀	C. L. Hubbs; AHF
San Pedro Breakwater	shore	Jan. 26, 1941	1230-41	1 ♂		
Baja California						
Bahia de Colnett	5-6	Mar. 2, 1949	1688-49	2 ♂	3 ♀ (2 ov)	
off Thurloe Head	30	Mar. 9, 1934	284-34	1 ♂		

TABLE 51  
PACHYCHELES CRINIMANUS, new species

Locality	Fms.	Date	Station	Number and Sex	Remarks
Peru					
Bahía de Sechura	ca. 5	Apr. 8, 1907	4 ♂	4 ♀ ov	R. E. Coker; USNM 40476
Bahía de Sechura	9.5	Feb. 15, 1938	845-38	1 ♂	holotype, AHF 3815
Bahía de Sechura	9.5	Feb. 15, 1938	845-38	5 ♂	paratypes; ♂ figured
Salaverry		Oct. 19, 1926	1 ♂	1 ♀ ov	W. L. Schmitt; paratypes, USNM
Salaverry		Oct. 21-22, 1926	36 ♂	28 ♀	W. L. Schmitt; paratypes, USNM
Salaverry		Oct. 23-24, 1926	ca. 140 specimens	(24 ov)	W. L. Schmitt; USNM 98518
off Middle Chincha I., Islas de Chincha	5	Jan. 15, 1935	387-35	4 ♂	paratypes
E of Isla de las Viejas, Bahía de la Independencia	7	Jan. 13, 1935	376-35	4 ♂	paratypes
Bahía de San Juan	shore	Feb. 7, 1938	825-38	1 ♂	paratype

TABLE 52  
PACHYCHELES GROSSIMANUS (Guérin)

Peru					
North Chincha I., Islas de Chincha		June 18, 1907		1 ♀	R. E. Coker; USNM 40477
North Chincha I., Islas de Chincha	shore	Feb. 11, 1938	837-38	1 yg	
Bahía de la Independencia	shore	Jan. 14, 1935	380-35	1 ♀ ov	
Bahía de la Independencia	shore	Feb. 9, 1938	831-38	11 ♀ (6 ov)	♀ figured
Bahía de San Juan	shore	Feb. 7, 1938	825-38	1 ♀ ov	
Chile					
Arica		Mar. 1955		1 ♀	E. R. Guiler; USNM 98288
Iquique		Feb. 1955		1 ♀ ov	E. R. Guiler; USNM 98289



PACHYCHELES RUDIS (cont.)						
Locality	Fms.	Date	Station	Number and Sex	Remarks	
Oregon (cont.)						
Cape Arago State Park						
Middle Bay	shore	July 26, 1942	1487-42	12 ♂	11 ♀ (6 ov)	AHF field party
Middle Bay	shore	July 1, 1942	1468-42	2 ♂		AHF field party
South Bay	shore	July 30, 1942	1492-42	17 ♂	17 ♀ (14 ov)	AHF field party
California						
Mendocino County						
Salmon Point	shore	June 11, 1949	EB-9	1 ♂	1 ♀ ov	W. K. Emerson, J. L. Barnard; AHF
Little River Cove	shore	July 15, 1949	EB-44	1 ♂		W. K. Emerson, J. L. Barnard; AHF
Point Arena	shore	June 30, 1949			1 ♀ ov	W. K. Emerson, J. L. Barnard; AHF
Point Arena	shore	July 1, 1949	EB-27	1 ♂		W. K. Emerson, J. L. Barnard; AHF
Point Arena	shore	July 1949	EB-41	13 ♂	10 ♀ (8 ov)	W. K. Emerson, J. L. Barnard; AHF
Sonoma County						
Shell Beach	shore	Dec. 18, 1949	M97-49		1 ♀	L. O. Miles; AHF
Shell Beach	shore	Jan. 31, 1950	M108-50		2 yg	L. O. Miles; AHF
Shell Beach	shore	Feb. 2, 1950	M110-50	2 ♂	3 ♀ (2 ov)	L. O. Miles; AHF
Stewart's Point	shore	Aug. 13, 1950	M142-50		1 ♀ ov	L. O. Miles; AHF
E Beach 1 mi N of mouth of Russian River	shore	Jan. 12, 1949	1676-49	3 ♂	5 ♀ (3 ov)	R. J. Menzies
Carmet, 1 mi N of Salmon Creek	shore	Oct. 31, 1948	1627-48		1 ♀	R. J. Menzies
Carmet, 1 mi N of Salmon Creek	shore	Nov. 16, 1948	1654-48	2 ♂	1 ♀ ov	R. J. Menzies

Horseshoe Cove 2 mi N of Bodega Head	shore	Dec. 29, 1948	1674-49	4 ♂	6 ♀ (4 ov)	3 yg	R. J. Menzies
Horseshoe Cove	shore	Jan. 13, 1949	1677-49	4 ♂	5 ♀ (3 ov)	5 yg	R. J. Menzies
Horseshoe Cove	shore	Jan. 23, 1949	1683-49	2 ♂	1 ♀ ov	1 yg	R. J. Menzies
Horseshoe Cove	shore	Jan. 27, 1949	1792-49				R. J. Menzies
Mussel Point 2 mi N of Bodega Head	shore	Feb. 10, 1949	1797-49	2 ♂	5 ♀ ov		R. J. Menzies
Bodega Lagoon	shore	Mar. 11, 1949	1808-49	8 ♂	4 ♀ ov		R. J. Menzies
North Jetty	shore	Dec. 27, 1948	1672-49	1 ♂		6 yg	R. J. Menzies
Campbell Cove	shore	Jan. 23, 1949	1682-49	2 ♂	6 ♀ (4 ov)		R. J. Menzies
Campbell Cove	shore	Feb. 9, 1949	1796-49	2 ♂	2 ♀ ov	1 yg	R. J. Menzies
Campbell Cove	shore	Feb. 11, 1949	1798-49	1 ♂	1 ♀ ov		R. J. Menzies
Campbell Cove	shore	July 11, 1949	M60-49	6 ♂	9 ♀ (7 ov)	1 yg	L. O. Miles, W. K. Emerson; AHF
Bodega Head	shore	Aug. 6, 1948	1609-48			1 yg	R. J. Menzies
Bodega Head	shore	Jan. 24, 1949	1684-49	4 ♂	1 ♀ ov		R. J. Menzies
Bodega Bay	shore	Feb. 25, 1949	1802-49	1 ♂	3 ♀ (2 ov)		R. J. Menzies
North Jetty	shore	Mar. 20, 1949	1813-49		3 ♀ (1 ov)	4 yg	R. J. Menzies
North Jetty	shore	Mar. 21, 1949	1814-49	5 ♂	5 ♀	5 yg	R. J. Menzies
North Jetty	shore	Mar. 22, 1949	1815-49	6 ♂	6 ♀ (1 ov)	10 yg	R. J. Menzies
South Jetty	shore	Mar. 23, 1949	1816-49		5 ♀ (1 ov)	5 yg	R. J. Menzies
South Jetty	shore	Mar. 24, 1949	1817-49	4 ♂	8 ♀ (1 ov)	4 yg	R. J. Menzies
South Jetty	shore	Mar. 25, 1949	1818-49	4 ♂	8 ♀ (1 ov)	4 yg	R. J. Menzies
South Jetty	shore	Aug. 8, 1949	M71-49	5 ♂	4 ♀ ov		L. O. Miles, W. K. Emerson; AHF

PACHYCHELES RUDIS (cont.)								
Locality	Fms.	Date	Station	Number and Sex	Remarks			
California (cont.)								
Marin County								
Dillon Beach	shore	Aug. 4, 1948	1607-48	16 ♂	7 ♀ (5 ov)	6 yg	R. J. Menzies	
Second Sled Road	shore	Oct. 20, 1948	1626-48	2 ♂	2 ♀ ov	4 yg	R. J. Menzies	
Second Sled Road	shore	Nov. 15, 1948	1653-48	1 ♂	1 ♀	14 yg	R. J. Menzies	
Tomales Point	shore	Aug. 5, 1948	1608-48	7 ♂	13 ♀ (11 ov)	7 yg	R. J. Menzies	
Tomales Bluff, bay side	shore	Nov. 2, 1948	1628-48	8 ♂	11 ♀ (9 ov)	2 yg	AHF field party	
Monterey County								
Elkhorn Slough	shore	Feb. 5, 1947	1590-47	1 ♂	2 ♂		A. S. Taylor; syntypes, MCZ 1389	
Monterey							AHF field party	
Point Pinos	shore	Feb. 4, 1947	1588-47	2 ♂			J. L. Barnard, J. Worden	
Point Pinos	shore	Dec. 26, 1947	1604-47	1 ♂				
Kasler Pt. between Pt. Sur and Pt. Lobos	shore	Feb. 3, 1947	1587-47	1 ♂	1 ♀		AHF field party	
Pacific Grove	shore	Aug. 25, 1942	1455-42	1 ♂	1 ♀ ov	1 yg	AHF field party	
S side lighthouse rock, Big Sur	shore	Feb. 6, 1947	1592-47	1 ♂	1 ♀ ov		AHF field party	
San Luis Obispo County								
Piedras Blancas	shore	Mar. 31, 1947	1598-47	4 ♂	4 ♀ (1 ov)	1 yg	AHF field party	
Leffingwell Landing near Cambria	shore	Jan. 5, 1947	1581-47	1 ♂	6 ♀ ov	8 yg	J. L. Mohr	
0.5 mi N of Cayucos	shore	Dec. 8, 1946	1576-46	24 ♂	37 ♀ (27 ov)	2 yg	J. S. Garth	
0.5 mi W of Cayucos	shore	Jan. 3, 1947	1579-47	2 ♂	4 ♀	1 yg	J. L. Mohr	



0.75 mi W of Cayucos	shore	Jan. 4, 1947	1580-47	12 ♂	11 ♀ (10 ov)	J. L. Mohr
4.5 mi westward to Cayucos, mouth of Villa Creek	shore	Jan. 7, 1947	1583-47	10 ♂	10 ♀ ov	J. L. Mohr
Santa Barbara County 6.7 mi S of Surf (Pedernales Point)	shore	Dec. 7, 1946	1575-46	2 ♂	1 ♀	J. S. Garth
Pt. Arguello, USCG Life Boat Station	shore	Mar. 13, 1942	1447-42		1 ♀ ov	AHF field party
Stevens Wharf, Santa Barbara	shore	Apr. 25, 1947	H47-74	2 ♂	2 ♀ ov	C. L. Hubbs; AHF
Santa Rosa Island Bechers Bay	13-16	Aug. 18, 1939	1004-39		1 ♀ ov	
Santa Cruz Island SW shore Smugglers Cove	shore	Dec. 29, 1948	1660-48			1 yg
Los Angeles County Venice		Feb. 19, 1913			1 ♀ ov	J. R. Beck; AHF
Hermosa Beach		Feb. 10, 1947	1593-47		1 ♀	pilings from wrecked pier; J. L. Mohr
Redondo Beach	40 ft	June-July 1941	Burch 4113	20 ♂	20 ♀ (15 ov)	submerged pilings; T. A. Burch; AHF
Palos Verdes		Dec. 24, 1939	Burch 3962	3 ♂	1 ♀ ov	T. A. Burch; AHF
off Bluff Cove, Palos Verdes		June 23, 1940	Burch 4085			T. A. Burch; AHF
Portuguese Bend	shore	Nov. 21, 1938	902-38		1 ♀	
Portuguese Bend	shore	May 1948		3 ♂	8 ♀ (7 ov)	B. C. Walton; AHF
Portuguese Bend	shore	Mar. 11, 1949		2 ♂	1 ♀ ov	AHF
San Pedro breakwater	shore	Jan. 26, 1941	1230-41	1 ♂	3 ♀ (2 ov)	
Santa Catalina Island White Cove	9-11	Dec. 1, 1948	1648-48			1 yg

PACHYCHELES RUDIS (cont.)									
Locality	Fms.	Date	Station	Number and Sex	Remarks				
California (cont.)									
Orange County									
Balboa, Newport Channel	shore	Jan. 25, 1941	1224-41	9 ♂	6 ♀ (5 ov)	4 yg			
Corona del Mar		Oct. 1941			1 ♀				N. MacGinitie; AHF
Corona del Mar	shore	Nov. 9, 1946	1572-46	2 ♂	1 ♀ ov				AHF field party
Corona del Mar side, Newport Channel	shore	Feb. 21, 1956		1 ♂		1 yg			J. Knudsen; AHF
Abalone Cove		Mar. 13, 1949		6 ♂	5 ♀ ov				AHF
Laguna Beach	shore	Nov. 29, 1940	1209-40	2 ♂	7 ♀ ov				
San Diego County									
La Jolla	shore	Nov. 28, 1940	1210-40	3 ♂	2 ♀ (1 ov)				
Baja California									
N of Pta. Descanso, 2 mi S of Rosarito	shore	Mar. 6, 1947	1597-47	1 ♂	1 ♀ ov				AHF field party
mouth of Río de Santo Tomás	shore	Mar. 4, 1947	1595-47	12 ♂	12 ♀ (11 ov)	1 yg			AHF field party
mouth of Río de Santo Tomás	shore	Mar. 5, 1947	1596-47	1 ♂					AHF field party
Cabo Colnett	shore	Jan. 13, 1946	1504-46		1 ♀ ov				E. Y. Dawson, F. E. Durham
Bahía de Colnett	5-6	Mar. 2, 1949	1688-49	1 ♂					
South Bay, Isla de Cedros	shore	Mar. 10, 1934	288-34			6 yg			
South Bay, Isla de Cedros	shore	Apr. 19, 1951	2027-51			1 yg			
1.1 mi NNE of Kelp Point, Pto. de San Bartolomé	shore	Feb. 11, 1954	2603-54	9 ♂	6 ♀ (5 ov)	1 yg			
Bahía de la Magdalena		1917		1 ♂					C. R. Orcutt; USNM

TABLE 54  
PACHYCHELES HOLOSERICUS Schmitt

Locality	Fms.	Date	Station	Number and Sex	Remarks
California					
Stevens Wharf, Santa Barbara	shore	Apr. 25, 1947	H47-74	1 ♂	C. L. Hubbs; AHF; figured
Venice				1 ♀ ov	<i>Anton Dolru</i> ; holotype, USNM 50156
Venice				2 ♀ ov	<i>Anton Dolru</i> ; paratypes, USNM
Redondo Beach	40 ft	June-July 1941	Burch 47 ♂ 4113	61 ♀ (43 ov)	from submerged pilings; T. A. Burch; AHF
Palos Verdes		Dec. 24, 1939	Burch 2 ♂ 3962	2 ♀ (1 ov)	T. A. Burch; AHF
off Bluff Cove, Palos Verdes		June 23, 1940	Burch 4085	2 ♀ ov	T. A. Burch; AHF
Portuguese Bend	shore	Dec. 8, 1938	906-38	1 ♀	
Portuguese Bend	shore	May 1948		1 ♀	B. C. Walton; AHF
Point Fermin	shore	Nov. 30, 1940	1217-40	1 ♀	
San Pedro breakwater	shore	Jan. 26, 1941	1230-41	5 ♀ (4 ov)	
W shore Anaheim Landing	shore	Feb. 12, 1942	1445-42	1 ♂	AHF field party
Balboa peninsula, bay side	shore	Mar. 13, 1942	1449-42	1 ♀ ov	off floats and piles; AHF field party
Balboa, Newport Channel	shore	Jan. 25, 1941	1224-41	11 ♂ (8 ov)	
Corona del Mar	shore	Oct. 1941		1 ♀	N. MacGinitie; AHF
Corona del Mar	shore	Nov. 9, 1946	1572-46	21 ♂ 23 ♀ (15 ov)	AHF field party
Abalone Cove	shore	Mar. 13, 1949		2 ♂	AHF
Laguna Beach	shore	Dec. 6, 1938	904-38	1 ♂	
Laguna Beach	shore	Nov. 29, 1940	1209-40	3 ♂	

PACHYCHELUS HOLOSERICUS (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
California (cont.)					
La Jolla	shore	Nov. 28, 1940	1210-40	6 ♂ 5 ♀ (4 ov)	
La Jolla	shore	Jan. 15, 1946	1506-46	1 ♂ 1 ♀ ov	E. Y. Dawson, F.E. Durham
Baja California					
2.5 mi N of La Playita (N of Ensenada)		Apr. 10, 1950	BC6-50	2 ♂	L. O. Miles; AHF
1.1 mi NNE of Kelp Pt., Pto. de San Bartolomé	shore	Feb. 11, 1954	2603-54	1 ♂ 41 ♀	<i>Yelero III</i> ; USNM 68573
Bahía de Santa María		Mar. 21, 1933	48 ♂	3 ♀ (3 ov)	C. R. Orcutt; USNM 50649
Bahía de la Magdalena		1917	3 ♂	(1 ov)	

TABLE 55

## ALLOPETROLISTHES ANGULOSUS (Guérin)

Peru					
Paita					
San Lorenzo					
Paracas					
Bahía de la Independencia	shore	Jan. 14, 1935	380-35	2 ♂ 23 ♂	5 ♀ ov Hastler; MCZ 7964 U. S. Expl. Exped.; MCZ 1409
Bahía de la Independencia	9-10	Jan. 14, 1935	385-35	37 ♀ (36 ov)	Hastler; MCZ 7974
Bahía de la Independencia	shore	Feb. 9, 1938	831-38	1 ♀ ov 33 ♀	
E of Isla de las Viejas	shore	Jan. 13, 1935	375-35	11 ♂ 8 ♀ (7 ov)	2 specimens, dry ♂ figured U. S. Expl. Exped.; ANSP 4160

—	Nov. 17, 1866	3 ♂	4 ♀ (3 ov)	H. Edwards; MCZ 7959
Chile				
Arica	Mar. 1955	1 ♂		E. R. Guiler; USNM 98283
Iquique	July 4, 1949	1 ♂	1 ♀ ov	Lund Univ. Chile Exped.; AHF
Tocopilla	Nov. 14, 1926		2 ♀ ov	W. L. Schmitt; USNM 93322
Antofagasta	Nov. 15, 1926	17 ♂	28 ♀ (21 ov)	W. L. Schmitt; USNM
Antofagasta	Feb. 1955	2 ♂		E. R. Guiler; USNM 98285 & 98286
Chañaral	Nov. 16, 1926	2 ♂	8 ♀ (6 ov)	W. L. Schmitt; USNM
Coquimbo	Feb. 1955		2 ♀	E. R. Guiler; USNM 98284
Valparaiso		2 specimens, dry		Guérin collection; types ♀, ANSP 3352
Valparaiso			3 ♀ (2 ov)	<i>Magenta</i> ; USNM 19535
Talcahuano	1872	ca. 70 specimens		<i>Hassler</i> ; MCZ 7957

