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A MONOGRAPH ON THE SHALLOW WATER CARIDEAN
SHRIMPS OF THE GULF OF CALIFORNIA, MEXICO

by *Mary K. Wicksten*

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For Dr. Chace, with thanks for
your help -

Mary K. Wicksten

SHALLOW WATER CARIDEAN SHRIMPS OF THE
GULF OF CALIFORNIA, MÉXICO

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ABSTRACT

Seventy-seven species of carideans are reported from the Gulf of California, México. *Dasycaris kerstitchi* n. sp., *Processa peruviana* n. sp., and *Alpheus mazatlanicus* n. sp. are described. *Hippolyte mexicana* Chace is found to be the male of *Hippolyte williamsi* Schmitt, not *H. californiensis* Holmes. *Alpheus fagei* Crosnier and Forest, *A. arenensis* (Chace), and *A. ridleyi* Pocock are synonymized with *A. websteri* Kingsley. *Alpheus cristulifrons* Rathbun, *Neopalpheopsis euryone* (De Man), and *Thor spinosus* Boone are recorded for the first time from the eastern Pacific Ocean.

The majority of carideans in the Gulf are of tropical origin. The fauna has strong affinities with the tropical Atlantic and Indo-West Pacific.

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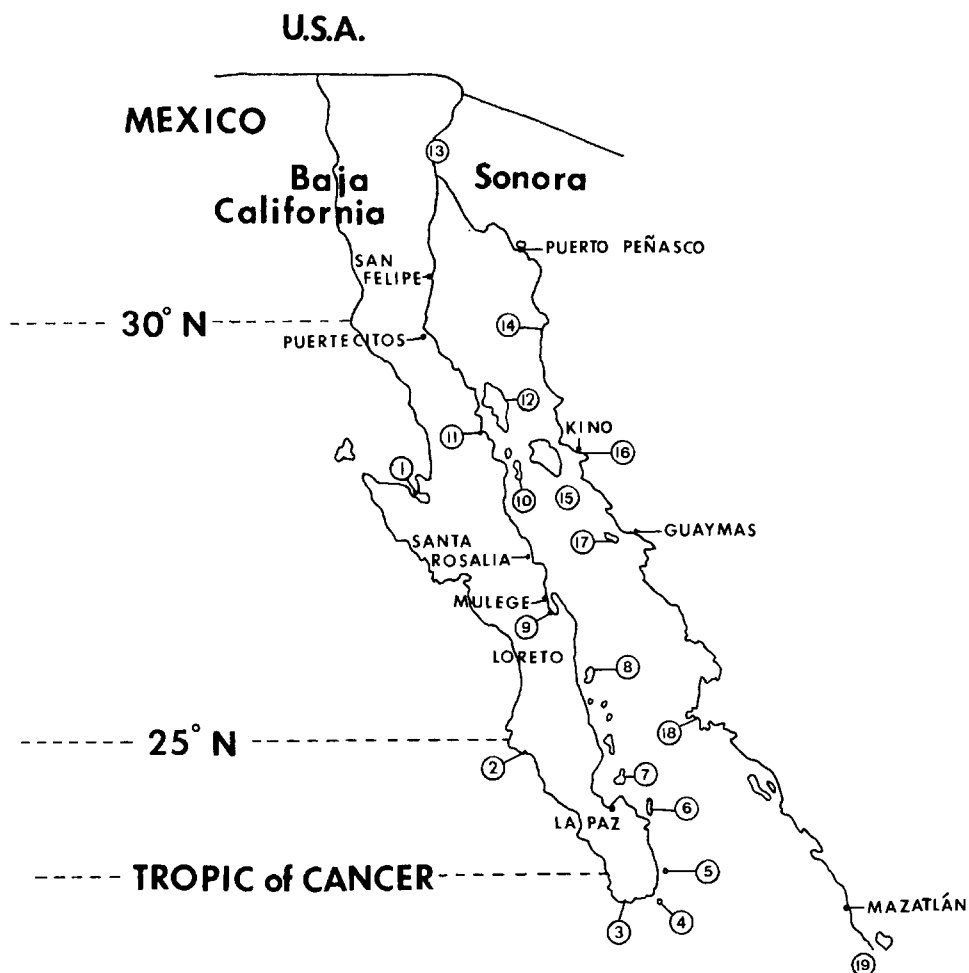


Figure 1

THE GULF OF CALIFORNIA AND VICINITY

- | | | |
|------------------------|------------------------------|----------------------------|
| 1. Scammon's Lagoon | 8. Isla Carmen | 14. Cabo Tepoca |
| 2. Bahía Magdalena | 9. Bahía Concepcion | 15. Isla Tiburón |
| 3. Cabo San Lucas | 10. Isla San Lorenzo | 16. Bahía Kino |
| 4. Gorda Banks | 11. Bahía de los Angeles | 17. Isla San Pedro Nolasco |
| 5. Cabo Pulmo | 12. Isla Ángel de la Guardia | 18. Punta San Ignacio |
| 6. Isla Cerralvo | 13. Río Colorado | 19. Laguna Caimanero |
| 7. Isla Espíritu Santo | | |

INTRODUCTION

Caridean shrimp compose one of the most common macroinvertebrate groups of shallow subtidal and intertidal habitats in the Gulf of California, México. Some are cleaners (Limbaugh 1961; Reynolds 1977; Corredor 1978), others are symbiotic with mollusks, sponges, ascidians, or antipatharians (Holthuis 1951b), and others are prey for fishes and birds (Chace 1937; Hobson and Chess 1976). Despite their abundance and probable ecological importance, there has been no comprehensive treatment of carideans of this area.