TABLE 56

## ALLOPETROLISTHES SPINIFRONS (H. Milne Edwards)

Peru				
Islas Pescadores	Feb. 12, 1907		1 ♀	R. E. Coker; USNM 40487
Bahía de la Independencia	Jan. 14, 1935	380-35	1 ♀ ov	
Bahía de la Independencia	Feb. 9, 1938	831-38	1 ♀ ov	
E of Isla de las Viejas	Jan. 13, 1935	375-35	3 ♂ 7 ♀ (5 ov)	♂ figured
Bahía de San Juan	Feb. 8, 1938	828-38	1 ♂ 1 ♀	
—	Nov. 17, 1866	2 ♂	1 ♀ ov	H. Edwards; MCZ 9794

## ALLOPETROLISTHES SPINIROUS (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Chile					
Iquique	8		1 ♂	1 ♀	F. Ringe; from HM collection; AHF
Antofagasta		Nov. 15, 1926	2 ♂	14 ♀ (9 ov)	W. L. Schmitt; USNM 98455
Antofagasta		Nov. 15, 1926		3 ♀ ov	W. L. Schmitt; USNM
Montemar near Valparaiso	7	Jan. 1955		1 ♀	USNM 98282
Talcahuano		1872	3 ♂	2 ♀	<i>Hasler</i> ; MCZ 8014

## TABLE 57

## EUCERAMUS PANATELUS Glassell

Mexico					
Bahía Chacahua	10-15	Mar. 20, 1939	927-39	1 ♀	
Bahía Tangola-Tangola	15-20	Feb. 28, 1934	259-34	1 specimen	abdomen missing
Guatemala off San José light	7-11	Jan. 11, 1938	770-38	33 ♂ 29 ♀ (12 ov)	♂ figured
Costa Rica Golfo Dulce	10-22	Mar. 26, 1939	939-39	1 ♂	
Ecuador La Libertad	6-9	Mar. 24, 1937		1 ♂	W. Williams on <i>Stranger</i> ; holotype, SDM 1126

## TABLE 58

## EUCERAMUS TRANSVERSILINEATUS (Lockington)

Baja California 0.5 mi SE of Punta Hughes, Bahía de Santa María	5-18	Apr. 4, 1949	1787-49	1 ♀	1 yg
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Bahía de la Magdalena 5 mi NE of Punta Entrada 2 mi E of Punta Entrada 1 mi off Punta Entrada	13 17-18 28-34	Mar. 8, 1949 Mar. 8, 1949 May 3, 1950	1715-49 1714-49 1965-50	1 ♂ 1 ♀ 1 ♀	<i>Hassler</i> ; MCZ 11822 figured
Gulf of California Punta Peñasco, Sonora	shore	Apr. 13, 1937		1 ♂	S. A. Glassell; [neo]- allotype, SDM 1128
off Punta Peñasco, Sonora Puerto Refugio, Isla Angel de la Guarda	10-11 21	Feb. 2, 1940 Jan. 27, 1940	1072-40 1051-40	1 ♂ 1 ♀	
Bahía de los Angeles Bahía de los Angeles off N end Isla Tiburón	20 18 12	Jan. 4, 1932 Mar. 20, 1937 Jan. 1, 1932	702-37	2 ♂ 1 ♂ 1 ♀	S. A. Glassell; USNM S. A. Glassell; neotype, SDM 1127
Ensenada de San Francisco, Sonora	2-6	Feb. 7, 1940	1088-40	1 ♂	
Costa Rica Port Parker	5-10	Mar. 25, 1939	936-39	1 ♂	
Panama Isla Taboga	2-5	May 2, 1939	960-39	1 ♂	
TABLE 59 MINYOCERUS KIRKI Glassell					
Gulf of California off Punta Peñasco, Sonora San Felipe	3-10 shore	Feb. 3, 1940 May 11, 1937	1073-40	2 ♂ 1 ♂	S. A. Glassell; holotype, SDM 1129 S. A. Glassell; paratype, SDM 1130 S. A. Glassell; paratype, USNM 75436
San Felipe	shore	May 11, 1937		1 ♀ ov	
San Felipe	shore	May 11, 1937		1 ♀ ov	
Bahía de Tepoca, Sonora	11-13	Feb. 4, 1940	1078-40	1 ♂ 2 ♀	

MINTYOCERUS KIRKI (cont.)						
Locality	Fms.	Date	Station	Number and Sex	Remarks	
El Salvador	4	1893		2 ♀ ov		
La Unión, Golfo de Fonseca	5-6	Dec. 27, 1937	Zaca 199	12 ♀	R. Paessler; HM K7668	
La Unión, Golfo de Fonseca			D-7 to 16	(10 ov)	Zaca; AHF	24 yg
Cutuco, Golfo de Fonseca		Dec. 21, 1937		3 ♀ ov	Zaca; AHF	
Nicaragua						
Punta Monypenny, Golfo de Fonseca	4-7	Dec. 24, 1937	Zaca 199	11 ♀	Zaca; AHF	
			D-5 and 6	(9 ov)		
TABLE 60						
PORCELLANA CANCRISOCIALIS Glassell						
Baja California						
Bahía de Santa María	5-25	Mar. 21, 1933	126-33	4 ♀		
				(3 ov)		
Bahía de Santa María	shore	Mar. 21, 1933	127-33	1 ♀ ov		
Bahía de Santa María	18-25	Jan. 19, 1940	1031-40	9 ♀		2 yg
				(2 ov)		
0.5 mi SE of Pta. Hughes	5-18	Apr. 4, 1949	1787-49	3 ♀		
				(2 ov)		
off Punta Tosco	15	Feb. 16, 1936	493-36	1 ♀ ov		
Gulf of California						
Punta Peñasco, Sonora	shore	May 2, 1935		1 ♀	S. A. Glassell; holotype, USNM 71542	
Punta Peñasco, Sonora	shore	May 2, 1935			S. A. Glassell; paratype, USNM	
Punta Peñasco, Sonora	shore	May 2, 1935		1 ♀	S. A. Glassell; paratypes, SDM 781 & 782	
Bahía de Tepoca, Sonora	11-13	Feb. 4, 1940	1078-40	1 ♀		
N of Punta Lobos, Sonora	25	Mar. 26, 1937	726-37	1 ♂		



off Pta. Willard, Bahía de San Luis Gonzaga	2-3	Mar. 23, 1937	716-37	1 ♂		
Canal de Los Angeles	30	Mar. 19, 1937	699-37		1 ♀	
Ensenada Bocoichibampo, Guaymas, Sonora	shore	May 16, 1946	1515-46		1 ♀ ov	E. Y. Dawson, F. E. Durham
E of Isla San Marcos	12	Mar. 14, 1936	581-36	1 ♂	1 ♀ ov	
off Bahía Concepción	3	Mar. 15, 1937	681-37	4 ♂	6 ♀ (5 ov)	♂ figured
Bahía Coyote, Bahía Concepción	2-3	Mar. 14, 1936	585-36		1 ♀ ov	
Bahía de San Ignacio, Sinaloa	3-5	Mar. 31, 1937	740-37	3 ♂	3 ♀ ov	
off Isla San Francisco	30	Feb. 24, 1936	513-36	1 ♂		
off Bahía San Gabriel, I. Espíritu Santo	29-35	Feb. 13, 1940	1107-40	1 ♂		
Mazatlán, Sinaloa	15 m	Aug. 20, 1906		5 ♂	3 ♀	R. Paessler; HM K7679
Mexico						
Isla Isabel	10-18	Apr. 2, 1937	745-37		1 ♀ ov	
Manzanillo	15 m	Aug. 17, 1906		2 ♂	1 ♀ ov	R. Paessler; HM K7678
Bahía Tangola-Tangola and Bahía de Santa Cruz	15-20	Feb. 28, 1934	259-34	1 ♂	2 ♀ ov	
Guatemala						
San José	9-12	1888, 1893		2 ♂	1 ♀ ov	R. Paessler; HM K7644
off Punta San José	7-11	Jan. 11, 1938	770-38	1 ♂		
El Salvador						
Acajutla	8.5	Dec. 16, 1906		7 ♂	10 ♀ (9 ov)	B. Jansen; HM K7527
Costa Rica						
Bahía de Salinas	2	Feb. 11, 1935	477-35	1 ♂		
Bahía de Salinas	12	Feb. 11, 1935	480-35		1 ♀ ov	
Port Parker	5	Feb. 9, 1935	468-35		1 ♀ ov	
Port Parker	5-10	Mar. 25, 1939	936-39		1 ♀	

PORCELLANA CANCRISOCIALIS (cont.)					
Locality	Fms.	Date	Station	Number and Sex	Remarks
Costa Rica (cont.)					
Puerto Culebra	10	Feb. 24, 1934	253-34	1 ♂	
Puerto Culebra	3-10	Feb. 24, 1934	254-34	2 ♂	
Bahía Cocos S of Puerto Culebra	2	Mar. 13, 1933	116-33	1 ♂ 6 ♀ (3 ov)	
Panama					
3 mi S of Islas Ladronez	54	Mar. 27, 1939	943-39	1 ♂	
Islas Secas	12	Feb. 5, 1935	448-35	3 ♂	
—	6-8 m	1905		1 ♂	R. Paessler; HM K7665
Ecuador					
Manta		1893		1 ♂	R. Paessler; HM K7670
off Bahía de Santa Elena	8-10	Feb. 9, 1934	209-34	1 ♀	
Bahía or Punta Santa Elena		Jan. 18-20, 1933		1 ♀ 1 ♀ ov	<i>Yelero III</i>
TABLE 61					
PORCELLANA PAGURICONVIVA Glassell					
Baja California					
Bahía de la Magdalena	13.5	Mar. 21, 1911	<i>Albatross</i> 5678	2 ♂	<i>Albatross</i> ; USNM 98484
Gulf of California					
Punta Peñasco, Sonora	shore	May 1, 1935		1 ♂	S. A. Glassell; holotype, USNM 71543
Punta Peñasco, Sonora	shore	May 1, 1935		1 ♀ ov	S. A. Glassell; paratype, USNM
Punta Peñasco, Sonora	shore	May 1, 1935		1 ♂	S. A. Glassell; paratypes, SDM 783 & 784
Puerto Peñasco, Sonora		Dec. 23, 1947		3 ♂	G. E. and N. MacGinitie; USNM 89464
off Bahía de Adair, Sonora	10	Mar. 26, 1889	<i>Albatross</i> 3027	1 ♀ ov	<i>Albatross</i> ; USNM 98482

off Bahía de San Jorge, Sonora	14	Mar. 24, 1889	<i>Albatross</i> 3021	2 ♂	1 ♀	<i>Albatross</i> ; USNM 98483
Bahía de Tepoca, Sonora	11-13	Feb. 4, 1940	1078-40	1 ♂	1 ♀	
N of Punta Lobos, Sonora	25	Mar. 26, 1937	726-37	1 ♂	1 ♀	S. A. Glassell; USNM
N end Isla Tiburón	20	Jan. 1, 1932		1 ♂		
outside Bahía Guaymas, Sonora	6-10	Jan. 23, 1940	1039-40	1 ♂		
Bahía Concepción	12	Mar. 16, 1937	686-37	2 ♂	1 ♀	
Bahía Coyote, Bahía Concepción	2-3	Mar. 14, 1936	585-36	1 ♂	2 ♀	
off Isla Hildefonso	50	Mar. 15, 1937	677-37	1 ♂		
Bahía de San Ignacio, Sinaloa	3-5	Mar. 31, 1937	740-37			
Mexico						
Bahía Tenacatita	5	Feb. 15, 1935	485-35	5 ♂	3 ♀ (2 ov)	A. Agassiz; MCZ 1125 <i>Hasler</i> ; MCZ 11892 R. Paessler; HM K26844
Acapulco		Jan. 26, 1860		2 ♂	1 ♀ ov 1 ♀ ov	
Acapulco		Aug. 17, 1906		1 ♂		
Manzanillo	15 m					
Guatemala						
Champerico		July 22, 1907			1 ♀ ov	R. Paessler; HM K7744
Costa Rica						
Bahía de Salinas	2	Feb. 11, 1935	477-35	1 ♂		
Bahía de Salinas	12	Feb. 11, 1935	480-35	2 ♂	2 ♀ ov	
Bahía de Salinas	6	Feb. 11, 1935	481-35		1 ♀	
Port Parker	5	Feb. 9, 1935	468-35	1 ♂	1 ♀ ov	
Port Parker	10	Feb. 9, 1935	469-35	1 ♂		
Port Parker	3-8	Mar. 24, 1939	934-39	1 ♂		
Puerto Culebra	10	Feb. 24, 1934	253-34		1 ♀ ov	
Puerto Culebra	3-10	Feb. 24, 1934	254-34	7 ♂	1 ♀	♂ figured
Bahía Cocos S of Puerto Culebra	2	Mar. 13, 1933	116-33	4 ♂	2 ♀ (1 ov)	

TABLE 62  
*PISIDIA MAGDALENENSIS* (Glassell)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Baja California					
Bahía de Santa María	5-25	Mar. 21, 1933	126-33	1 ♂ ov	
0.5 mi SE of Punta Hughes	5-18	Apr. 4, 1949	1787-49	1 ♀ ov	1 yg
Bahía de la Magdalena	12	Dec. 2, 1931		1 ♀ ov	S. A. Glassell; holotype, USNM 71544
Bahía de la Magdalena	12	Dec. 2, 1931		1 ♀ ov	S. A. Glassell; paratype, SDM 785
2 mi E of Punta Entrada	17-18	Mar. 8, 1949	1714-49	1 ♀ ov	
Marcy Channel	13	Mar. 9, 1949	1718-49	3 ♀ ov	♂ figured
Mexico					
E of White Friars Islands	5-10	Mar. 3, 1934	269-34	1 ♀	
Bahía Santa Lucia, Acapulco	1-4	Feb. 1-2, 1954	2596-54	2 ♂	Zaca; AHF
Puerto Guatulco	10	Dec. 7, 1937	Zaca 195	1 ♂	Sec. Agricultura y Fomento; USNM
		1926		1 ♂ + 1 fragmented	
Guatemala					
Ocos				1 ♂	R. Paessler; HM K7675
off Punta San José	7-11	Jan. 11, 1938	770-38	1 ♂	
Nicaragua					
Corinto	3	Jan. 7, 1938	Zaca 200	18 ♂	Zaca; AMNH 11838
Costa Rica					
Bahía de Salinas	2	Feb. 11, 1935	477-35	ca. 70 specimens	
Bahía de Salinas	1.5	Feb. 11, 1935	478-35	1 ♂	
Bahía de Salinas	2	Feb. 11, 1935	479-35	2 ♂	
Bahía de Salinas	6	Feb. 11, 1935	481-35		1 yg
Port Parker	5	Feb. 9, 1935	468-35	1 ♀ ov	
Port Parker	5	Feb. 9, 1935	470-35	4 ♀ (3 ov)	

Port Parker	7	Jan. 22, 1938	Zaca 203	1 ♀ ov	Zaca; AHF
Playa Blanca	3-5	Feb. 8, 1935	460-35	1 ♀	R. Paessler; HM K7742
Puerto Culebra	12-14 m	July 17, 1911		52 ♀ (45 ov)	
Puerto Culebra	10	Feb. 24, 1934	253-34	1 ♀ ov	
off S Islas Viradores, Puerto Culebra	10	Feb. 25, 1934	257-34	3 ♀ (2 ov)	1 yg
Bahía Cocos S of Puerto Culebra	2	Mar. 13, 1933	116-33	1 ♀	L. Leibfarth; HM K26845
Puntarenas	6-8	1894		2 ♀ ov	R. Paessler; HM K7578
Puntarenas	6-8	May 6, 1912		8 ♀ (5 ov)	
Panama					
Bahía Honda	5-8	Mar. 9, 1933	113-33	2 ♀ ov	Sternbergh; MCZ 11891
Panama [City?]				2 ♀ ov	
Panama City	shore	Feb. 2, 1935	445-35	10 ♀ (4 ov)	Elinor D. Robson; USNM
San Francisco		Apr. 1, 1939		1 ♀ ov	S. W. Garman; MCZ
Islas de las Perlas		Apr. 1875		1 ♂	11890
Ecuador					
Isla Salango	12	Jan. 18, 1935	396-35	1 ♂	
off beach at La Libertad	4	Jan. 19, 1933	12-33	11 ♂	
off La Libertad	10	Jan. 20, 1933	15-33	4 ♂	
near S shore Bahía de Santa Elena	5-7	Feb. 9, 1934	210-34	1 ♂	2 yg
Costa Rica					
Bahía de Salinas	shore	Feb. 10, 1935	474-35	1 ♀	
Panama					
Panama [City?]					A. Agassiz; MCZ 1629
Panama [City?]				1 ♀	Hassler; MCZ 11825
N shore Isla Taboguilla	shore	Mar. 4-5, 1926		1 ♂	W. G. Van Name, Mrs. S. E. Brewster; AMNH 6271

TABLE 63

MEGALOBRACHIUM POEYI (Guérin)

MEGALOBRAACHIUM POEYI (cont.)		Fms.	Date	Station	Number and Sex	Remarks
Locality	Date					
Panama (cont.)	Apr. 1, 1939			1 ♂		Elinor D. Robson; USNM; figured
San Francisco						
TABLE 64						
MEGALOBRAACHIUM SMITHI (Glassell)						
Gulf of California						
Bahía de Tepoca, Sonora	Feb. 3, 1940	shore	1076-40	1 ♂	1 ♀	
Bahía de Tepoca, Sonora	Feb. 4, 1940	shore	1077-40	1 ♂	1 ♀	
Isla Angel de la Guarda						
Puerto Refugio	Mar. 4, 1936	shore	545-36	1 ♂		
Puerto Refugio	Jan. 27, 1940	shore	1049-40	1 ♂	1 ♀	
Puerto Refugio	Jan. 28, 1940	shore	1053-40	6 ♂	2 ♀	
S shore Isla Tiburón	Jan. 25, 1940	shore	1045-40	1 ♂	2 ♀	1 yg
vicinity of Puerto San Carlos, Sonora	Mar. 24, 1949	shore	1767-49	1 ♂	1 ♀	
Miramar Beach near Guaymas, Sonora	Dec. 23, 1931	shore			1 ♀	S. A. Glassell; holotype, USNM 71538
Miramar Beach	Dec. 23, 1931	shore		1 ♂		S. A. Glassell; paratype, USNM
Miramar Beach	Dec. 23, 1931	shore			1 ♀	S. A. Glassell; paratype, SDM 773
Bahía Catalina off Guaymas, Sonora	Feb. 9, 1940	shore	1092-40	1 ♂	2 ♀	
Punta Aguja, Bahía Concepción	Mar. 26, 1949	shore	1769-49	3 ♂		1 figured
San Marcial Reef, Bahía de Agua Verde	Mar. 11, 1937	shore	664-37	3 ♂	7 ♀	
Isla San Francisco	Mar. 9, 1937	shore	652-37		1 ♀	
North Bay, Isla San Francisco	Feb. 25, 1936	shore	518-36		1 ♀	

TABLE 65  
MEGALOBRACHIUM SINUIMANUS (Lockington)

Isla Espíritu Santo									
Bahía San Gabriel	shore	Feb. 20, 1936	500-36	1 ♂					2 ♀
Bahía San Gabriel	shore	Feb. 20, 1936	501-36						1 ♀
Bahía San Gabriel	shore	Mar. 7, 1937	638-37	2 ♂					
Bahía San Gabriel	shore	Feb. 14, 1940	1110-40	2 ♂					2 ♀
Bahía San Gabriel	shore	Mar. 15, 1949	1739-49	1 ♂					
Gulf of California									
Isla Angel de la Guarda									
Puerto Refugio	shore	Mar. 20, 1937	707-37						1 ♀
Puerto Refugio	shore	Jan. 27, 1940	1049-40	5 ♂					3 ♀
Puerto Refugio	shore	Jan. 28, 1940	1053-40	8 ♂					5 ♀
Isla Tiburón		Feb. 1, 1932		2 ♂					2 ♀
Ensenada de San Francisco,									
Sonora	shore	May 17, 1946	1516-46						1 ♀ ov
Bahía Catalina off Guaymas,									
Sonora	shore	Feb. 9, 1940	1092-40	1 ♂					3 ♀
W side Isla Bargo, Bahía									
Concepción	shore	Mar. 27, 1949	1772-49	1 ♂					
Puerto Escondido	shore	Dec. 19, 1931		1 ♂					
Puerto Escondido	shore	Dec. 19, 1931							1 ♀
Puerto Escondido	shore	Mar. 16, 1936	591-36	3 ♂					4 ♀
Puerto Escondido	shore	Mar. 12, 1937	670-37	13 ♂					11 ♀
Puerto Escondido	shore	Feb. 10, 1940	1094-40	8 ♂					6 ♀
Bahía de Agua Verde	shore	Feb. 27, 1936	522-36	11 ♂					14 ♀
San Marcial Reef, Bahía de									
Agua Verde	shore	Mar. 11, 1937	664-37	1 ♂					1 ♀
North Bay, Isla San Francisco	shore	Feb. 26, 1936	519-36	3 ♂					7 ♀

S. A. Glassell; MCZ  
10267

E. Y. Dawson, F. E.  
Durham

S. A. Glassell; neotype,  
SDM 1132  
S. A. Glassell; [neo]-  
allotype, SDM 1133

## MEGALOBRACHIUM SINUIMANUS (cont.)

Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California (cont.)					
Isla Espíritu Santo					
Bahía San Gabriel	shore	Feb. 20, 1936	500-36	16 ♂	
Bahía San Gabriel	shore	Feb. 20, 1936	501-36	2 ♂	
Bahía San Gabriel	shore	Mar. 20, 1936	604-36	2 ♂	
Bahía San Gabriel	shore	Mar. 7, 1937	638-37	18 ♂	
Bahía San Gabriel	shore	Feb. 14, 1940	1110-40	16 ♂	
Bahía San Gabriel	shore	Feb. 14, 1940	1112-40	3 ♂	
Bahía San Gabriel	1	Mar. 15, 1949	1737-49	8 ♂	
Los Frailes	shore	Mar. 13, 1949	1734-49	6 ♂	♂ figured
Cabeza Ballena	shore	Mar. 4, 1937	623-37	2 ♂	CAS
Mazatlán, Sinaloa		Dec. 8, 1931		1 ♀	
Mexico					
Isla Isabel	shore	Mar. 19, 1933	125-33	30 ♂	1 yg
Islas Las Tres Marias					
Isla María Cleofas	shore	Mar. 18, 1956	KW-17	2 ♂	J. Knudsen; AHF

TABLE 66

## MEGALOBRACHIUM GARTHI Haig

Locality	Fms.	Date	Station	Number and Sex	Remarks
Gulf of California					
Isla Turner S of Isla Tiburón	shore	Jan. 24, 1940	1042-40	1 ♂	holotype, AHF 409
Isla Turner S of Isla Tiburón	shore	Jan. 24, 1940	1042-40	1 ♀	paratype
Isla Espíritu Santo					
Bahía San Gabriel	shore	Feb. 14, 1940	1110-40	1 ♀	
Bahía San Gabriel	1	Mar. 15, 1949	1737-49	1 ♂	





TABLE 68  
MEGALOBRAACHIUM FESTAI (Nobili)

Locality	Fins.	Date	Station	Number and Sex	Remarks
Mexico					
San Lorenzo Rocks, Acapulco	shore	Jan. 30, 1954	2591-54	1 ♀	
Bahía Santa Lucía, Acapulco	1-4	Feb. 1-2, 1954	2596-54	20 ♀ (12 ov)	3 yg ♀ figured
Puerto Guatulco	shore	Mar. 8, 1938		4 ♀ (2 ov)	S. A. Glassell; MCZ 10281
Bahía Tangola-Tangola	shore	Mar. 1, 1934	261-34	1 ♂	
El Salvador					
Acajutla		Apr. 23, 1912		1 ♀ ov	R. Paessler; HM K26846
Ecuador					
Bahía de Santa Elena				1 ♂	E. Festa; holotype, TM

TABLE 69  
MEGALOBRAACHIUM TUBERCULIPES (Lockington)

Gulf of California					
Punta Peñasco, Sonora	shore	May 2, 1935		1 ♂	S. A. Glassell; neotype, SDM 1134
Punta Peñasco, Sonora	shore	May 2, 1935		1 ♀ ov	S. A. Glassell; [neo]-allotype, SDM 1135
San Felipe and 1-2 mi N	shore	Apr. 12-13, 1954	2623-54	1 ♂	AHF field party
S shore Isla Tiburón	shore	Jan. 25, 1940	1045-40	1 ♀	1 figured
I. Turner, S of Isla Tiburón	shore	Jan. 24, 1940	1042-40	3 ♂	
Bahía Catalina off Guaymas, Sonora	shore	Feb. 9, 1940	1092-40	1 ♂	
Isla del Carmen	shore	Jan. 21, 1932		1 ♀	S. A. Glassell; USNM
Isla San José	shore	Dec. 10, 1931		1 ♀	S. A. Glassell; USNM
Bahía San Gabriel, Isla Espiritu Santo	1	Mar. 15, 1949	1737-49	1 ♂	J. Xantus; MCZ 11909
Cabo San Lucas				1 ♂	



## APPENDIX II

## A Summary of the Commensal Relationship of Porcellanids and Their Hosts in the Eastern Pacific

Host	Porcellanid	Remarks	Reference
<b>SPONGES</b>			
Unidentified species	<i>Petrolisthes</i> , 6 spp.; <i>Pachycheles</i> , 4 spp.; <i>Pisidia magdalenensis</i> ; <i>Megalobrachium</i> , 3 spp.	Perhaps occur in sponges more commonly than is evident from the records, nearly all of which are from a single collecting station reported herein.	Glassell, 1938a; Steinbeck & Ricketts, 1941; Haig, 1957a; this paper
<b>GORGONIAN CORALS</b>			
<i>Eugorgia nobilis</i> Verrill	<i>Orthochela pumila</i>	Probably an obligatory commensal	This paper
Unidentified species			Glassell, 1936; this paper
<b>MADREPORARIAN CORALS</b>			
<i>Pocillopora</i> and <i>Pavona</i> spp.; perhaps others	<i>Petrolisthes</i> , 13 spp.; <i>Neopisoma dohertyi</i> ; <i>Pachycheles</i> , 9 spp.; <i>Pisidia magdalenensis</i> ; <i>Megalobrachium</i> , 4 spp.	Spp. typical of coral head community incl. <i>Petrolisthes glasselli</i> , <i>P. marginatus</i> , <i>P. hians</i> , and <i>Pachycheles biocellatus</i> . Many others occur in coral only occasionally.	Glassell, 1937; Steinbeck & Ricketts, 1941; Haig, 1957a and 1957b; this paper
<b>ANEMONES</b>			
Unidentified species	<i>Allopetrolisthes spinifrons</i>		This paper

SEA STARS				
<i>Helianthus</i> (Lamarck)	<i>Liopetrolisthes mitra</i>			Bouvier, 1906, as <i>Petrolisthes patagonicus</i>
<i>Stichaster striatus</i> Müller and Troschel				Meredith, 1939, as <i>Porcellana mitra</i> ; Haig, 1955, as <i>Petrolisthes mitra</i>
? <i>Meyenaster gelatinosus</i> (Meyen)				Haig, 1955, as <i>Petrolisthes mitra</i>
Unidentified species				Haig, 1955, as <i>Petrolisthes mitra</i>
<i>Meyenaster gelatinosus</i> (Meyen)	<i>Allopetrolisthes spinifrons</i>			Haig, 1955, as <i>Petrolisthes spinifrons</i>
<i>Stichaster striatus</i> Müller and Troschel				Haig, 1955, as <i>Petrolisthes spinifrons</i>
<i>Luidia columbia</i> (Gray)	<i>Minyocerus kirki</i>		Probably an obligatory commensal	Glassell, 1938a
<i>Luidia phragma</i> H. L. Clark				This paper
? <i>Luidia foliolata</i> Grube				This paper
SERPENT STARS				
? <i>Astrocanthem spinosum</i> (Lyman)	<i>Porcellana corbicola</i>			This paper
<i>Amphipholis platydisca</i> Nielsen, <i>Ophiolithrix spiculata</i> Leconte, or <i>Ophiolipsis grisea</i> H. L. Clark	<i>Minyocerus kirki</i>			This paper
			Evidence of commensalism not definitely established	

Host	Porcellanid	Remarks	Reference
SEA URCHINS			
<i>Loxechinus albus</i> (Molina)	<i>Liopetrolisthes mitra</i>		Porter, 1926, as <i>Petrolisthes patagonicus</i> Haig, 1955, as <i>Petrolisthes mitra</i>
Unidentified species			
Probably <i>Centrostephanus</i> sp.	<i>Petrolisthes hians</i>		Steinbeck & Ricketts, 1941, as <i>Pisosoma flagratiata</i>
POLYCHAETES			
<i>Chaetopterus variopedatus</i> (Renier)	<i>Polyonyx quadriungulatus</i>		Glassell, 1935
<i>Chaetopterus</i> sp.			Haig, 1956b; this paper
HERMIT CRABS			
<i>Petrochirus californiensis</i> Bouvier	<i>Porcellana cancrisocialis</i>		Glassell, 1936
? <i>Pagurus albus</i> (Benedict)			Steinbeck & Ricketts, 1941
? <i>Dardanus sinistripes</i> (Stimpson)			Steinbeck & Ricketts, 1941
<i>Petrochirus californiensis</i> Bouvier	<i>Porcellana paguriconversa</i>		Glassell, 1936
? <i>Paguristes digueti</i> Bouvier			Steinbeck & Ricketts, 1941

## Explanation of Plates

Every species treated in this report is represented by a toto-illustration, with the exception of *Polyonyx nitidus* Lockington. That species differs from *P. quadriungulatus* Glassell only in very minor characters, which are shown in text-figure 12. The illustrations of *Minyocerus kirki* Glassell and *Ulloaia perpusillia* Glassell are from drawings by Anker Petersen (after Glassell, 1938a). All other species, with the exception of *Pachycheles velerae*, *Porcellana corbicola*, and *Polyonyx confinis*, new species, are illustrated by photographs of specimens from among the material examined. Those three species, as well as thirteen other new species and one new subspecies described herein, are illustrated by drawings.

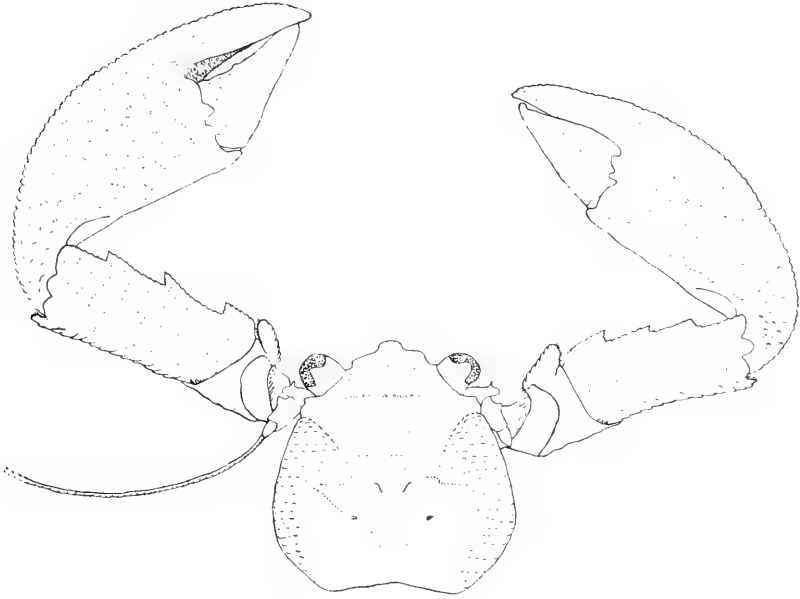
The photographs were taken by Mr. Francis Munger; the drawings are by the writer.

## PLATE 1

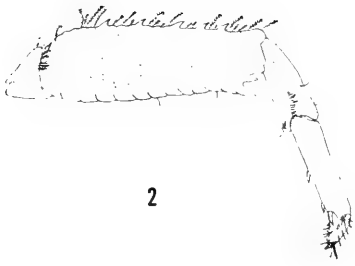
*Petrolisthes nobilii*, new species

- Fig. 1. Male holotype, dorsal view, x  $3\frac{1}{2}$ .  
Fig. 2. Right walking leg 1, x 5.  
Fig. 3. Right antennule, basal segment, ventral view, x 10.

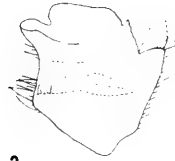




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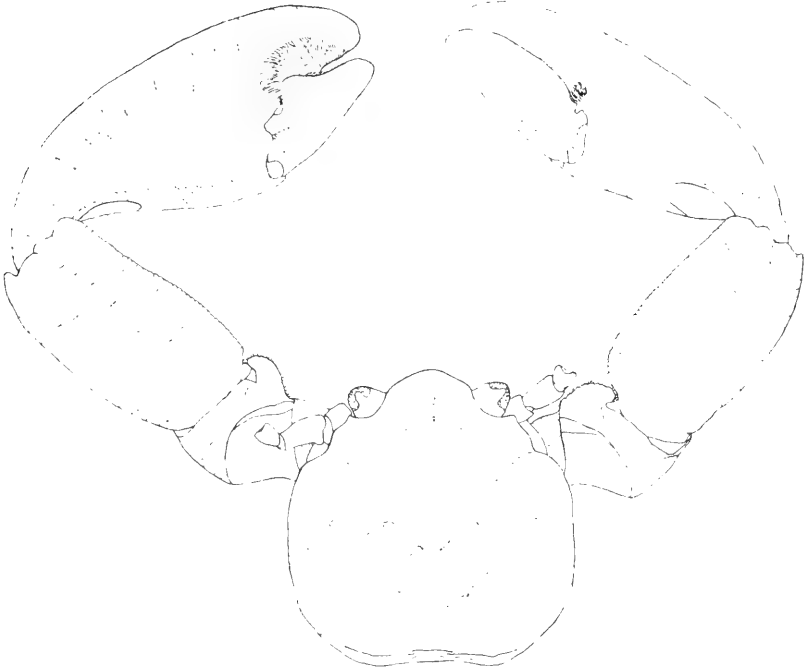


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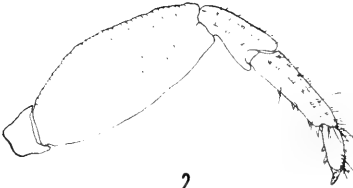
## PLATE 2

*Petrolisthes galapagensis*, new species

- Fig. 1. Male holotype, dorsal view, x  $3\frac{1}{2}$ .  
Fig. 2. Right walking leg 3, x 6.  
Fig. 3. Right antennule, basal segment, ventral view, x  $16\frac{1}{2}$ .



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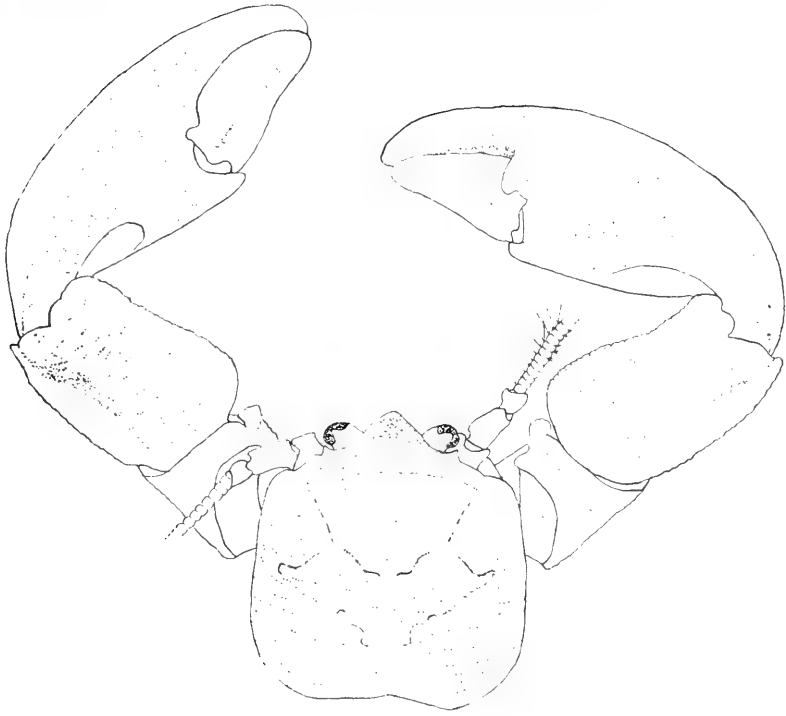


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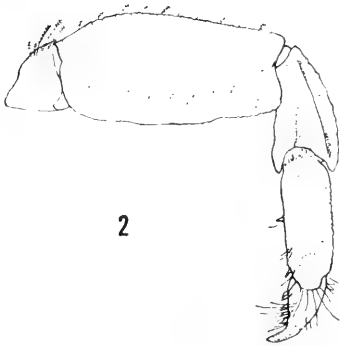
## PLATE 3

*Petrolisthes tonsorius*, new species

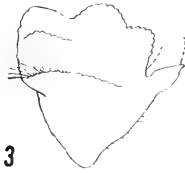
- Fig. 1. Male holotype, dorsal view, x 3%.
- Fig. 2. Right walking leg 1, x 5%.
- Fig. 3. Right antennule, basal segment, ventral view, x 10½.



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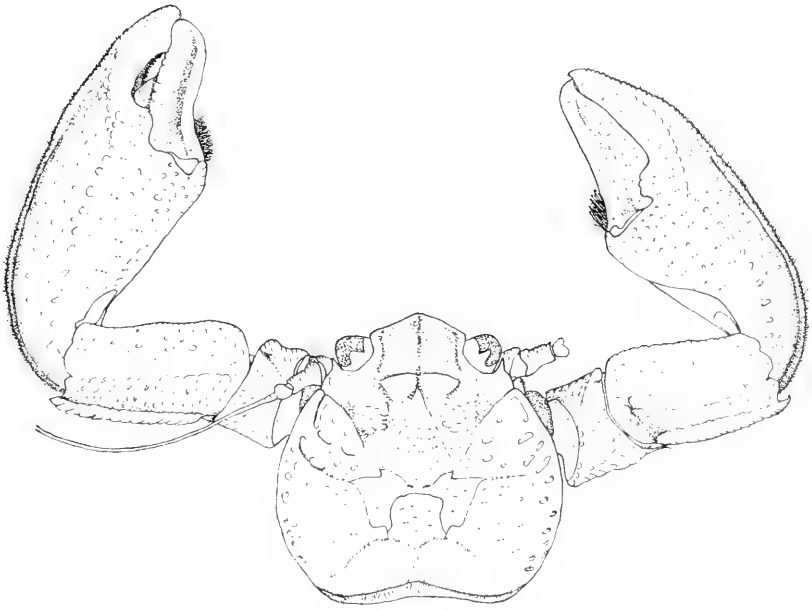


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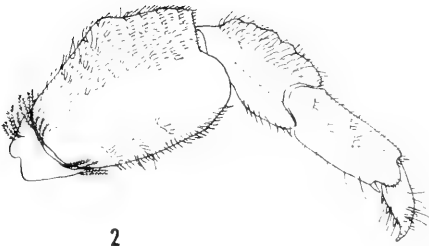
## PLATE 4

*Petrolisthes platymerus*, new species

- Fig. 1. Male holotype, dorsal view, x 7.  
Fig. 2. Holotype, right walking leg 3, x 12½.  
Fig. 3. Right antennule, basal segment, ventral view, x 25.



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## PLATE 5

*Petrolisthes lewisi austrinus*, new subspecies

- Fig. 1. Male holotype, dorsal view, x 6.  
Fig. 2. Right antennule, basal segment, ventral view, x 22.  
Fig. 3. Right walking leg, x 9.





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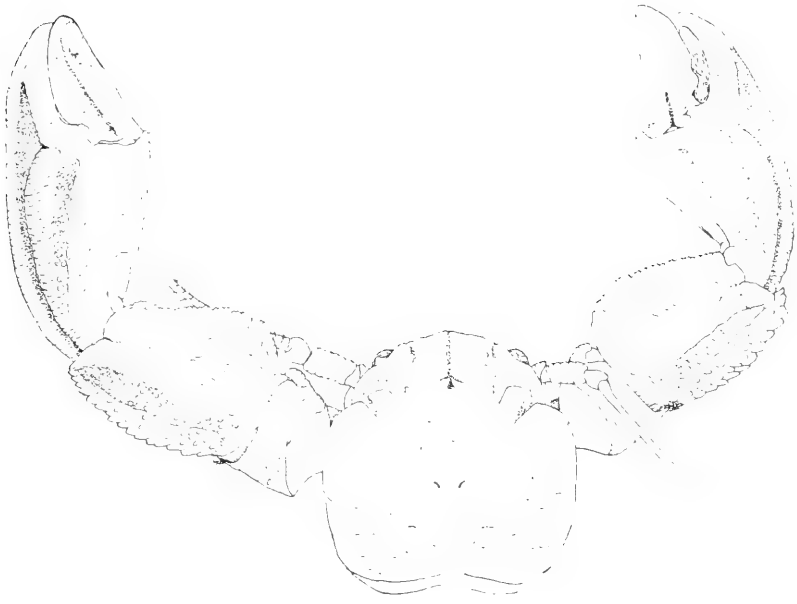


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## PLATE 6

*Petrolisthes cocoensis*, new species

- Fig. 1. Male holotype, dorsal view, x  $6\frac{1}{2}$ .  
Fig. 2. Right walking leg 1, x 9.  
Fig. 3. Right antennule, basal segment, ventral view, x 25.



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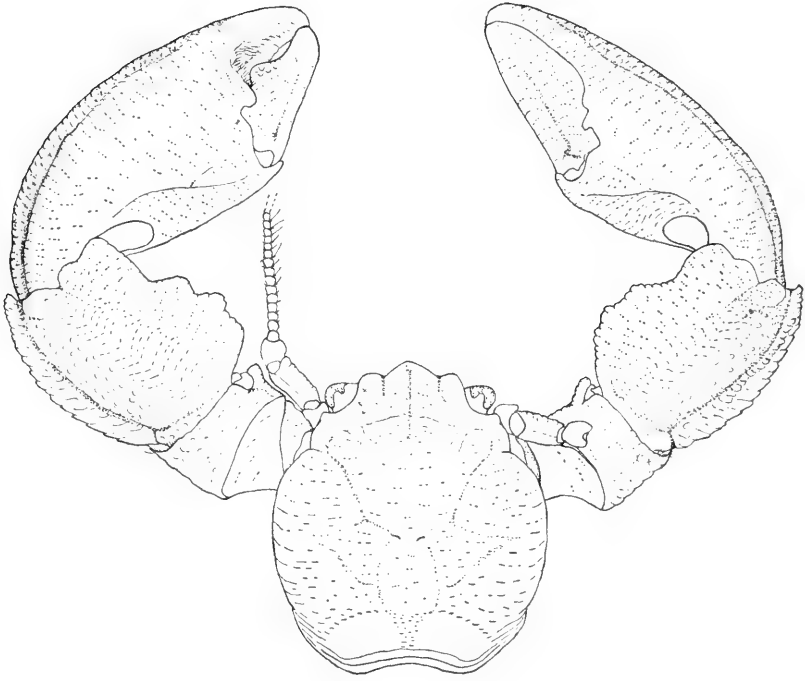


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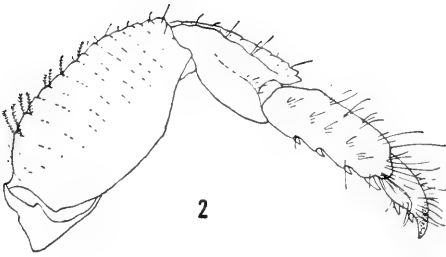
## PLATE 7

*Petrolisthes artifrons*, new species

- Fig. 1. Male holotype, dorsal view, x 5.  
Fig. 2. Right walking leg 1, x  $5\frac{1}{2}$ .  
Fig. 3. Right antennule, basal segment, ventral view, x  $12\frac{1}{2}$ .



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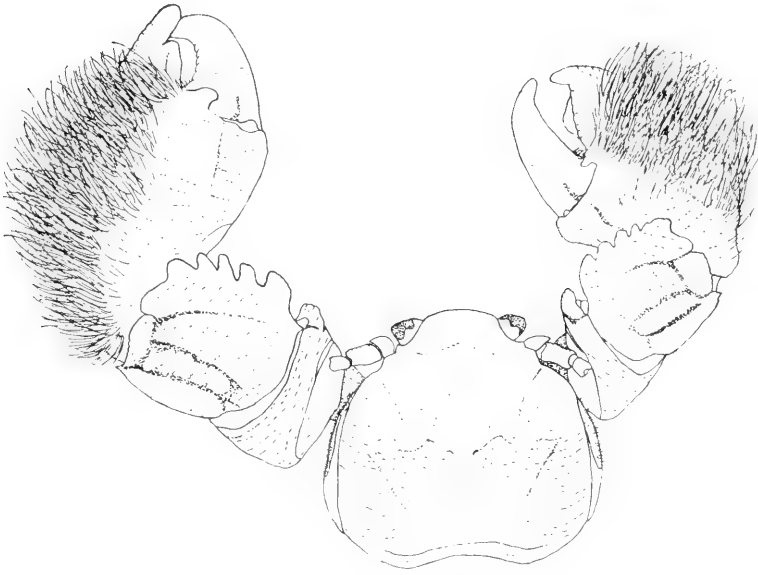


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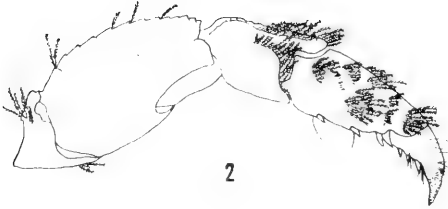
## PLATE 8

*Neopisosoma bicapillatum*, new species

- Fig. 1. Male holotype, dorsal view, x 6.  
Fig. 2. Right walking leg, x  $8\frac{1}{2}$ .  
Fig. 3. Right antennule, basal segment, ventral view, x 24.  
Fig. 4. Carapace, frontal view, x  $6\frac{1}{2}$ .  
Fig. 5. Carapace, side view, x  $6\frac{1}{2}$ .



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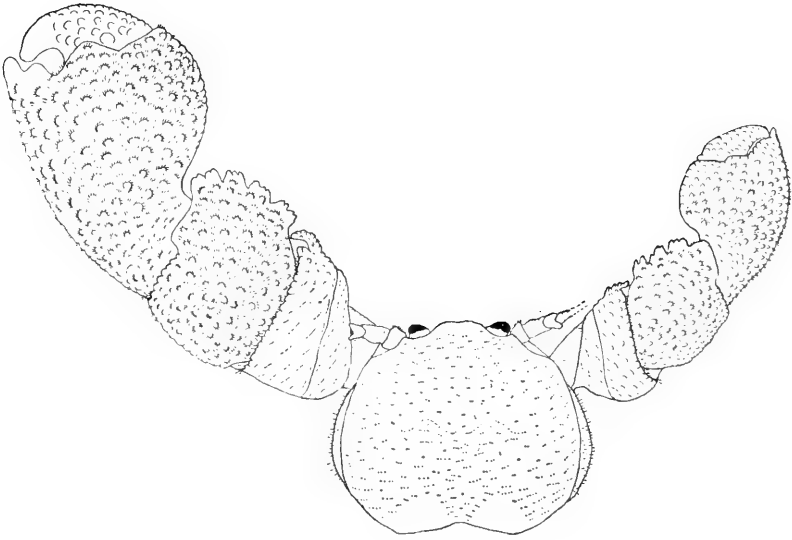
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## PLATE 9

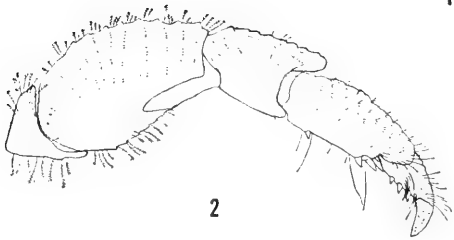
*Neopisosoma dohenyi*, new species

- Fig. 1. Male holotype, dorsal view, x 7.  
Fig. 2. Right walking leg, x  $12\frac{1}{2}$ .  
Fig. 3. Right antennule, basal segment, ventral view, x 28.  
Fig. 4. Carapace, frontal view, x 10.  
Fig. 5. Side view, x 6.





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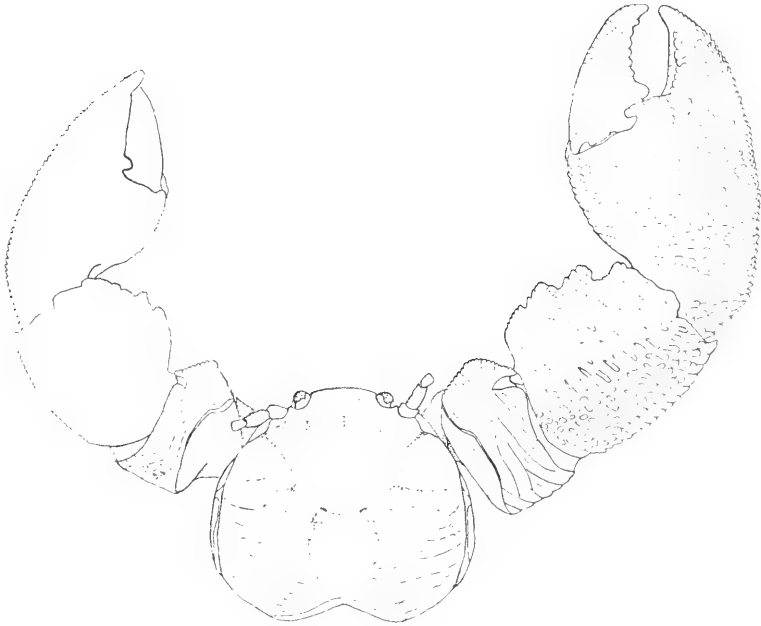


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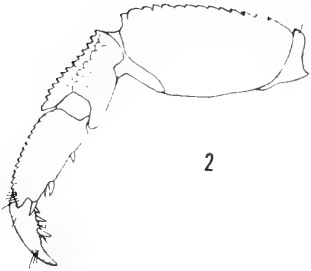
## PLATE 10

*Pachycheles calcosus*, new species

- Fig. 1. Male holotype, dorsal view, x  $5\frac{1}{2}$ .  
Fig. 2. Left walking leg 1, x 8.  
Fig. 3. Right antennule, basal segment, ventral view, x 25.  
Fig. 4. Carapace, side view, x  $7\frac{1}{2}$ .



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## PLATE 11

*Pachycheles velerae*, new species

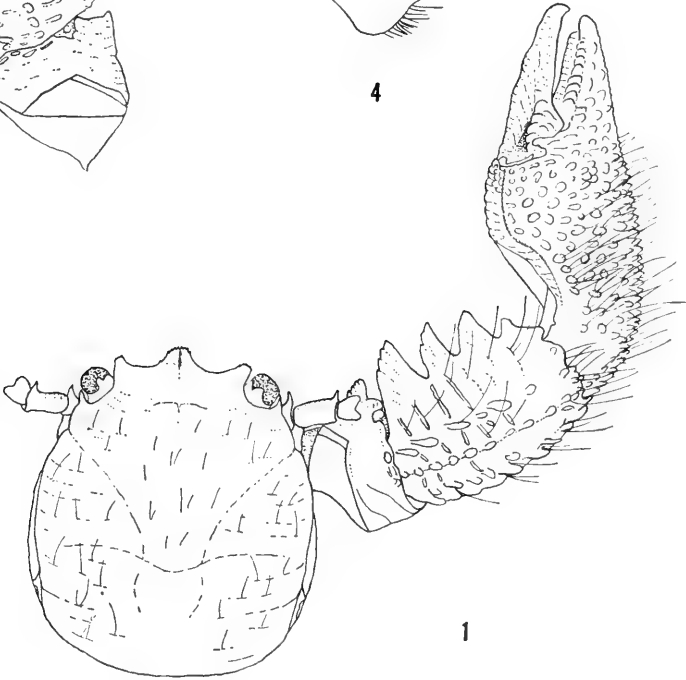
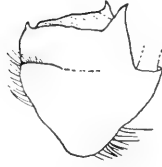
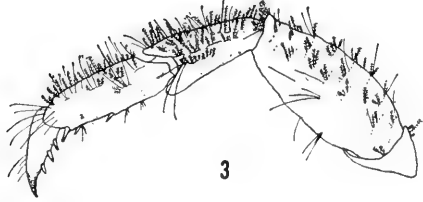
Female holotype (soft-shelled, slightly distorted)

Fig. 1. Dorsal view, x 10.

Fig. 2. Left cheliped, x 10.

Fig. 3. Left walking leg, x 12½.

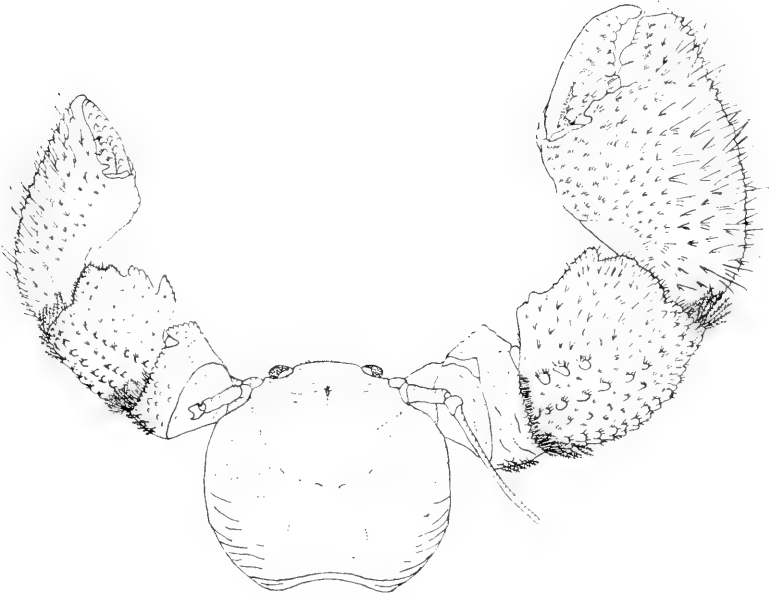
Fig. 4. Right antennule, basal segment, ventral view, x 22½.



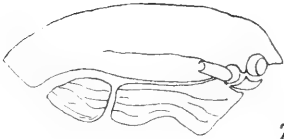
## PLATE 12

*Pachycheles trichotus*, new species

- Fig. 1. Male holotype, dorsal view, x 6.  
Fig. 2. Carapace, side view, x  $6\frac{1}{2}$ .  
Fig. 3. Right walking leg, x 6.  
Fig. 4. Right antennule, basal segment, ventral view, x  $22\frac{1}{2}$ .  
Fig. 5. Carapace, frontal view, x 6.



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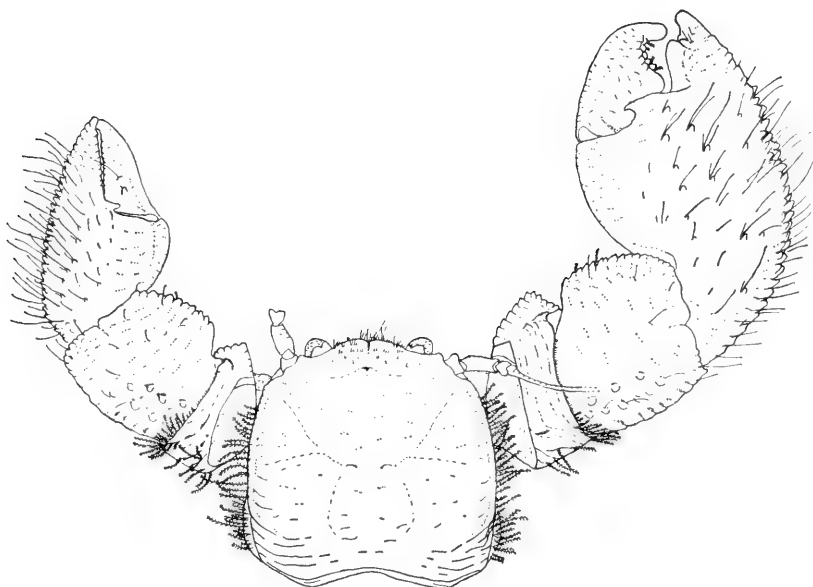
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## PLATE 13

*Pachycheles subsetosus*, new species

- Fig. 1. Male holotype, dorsal view, x  $5\frac{1}{2}$ .  
Fig. 2. Carapace, frontal view, x  $5\frac{1}{2}$ .  
Fig. 3. Right walking leg 1, x  $5\frac{1}{2}$ .  
Fig. 4. Right antennule, basal segment, ventral view, x  $21\frac{1}{2}$ .  
Fig. 5. Carapace, side view, x  $4\frac{1}{2}$ .





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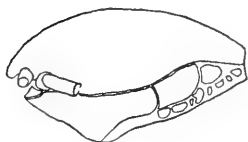
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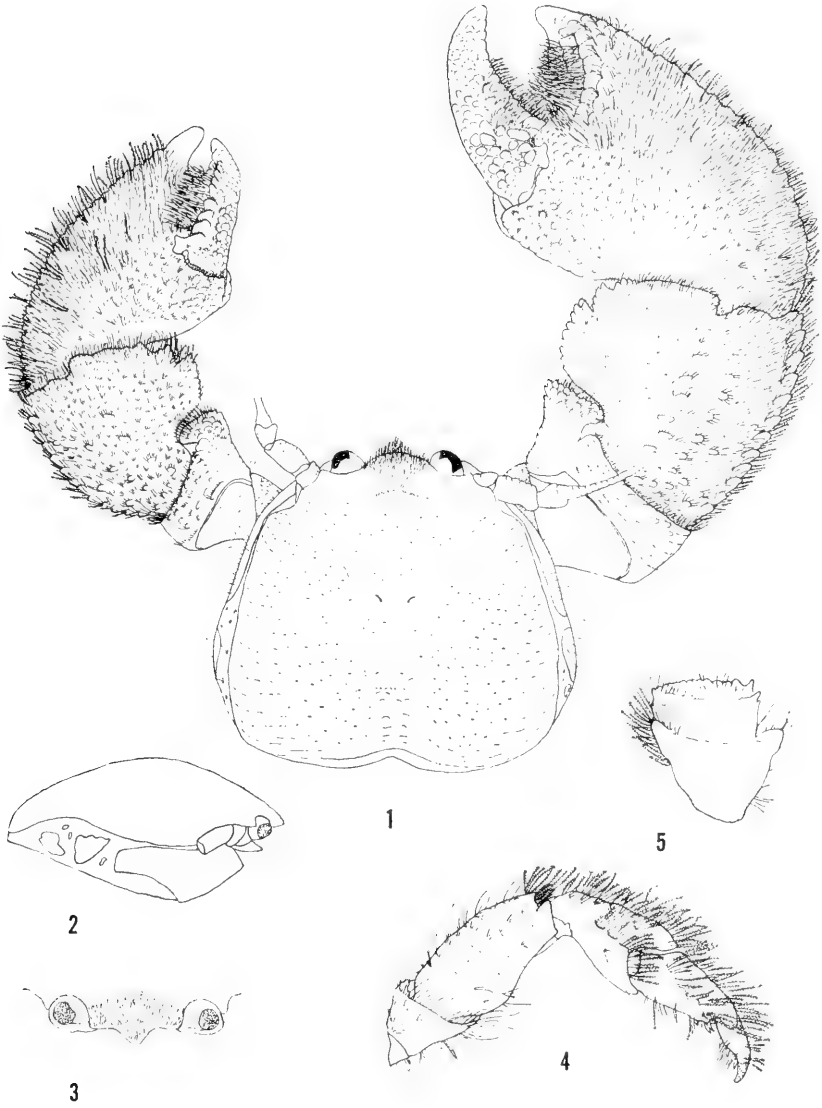


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## PLATE 14

*Pachycheles crinimanus*, new species

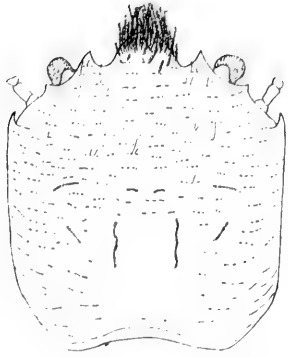
- Fig. 1. Male holotype, dorsal view, x 2.  
Fig. 2. Carapace, side view, x  $1\frac{3}{4}$ .  
Fig. 3. Carapace, frontal view, x  $3\frac{1}{4}$ .  
Fig. 4. Right walking leg 1, x 3.  
Fig. 5. Right antennule, basal segment, ventral view, x  $7\frac{1}{2}$ .



## PLATE 15

*Porcellana corbicola*, new species  
Female holotype (soft-shelled)

- Fig. 1. Carapace, dorsal view, x  $7\frac{1}{2}$ .  
Fig. 2. Right cheliped, x  $7\frac{1}{2}$ .  
Fig. 3. Left cheliped, x  $7\frac{1}{2}$ .  
Fig. 4. Left chela, ventral view, x  $7\frac{1}{2}$ .  
Fig. 5. Right antennule, basal segment, ventral view, x 18.  
Fig. 6. Left walking leg, x  $7\frac{1}{2}$ .



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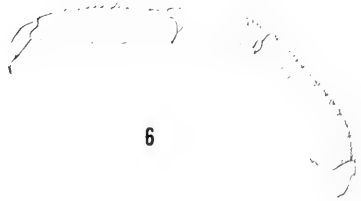
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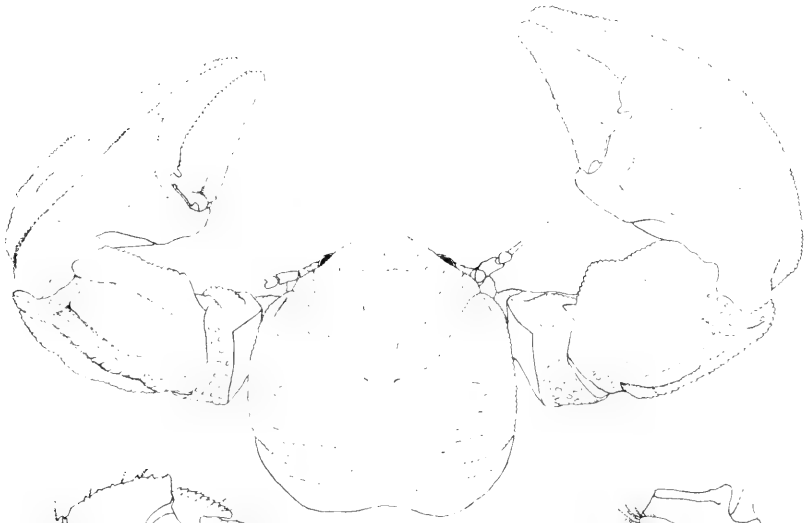
## PLATE 16

*Megalobrachium peruvianum*, new species

- Fig. 1. Male holotype, dorsal view, x 6 $\frac{3}{4}$ .  
Fig. 2. Right walking leg 1, x 4 $\frac{3}{4}$ .  
Fig. 3. Right antennule, basal segment, ventral view, x 33.

## Frontal view of carapace of

- Fig. 4. *Megalobrachium poeyi*, x 2 $\frac{3}{4}$ .  
Fig. 5. *M. smithi*, x 3 $\frac{1}{2}$ .  
Fig. 6. *M. sinuimanus*, x 5.  
Fig. 7. *M. garthi*, x 4 $\frac{1}{4}$ .  
Fig. 8. *M. erosum*, x 3 $\frac{1}{2}$ .  
Fig. 9. *M. peruvianum*, x 4 $\frac{3}{4}$ .  
Fig. 10. *M. festai*, x 5.  
Fig. 11. *M. tuberculipes*, x 6.



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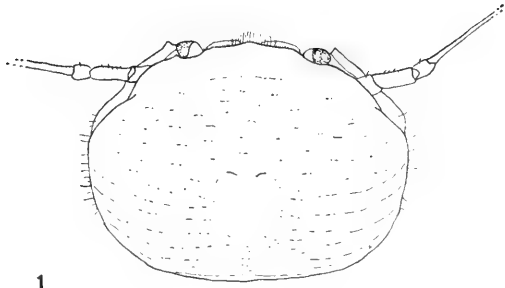
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## PLATE 17

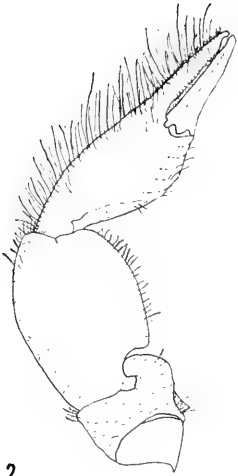
*Polyonyx confinis*, new species

- Fig. 1. Male holotype, carapace, dorsal view, x 13.  
Fig. 2. Holotype, left cheliped, x 13.  
Fig. 3. Holotype, right cheliped, x 13.  
Fig. 4. Holotype, left walking leg 3, x  $17\frac{1}{2}$ .  
Fig. 5. Paratype, right antennule, basal segment, ventral view, x 56.  
Fig. 6. Holotype, carapace, frontal view, x 14.

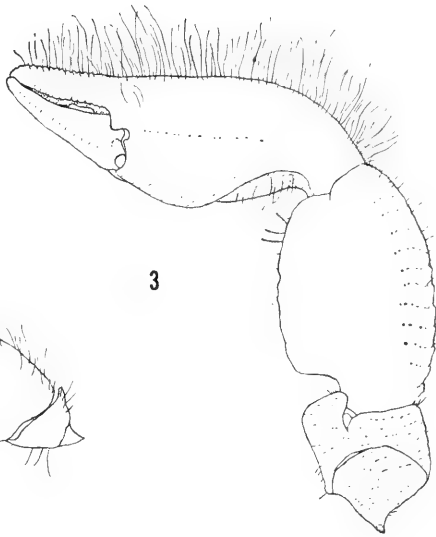




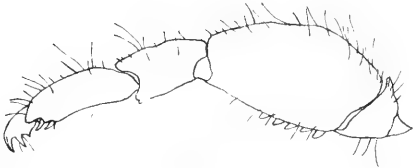
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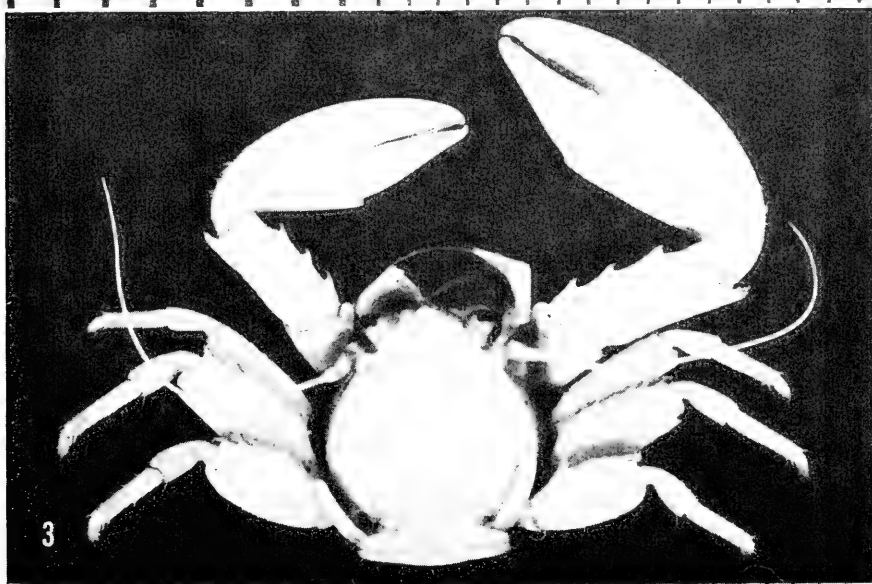
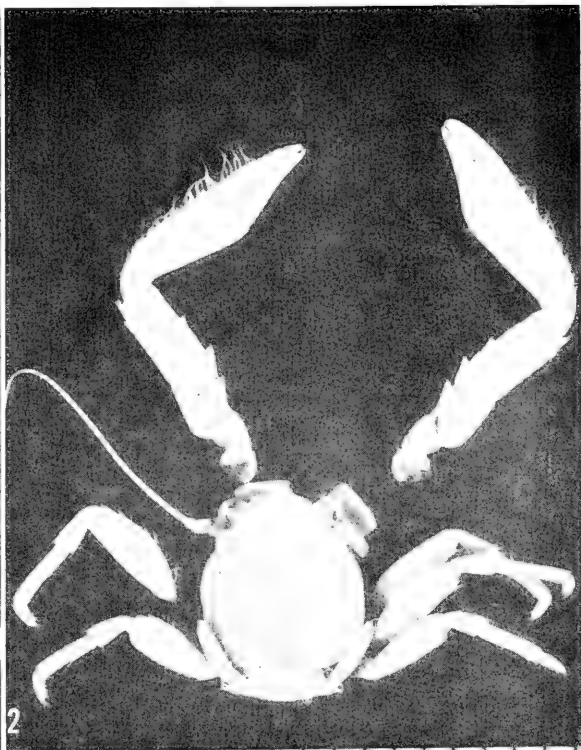
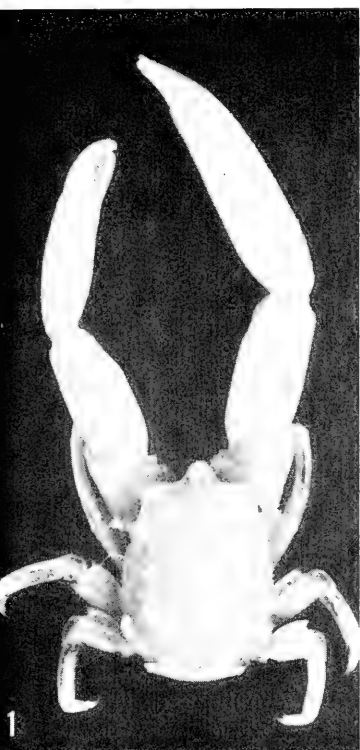
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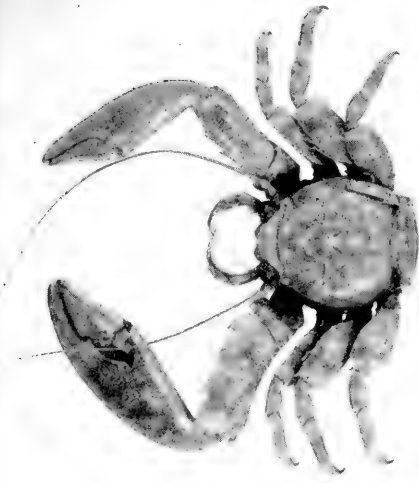
## PLATE 18

- Fig. 1. *Orthochela pumila* Glassell, male. Bahía de la Magdalena, Baja California.
- Fig. 2. *Petrolisthes robsonae* Glassell, male (HM K26843). Guayaquil, Ecuador.
- Fig. 3. *Petrolisthes nobilii*, n. sp., male paratype. Puerto Utría, Colombia.



## PLATE 19

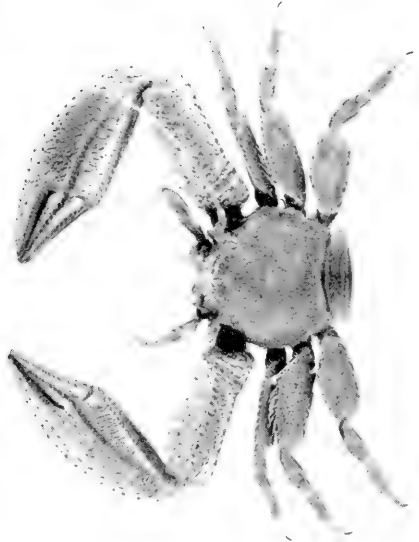
- Fig. 1. *Petrolisthes hirtispinosus* Lockington, male. Puerto San Carlos, Gulf of California.
- Fig. 2. *Petrolisthes armatus* (Gibbes), male. Bahía de Salinas, Costa Rica.
- Fig. 3. *Petrolisthes desmarestii* (Guérin), male. Coronel, Chile.
- Fig. 4. *Petrolisthes galathinus* (Bosc), male. Panama City, Panama.



2



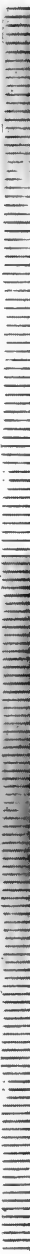
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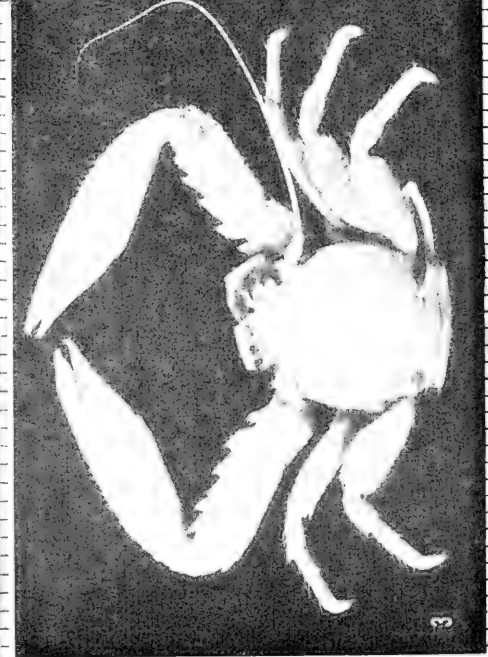
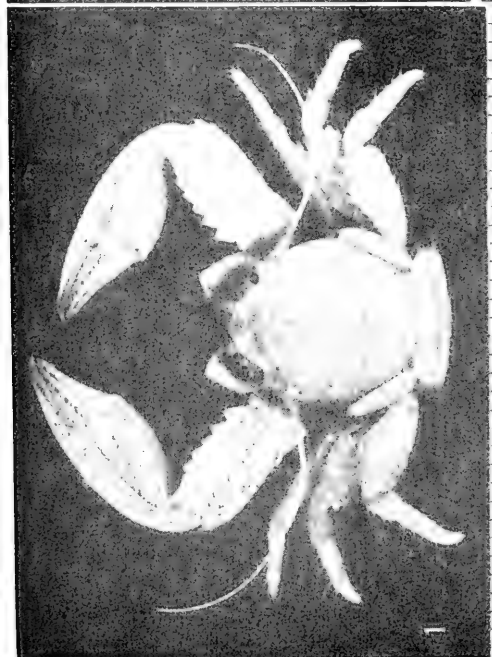
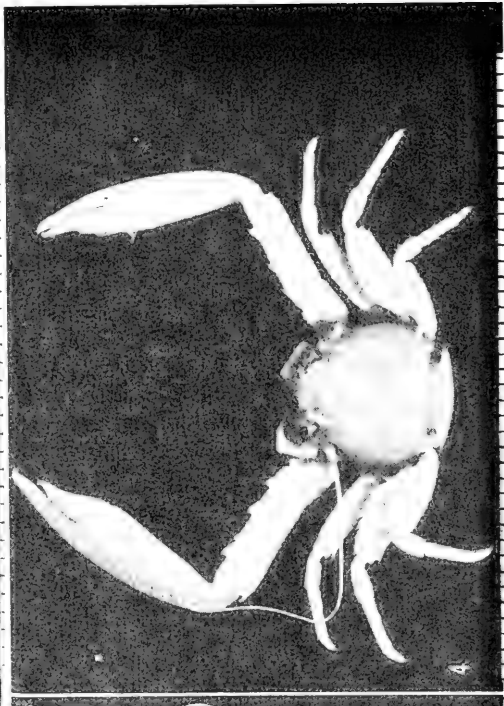
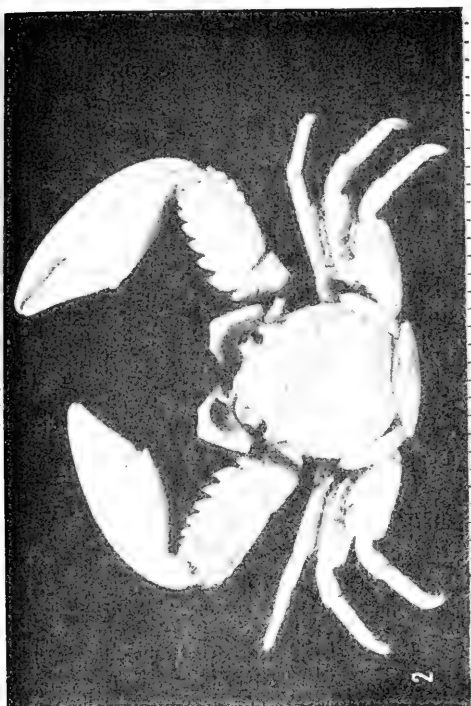


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## PLATE 20

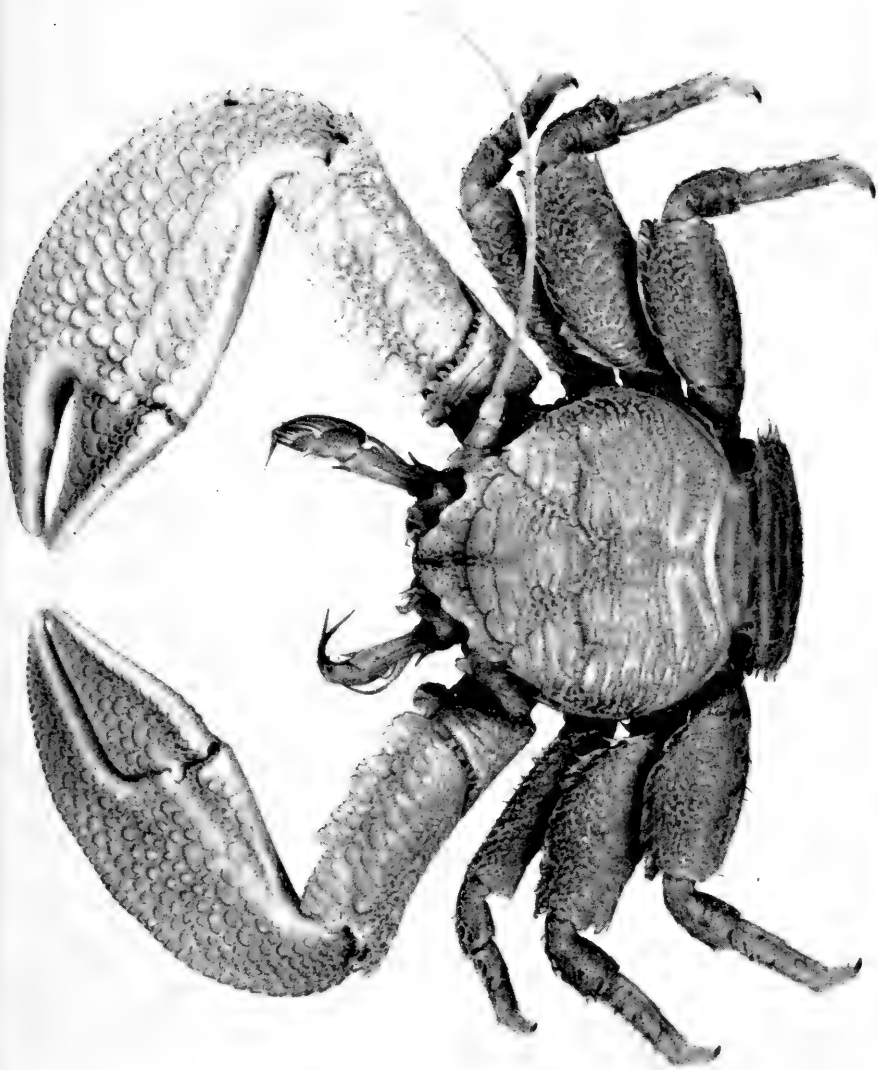
- Fig. 1. *Petrolisthes marginatus* Stimpson, female. Isla Socorro, Islas Revillagigedo, Mexico.
- Fig. 2. *Petrolisthes glasselli* Haig, female paratype. Bahía Octavia, Colombia.
- Fig. 3. *Petrolisthes sanfelipensis* Glassell, male. Isla Tiburón, Gulf of California.
- Fig. 4. *Petrolisthes agassizii* Faxon, male. Venado, Panama.



## PLATE 21

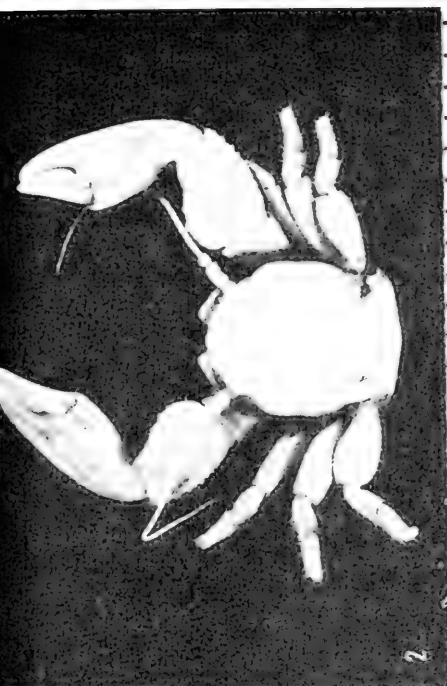
*Petrolisthes edwardsii* (Saussure), male. Los Frailes, Gulf of California.





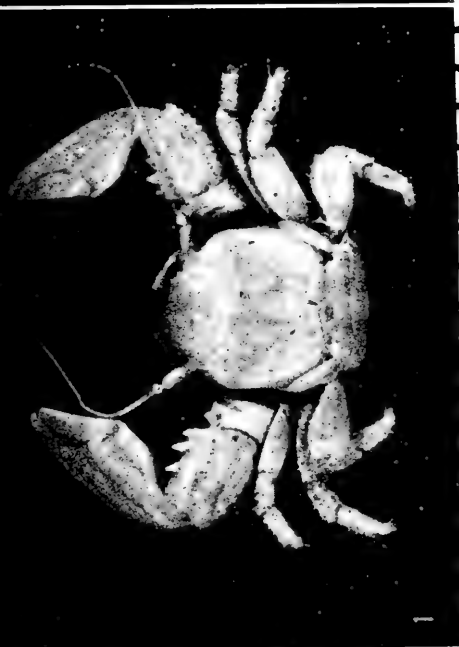
## PLATE 22

- Fig. 1. *Petrolisthes polymitus* Glassell, male. Los Frailes, Gulf of California.
- Fig. 2. *Petrolisthes cocensis*, n. sp., female paratype. Isla del Coco, Costa Rica.
- Fig. 3. *Petrolisthes hiens* Nobili, male. Acapulco, Mexico.
- Fig. 4. *Petrolisthes artifrons*, n. sp., male paratype. Punta Santa Elena, Ecuador.



## PLATE 23

- Fig. 1. *Petroiisthes lewisi lewisi* (Glassell), female. Isla María Cleofas, Islas Las Tres Marias, Mexico.
- Fig. 2. *Petroiisthes lewisi austrinus*, n. subsp., female paratype. Cabo de San Francisco, Ecuador.
- Fig. 3. *Petroiisthes ortmanni* Nobili, female. Los Frailes, Gulf of California.
- Fig. 4. *Petroiisthes crenulatus* Lockington, male. Isla Espíritu Santo, Gulf of California.



## PLATE 24

- Fig. 1. *Petrolisthes nigrunguiculatus* Glassell, male. Bahía de San Lucas, Gulf of California.
- Fig. 2. *Petrolisthes tuberculatus* (Guérin), male. Bahía de la Independencia, Peru.
- Fig. 3. *Petrolisthes hirtipes* Lockington, male. Puerto San Carlos, Gulf of California.
- Fig. 4. *Petrolisthes tuberculosus* (H. Milne Edwards), male. Bahía de San Juan, Peru.



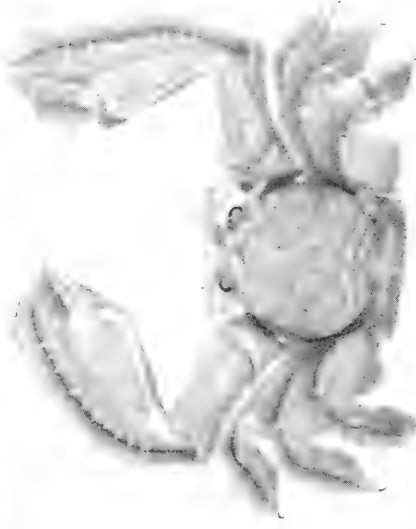
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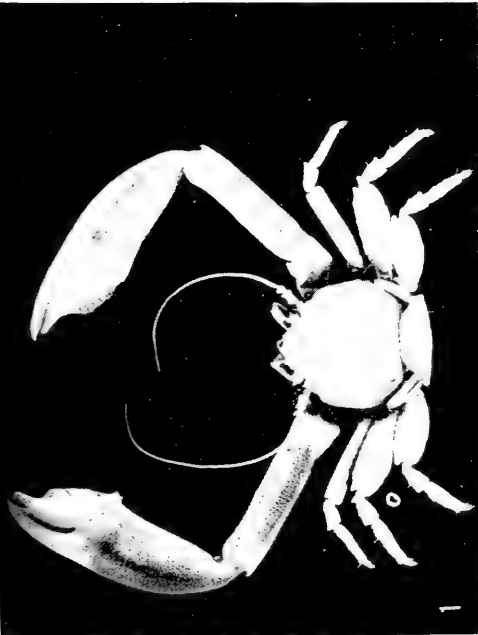
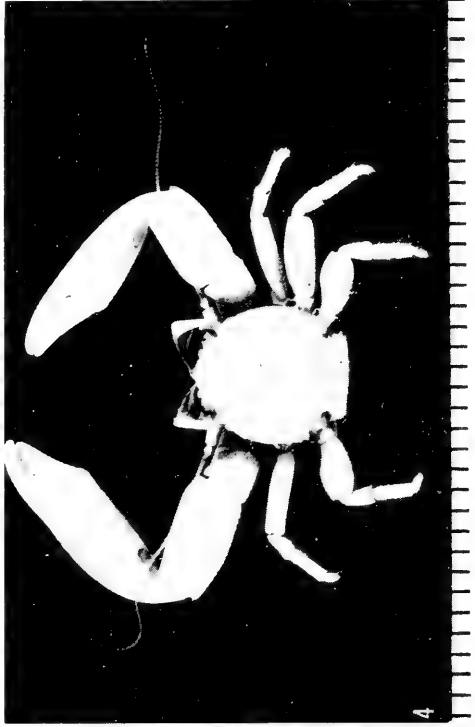
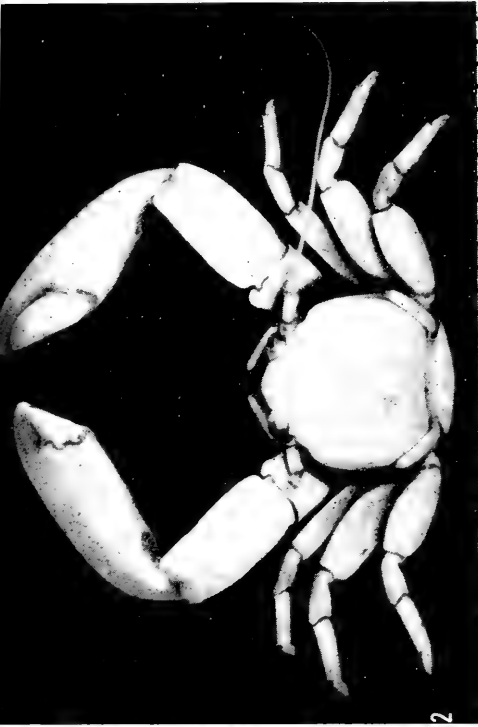


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## PLATE 25

- Fig. 1. *Petrolisthes tiburonensis* Glassell, male. Isla Angel de la Guarda, Gulf of California.
- Fig. 2. *Petrolisthes galapagensis*, n. sp., male paratype. Isla Charles, Galapagos Islands.
- Fig. 3. *Petrolisthes tiburonensis* Glassell, female. Isla Angel de la Guarda, Gulf of California.
- Fig. 4. *Petrolisthes tridentatus* Stimpson, male. Port Parker, Costa Rica.



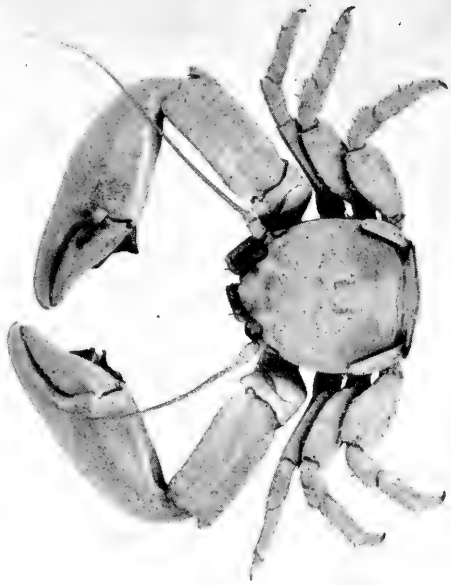


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- Fig. 1. *Petrolisthes tonsorius*, n. sp., male paratype. Isla Bartolomé, Galapagos Islands.
- Fig. 2. *Petrolisthes rathbunae* Schmitt, female. Isla Guadalupe, Baja California.
- Fig. 3. *Petrolisthes cabrilloi* Glassell, male. Dana Point, California.
- Fig. 4. *Petrolisthes eriomerus* Stimpson, male. Cape Arago State Park, Oregon.



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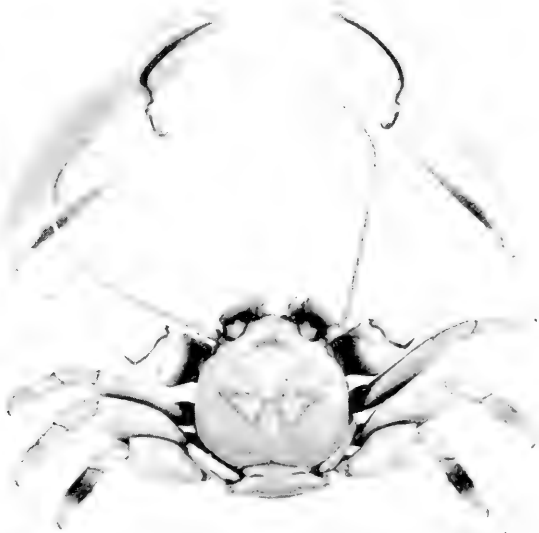
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- Fig. 1. *Petrolisthes manimaculis* Glassell, male. Cambria, California.  
Fig. 2. *Petrolisthes gracilis* Stimpson, male. Puerto San Carlos, Gulf  
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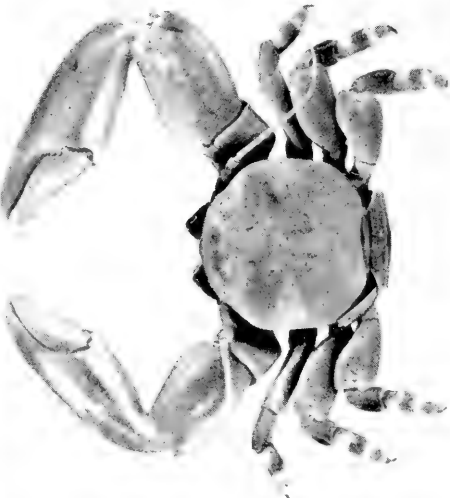
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- Fig. 1. *Petrolisthes granulatus* (Guérin), male. Bahía de la Independencia, Peru.
- Fig. 2. *Petrolisthes laevigatus* (Guérin), male. Golfo de Quetalmahué, Chile.
- Fig. 3. *Petrolisthes cinctipes* (Randall), male. Coos Bay, Oregon.
- Fig. 4. *Petrolisthes violaceus* (Guérin), male. Bahía de San Juan, Peru.



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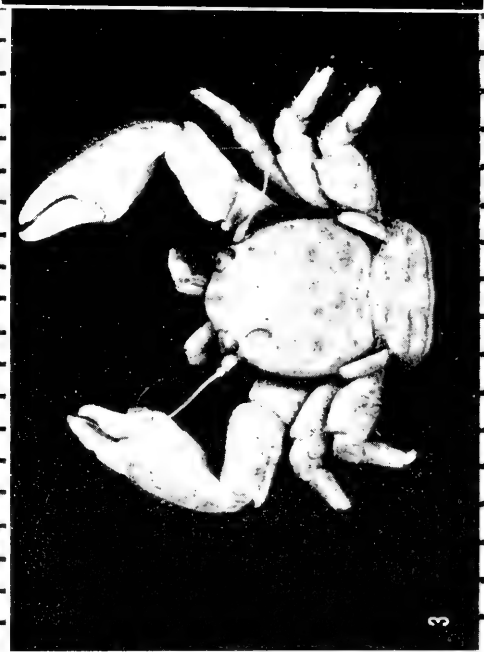
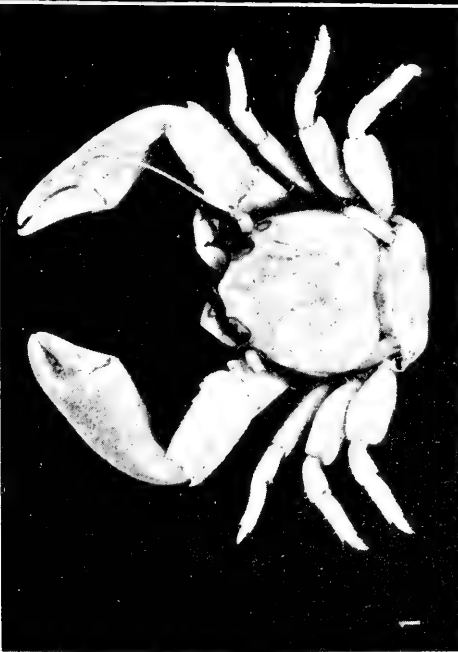
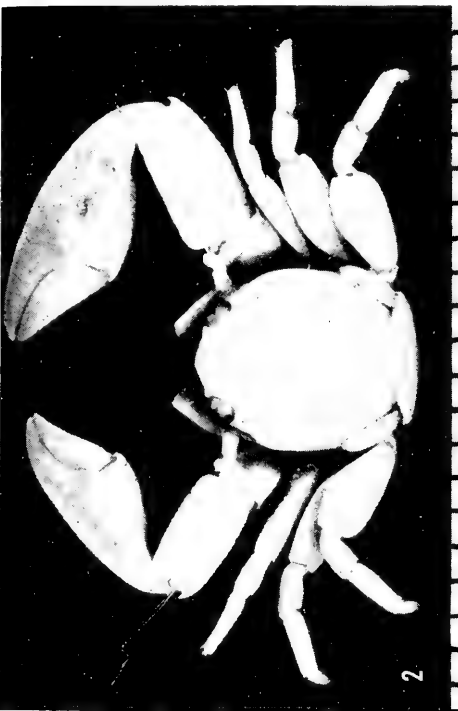
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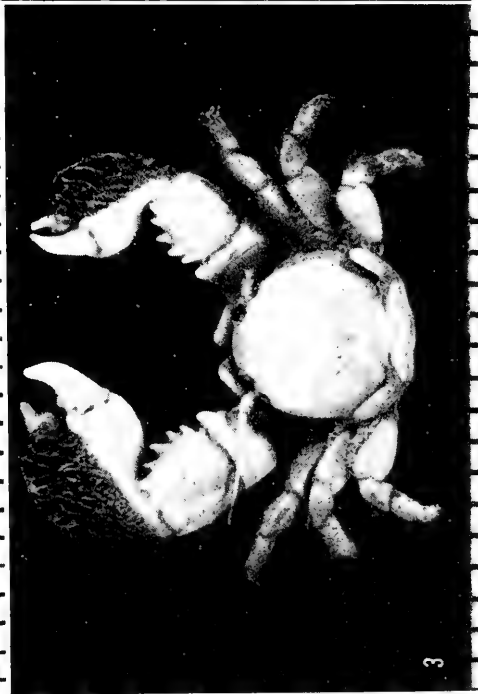
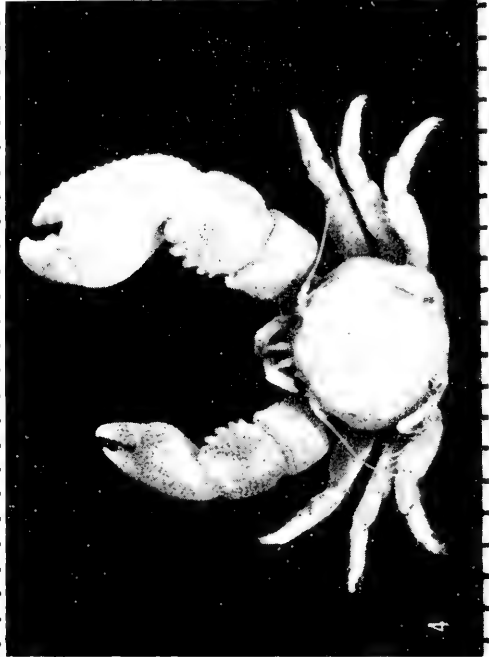
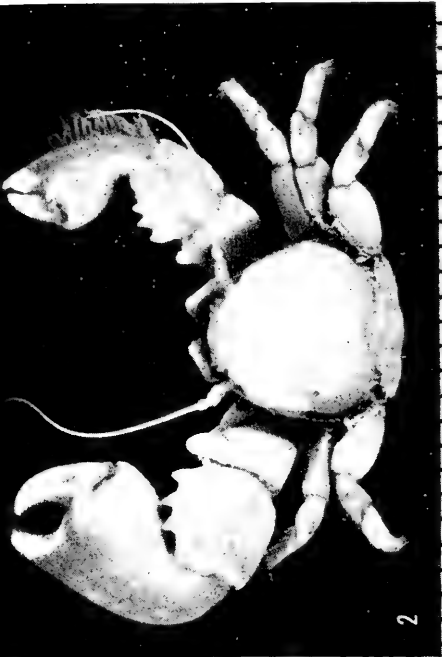
- Fig. 1. *Petrolisthes schmitti* Glassell, female. Isla San Francisco, Gulf of California.
- Fig. 2. *Petrolisthes brachycarpus* Sivertsen, male. Isla Indefatigable, Galapagos Islands.
- Fig. 3. *Petrolisthes platymerus*, n. sp., female paratype. Port Parker, Costa Rica.
- Fig. 4. *Petrolisthes holotrichus* Nobili, male. Bahía de Salinas, Costa Rica.





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- Fig. 1. *Clastoecus diffractus* (Haig), male holotype (AHF 542). Acapulco, Mexico.
- Fig. 2. *Neopisosoma mexicanum* (Streets), male. La Libertad, Ecuador.
- Fig. 3. *Neopisosoma bicapillatum*, n. sp., male paratype. La Libertad, Ecuador.
- Fig. 4. *Neopisosoma dohenyi*, n. sp., male paratype. Acapulco, Mexico.

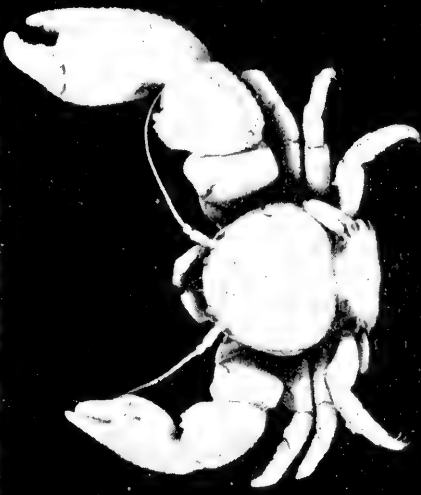


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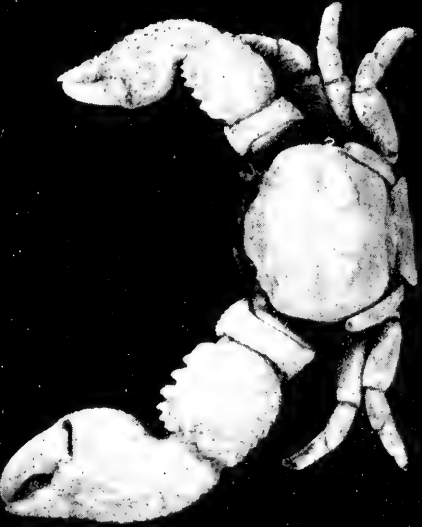
- Fig. 1. *Pachycheles crassus* (A. Milne Edwards), male (USNM 77509). Balboa, Canal Zone, Panama.
- Fig. 2. *Pachycheles setimanus* (Lockington), male. Bahía de Guaymas, Gulf of California.
- Fig. 3. *Pachycheles chacei* Haig, male. Bahía Piñas, Panama.
- Fig. 4. *Pachycheles calculosus*, n. sp., male paratype. Bahía Tangola-Tangola, Mexico.



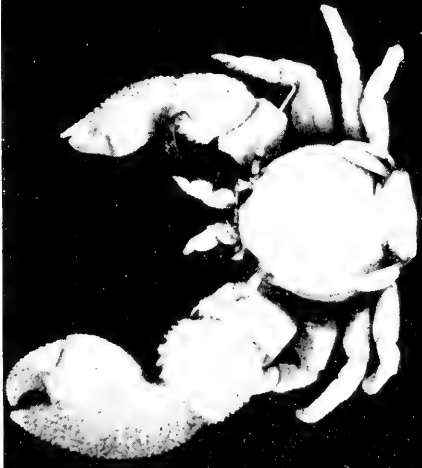
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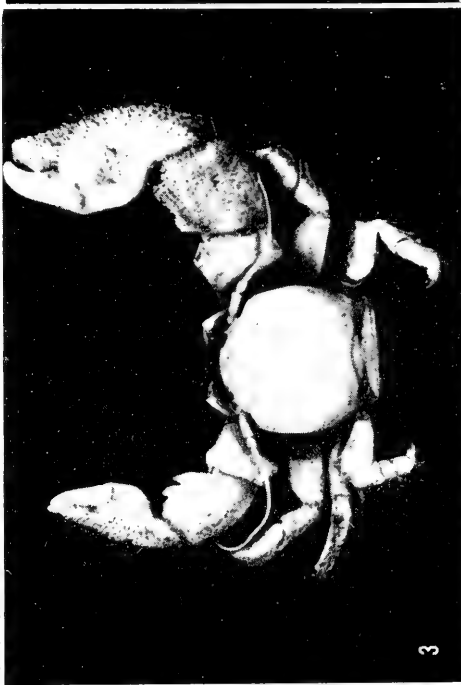
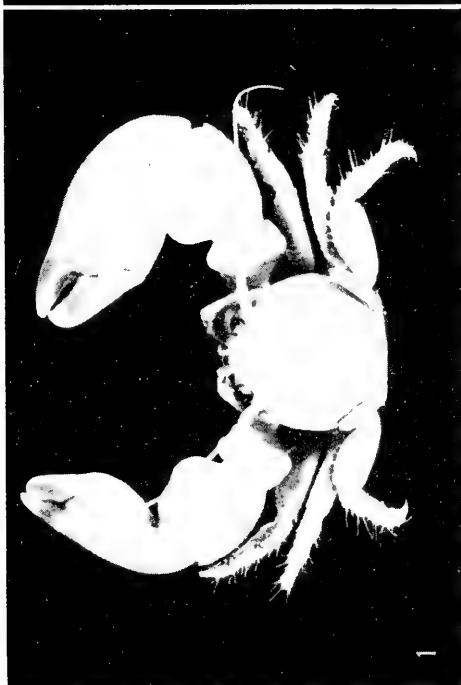
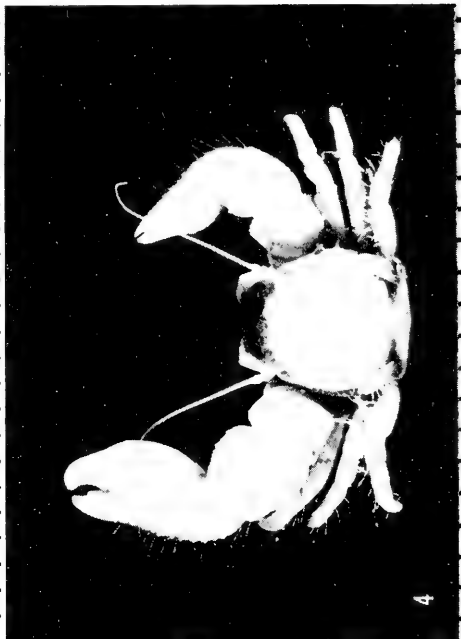
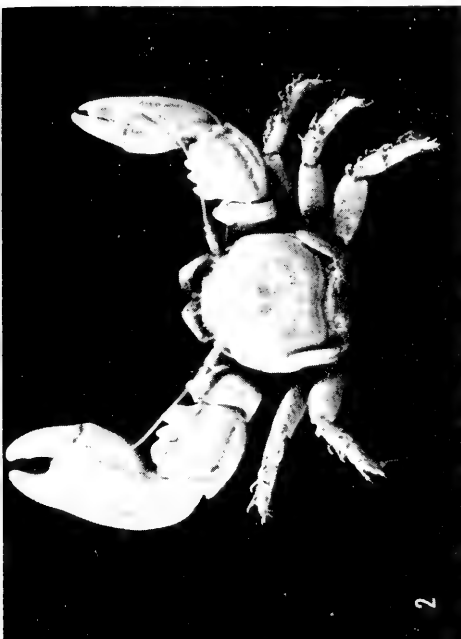
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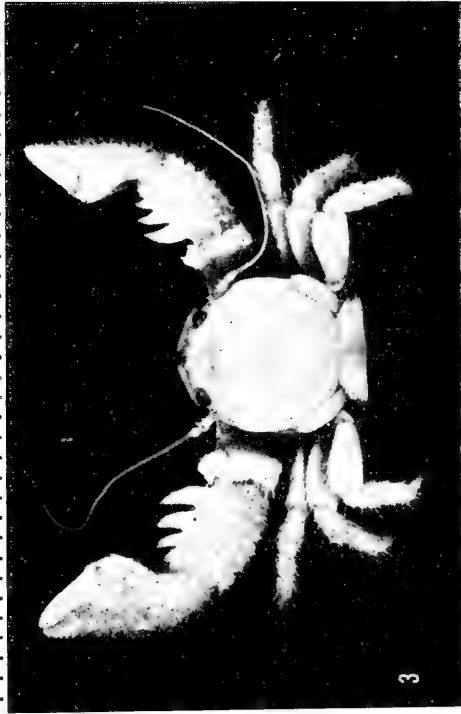
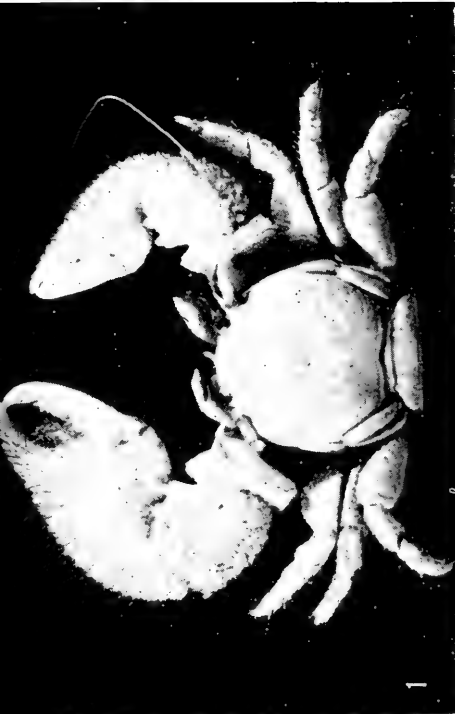
- Fig. 1. *Pachycheles biocellatus* (Lockington), male. Puerto Utría, Colombia.
- Fig. 2. *Pachycheles vicarius* Nobili, male. Port Parker, Costa Rica.
- Fig. 3. *Pachycheles trichotus*, n. sp., male holotype (USNM 102412). Isla Verde, Panama.
- Fig. 4. *Pachycheles subsetosus*, n. sp., male paratype. Puntarenas, Costa Rica.



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- Fig. 1. *Pachycheles panamensis* Faxon, male. Isla Tiburón, Gulf of California.
- Fig. 2. *Pachycheles spinidactylus* Haig, male. Bahía de Santa María, Baja California.
- Fig. 3. *Pachycheles marcortezensis* Glassell, male. Isla Angel de la Guarda, Gulf of California.
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- Fig. 1. *Pachycheles rudis* Stimpson, male. Sunset Bay, Oregon.  
Fig. 2. *Pachycheles holosericus* Schmitt, male. Santa Barbara, California.  
Fig. 3. *Pachycheles pubescens* Holmes, female. Bodega Bay, California.  
Fig. 4. *Pachycheles crinimanus*, n. sp., male paratype. Bahía de Sechura, Peru.



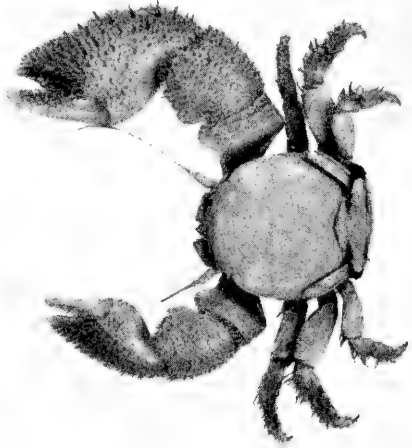
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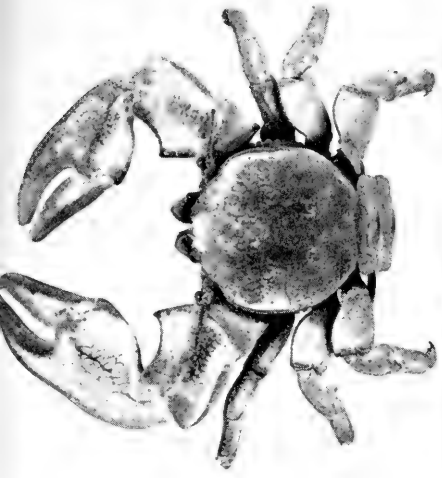
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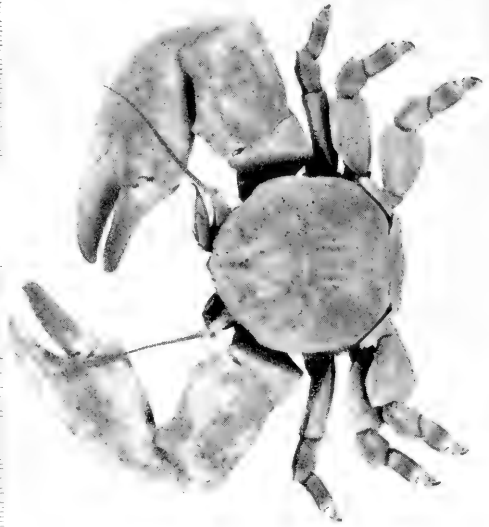
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- Fig. 1. *Pachycheles grossimanus* (Guérin), female. Bahía de la Independencia, Peru.
- Fig. 2. *Allopetrolisthes punctatus* (Guérin), male. Montemar, Chile.
- Fig. 3. *Allopetrolisthes spinifrons* (H. Milne Edwards), male. Bahía de la Independencia, Peru.
- Fig. 4. *Allopetrolisthes angulosus* (Guérin), male. Bahía de la Independencia, Peru.



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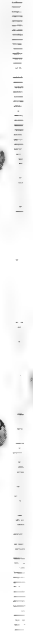
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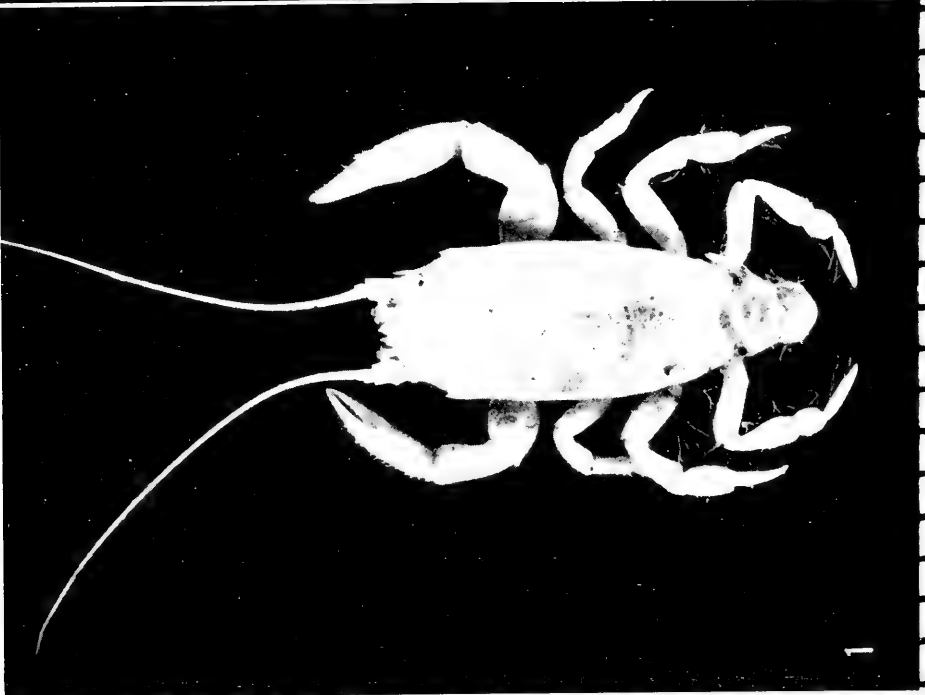
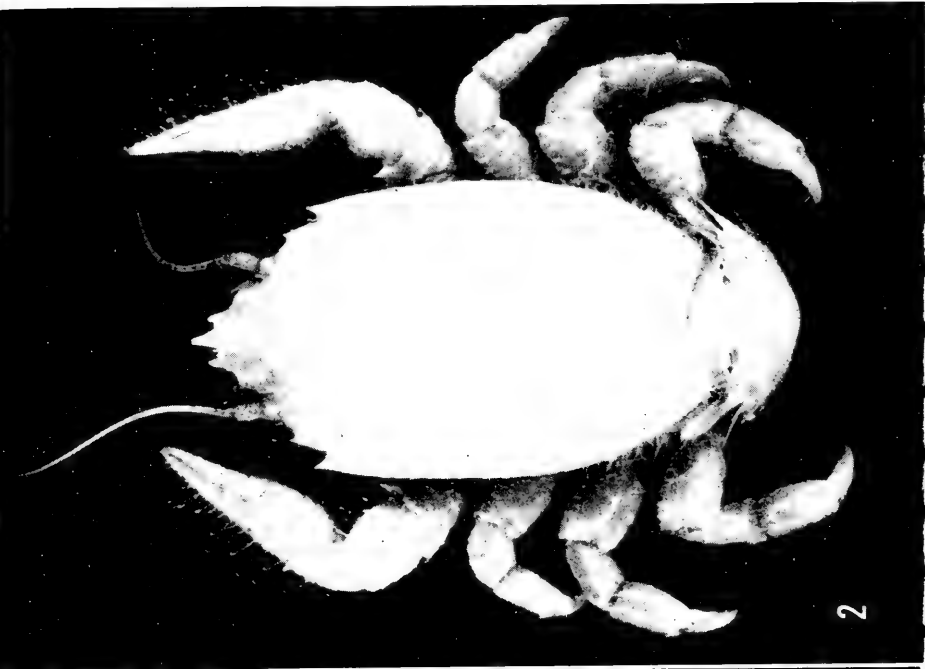


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## PLATE 36

- Fig. 1. *Euceramus panatellus* Glassell, male. San José, Guatemala.  
Fig. 2. *Euceramus transversilineatus* (Lockington), female. Bahía de la Magdalena, Baja California.

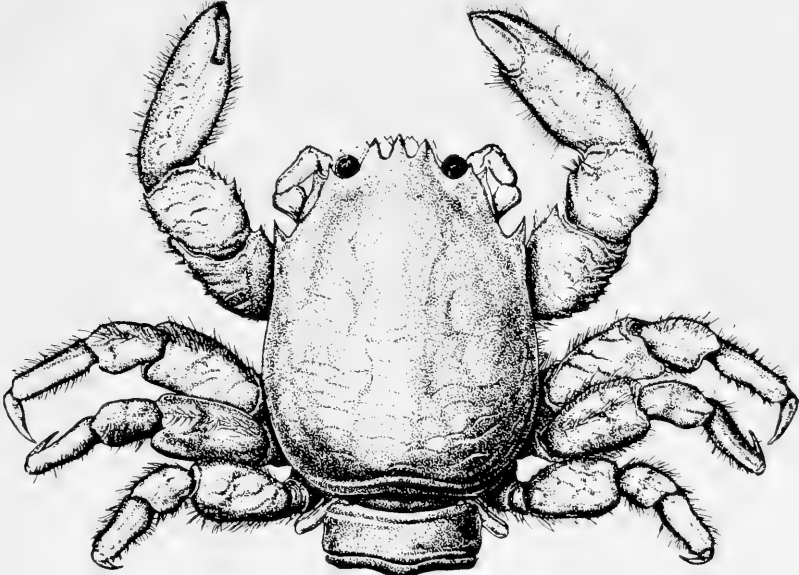


## PLATE 37

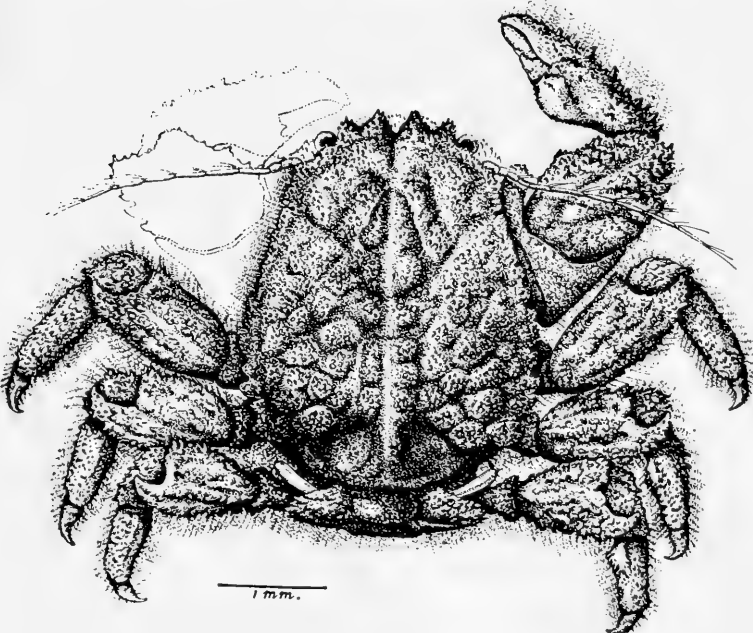
Fig. 1. *Minyocerus kirki* Glassell. (After Glassell, 1938a)

Fig. 2. *Ulloaia perpusillia* Glassell. (After Glassell, 1938a)





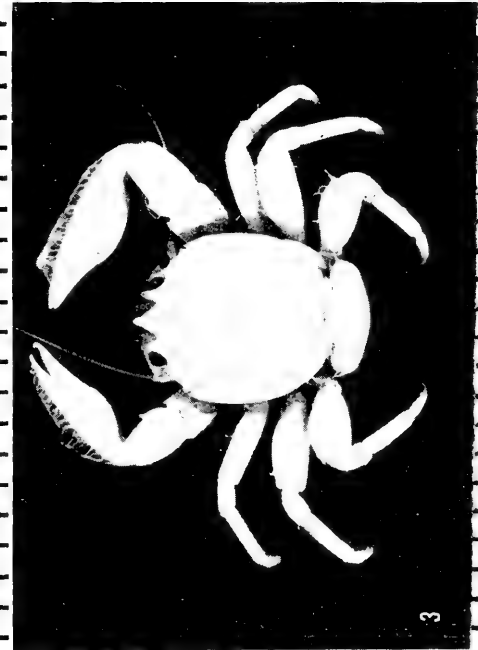
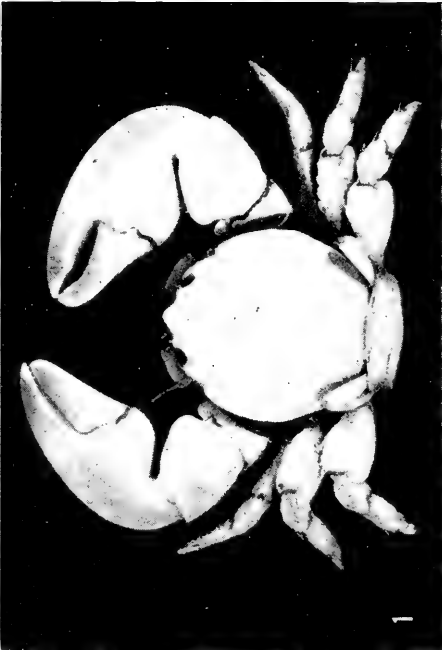
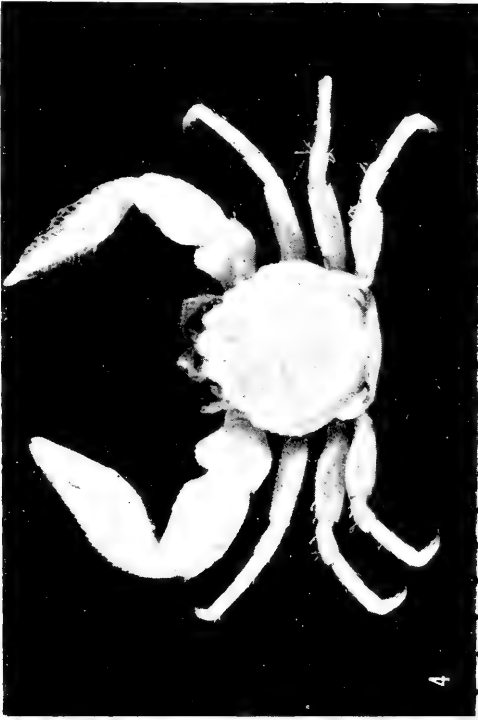
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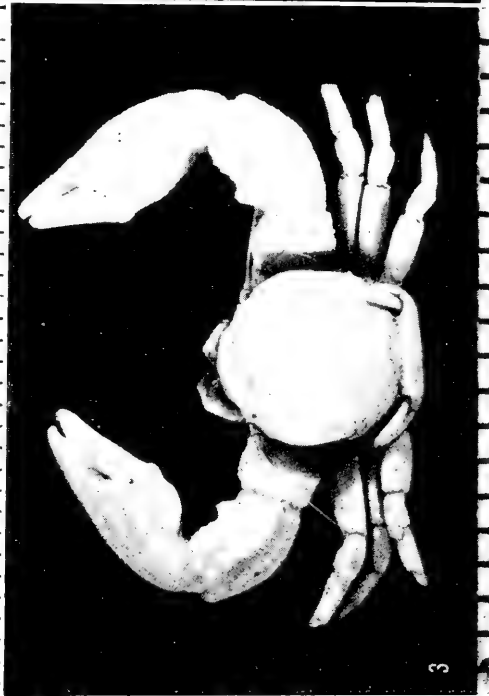
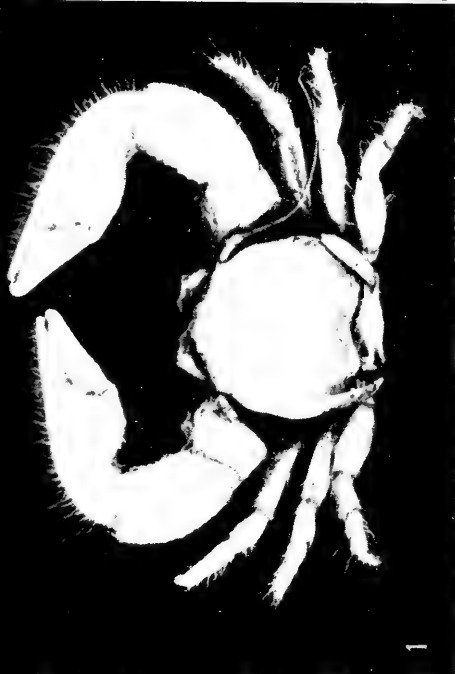
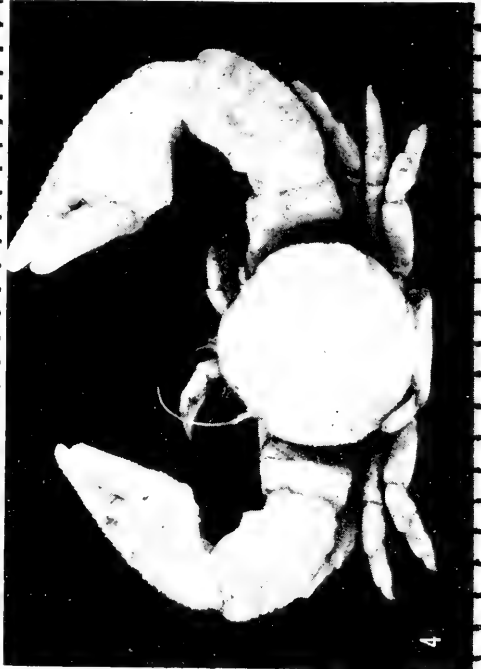
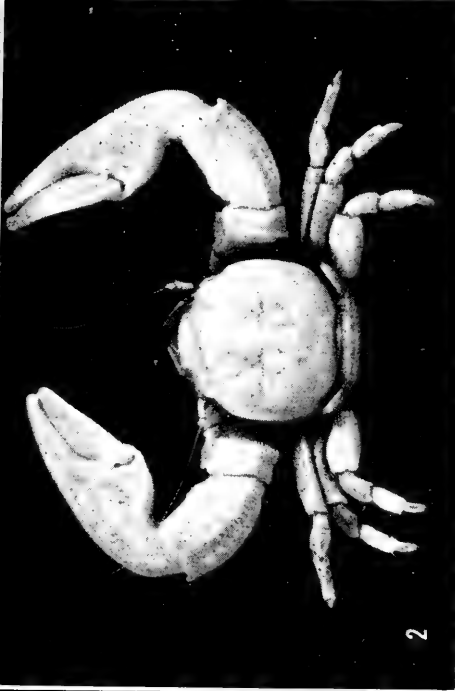
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- Fig. 1. *Porcellana paguriconzia* Glassell, male. Port Culebra, Costa Rica.
- Fig. 2. *Porcellana cancrisocialis* Glassell, male. Bahía de Concepción, Gulf of California.
- Fig. 3. *Porcellana hancocki* Glassell, male holotype (AHF 363). Bahía de los Angeles, Gulf of California.
- Fig. 4. *Pisidia magdalenensis* (Glassell), male. Bahía de la Magdalena, Baja California.



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- Fig. 1. *Megalobrachium pocyi* (Guérin), male. San Francisco, Panama.
- Fig. 2. *Megalobrachium smithi* (Glassell), male. Bahía de Concepción, Gulf of California.
- Fig. 3. *Megalobrachium sinuimanus* (Lockington), male. Los Frailes, Gulf of California.
- Fig. 4. *Megalobrachium garthi* Haig, male. Acapulco, Mexico.



## PLATE 40

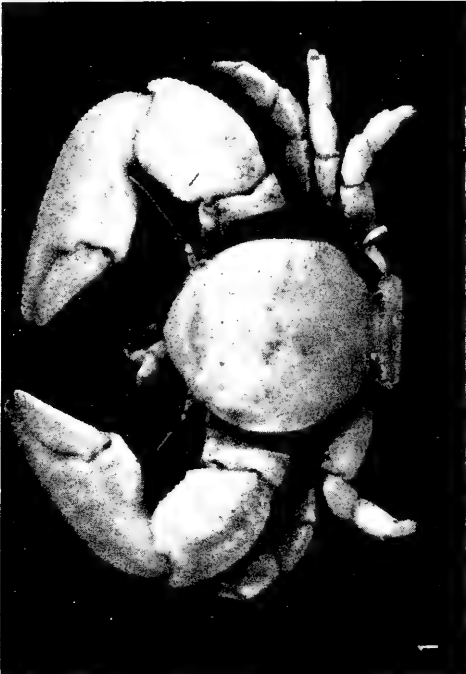
- Fig. 1. *Megalobrachium peruvianum*, n. sp., male holotype (USNM 102413). Islas Lobos de Afuera, Peru.
- Fig. 2. *Megalobrachium erosum* (Glassell), male. Isla Isabel, Mexico.
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- Fig. 4. *Megalobrachium tuberculipes* (Lockington), male. Isla Turner, Gulf of California.



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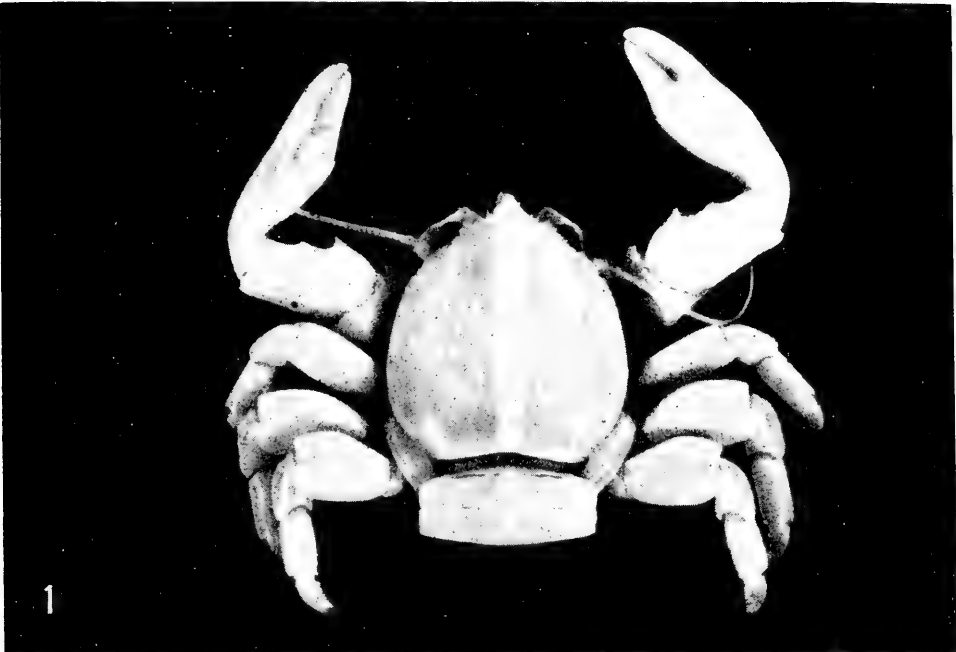
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## PLATE 41

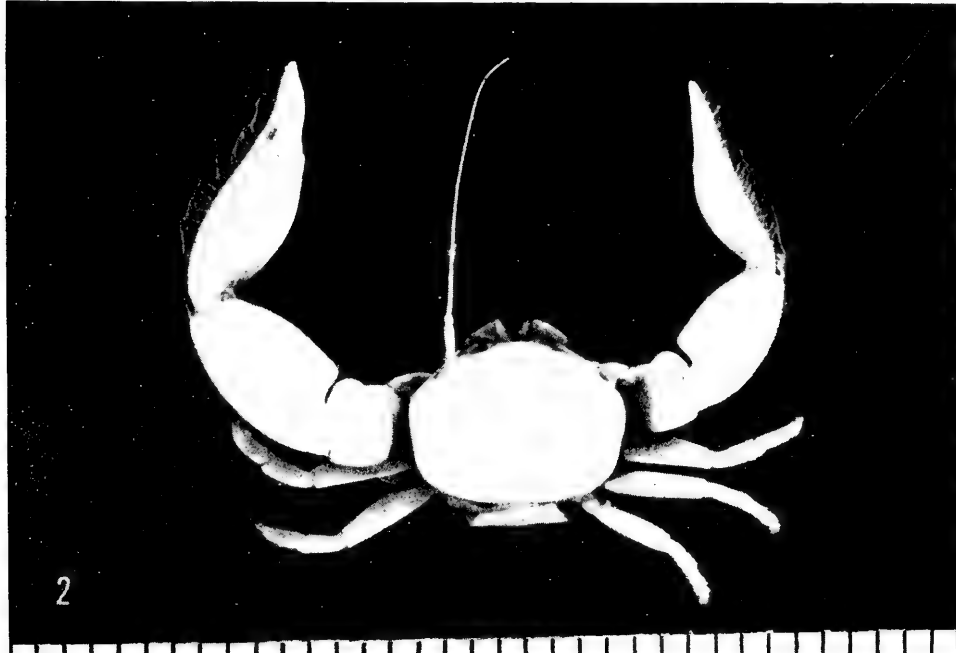
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