Literature on the carideans of the Gulf of California is scattered in many works. Faxon's reports (1893, 1895) on material taken by the R.V. *Albatross* remain useful for many species, particularly offshore animals. Chace (1937) reported on shrimp taken by the *Zaca* expedition off southern Baja California. Species ranging from California into western México have been described by Holmes (1900), Rathbun (1904), and Schmitt (1921). Word and Charwat (1976) provided keys to common carideans of southern California, including a few Mexican species. A short treatment of intertidal carideans of the Gulf was included in the guidebook by Brusca (1980).

Short accounts of carideans have been given for other parts of the Panamic Province. Many include species ranging into the Gulf of California. Abele (1975, 1976) provided lists of species from Panama and discussed interspecies relationships. Chace (1962) reported on the fauna of Clipperton Island. Schmitt (1924), Siversten (1933), and Hult (1939) wrote on the shrimp of the Galápagos Islands. The work by Chace (1972) on carideans of the Caribbean Sea provides useful references on amphi-American species. Méndez (1981) and Wicksten and Méndez (1983) have described and reported on carideans off northern Perú.

To identify most Mexican carideans, systematic treatments of the higher taxa are useful, if not essential. The alpheids have been discussed in works by De Man (1911), Coutière (1909), Banner (1953, 1956, and 1959), and Hart (1964). Hippolytids have been treated world-wide by Holthuis (1947). Hayashi (1975) wrote on Indo-West Pacific processids. The American palaemonids were treated in two volumes by Holthuis (1951b, 1952b). Chace (1954) discussed the species of *Hippolyte* on the west coast of North America. Abele (1972) described two species of *Ambidexter* from the Panamic Province. Wicksten (1978, 1981) has worked on the species of *Plesionika* and *Automate* in the area.

METHODS

In this work, the Gulf of California is defined as that body of water and its coasts extending from Cabo San Lucas (at the tip of the peninsula of Baja California) to the estuary of the Colorado River on the north and along the mainland coast of México south to the vicinity of Mazatlán, Sinaloa. The northernmost limit of the Gulf lies at approximately 31°50'N, the southernmost at about 22°50'N. Shallow water is defined as extending from the high tide mark to 100 fathoms (183 m), approximately the limit of the continental shelf. The majority of the species treated here, however, were collected at depths of 25 fathoms (50 m) or less.

Except as noted, the specimens examined for this study are in the collections of the Allan Hancock Foundation (AHF), University of Southern California. Other material is housed at Scripps Institution of Oceanography (SIO), the Instituto del Mar del Perú (IMARPE), and the Estación Mazatlán of the Universidad Nacional Autónoma de México (EMU). Specimens collected by the R.V. *Velero III* in the Galápagos Islands and other specimens as noted were observed at the U.S. National Museum of Natural History (USNM), Smithsonian Institution. Additional specimens were obtained on loan from the Muséum National d'Histoire Naturelle, Paris; the American Museum of Natural History, and the California Academy of Sciences. Almost all the specimens were taken intertidally by hand or subtidally by trawling or dredging. Other methods of collection included beach seining, poisoning while collecting fishes, picking from sponges and corals, use of a Van Veen grab, and hand netting by SCUBA divers. Very few of the specimens were taken during quantitative sampling programs. Most of the collecting was carried out by the staff of the R.V. *Velero III* in 1936, 1937, and 1940 (station numbers ending in -36 to -40); the *Velero IV* in 1949, 1950, and 1955 (station numbers ending in -49, -50, and -55); Tom and Beatrice Burch in 1967-68, the R.V. *Searcher* in 1971, personnel of the University of Arizona in the 1970's, R. C. Brusca in 1970-80, Alex Kerstitch in 1978-81, and the staff of the R.V. *El Puma* in 1981. A key to abbreviations of the stations and collectors is given in Appendix 1.

I have presented all records with the account of each species if I examined 12 or less lots of

Table A
Ranges of Species.

Tropical Eastern Pacific:	
<i>Alpheus grahami</i>	<i>Pontonia chimaera</i>
<i>Alpheus mazatlanicus</i>	<i>Pontonia longispina</i>
<i>Ambidexter panamensis*</i>	<i>Pontonia simplex</i>
<i>Ambidexter swifti</i>	<i>Processa peruviana</i>
<i>Automate rugosa</i>	<i>Pseudocourtierea elegans*</i>
<i>Dasycais kerstitchi</i>	<i>Salmones serratidigitus</i>
<i>Gnathophyllum panamense</i>	<i>Synalpheus apioceros sanjosei (TA)</i>
<i>Lysmata galapagensis</i>	<i>Synalpheus digueti</i>
<i>Neopontonides dentiger</i>	<i>Synalpheus goodei occidentalis (TA)</i>
<i>Ogyrides sp.</i>	<i>Synalpheus nobilii</i>
<i>Palaemon gracilis</i>	<i>Synalpheus paulsonoides</i>
<i>Palaemon ritteri*</i>	<i>Synalpheus sanlucasi</i>
<i>Palaemonetes hiltoni*</i>	<i>Synalpheus townsendi mexicanus</i>
<i>Pantomus affinis</i>	<i>Typton hephaestus</i>
<i>Periclimenes lucasi</i>	<i>Typton serratus</i>
<i>Plesionika mexicana*</i>	
<i>Pomagnathus corallinus</i>	
Mexico-California:	Tropical Western America-
<i>Alpheus bellimanus</i>	Tropical Atlantic:
<i>Betaeus longidactylus</i>	<i>Alpheus armillatus</i>
<i>Crangon munitellus</i>	<i>Alpheus cristulifrons</i>
<i>Eualus lineatus**</i>	<i>Alpheus cylindricus</i>
<i>Heptacarpus palpator**</i>	<i>Alpheus floridanus</i>
<i>Hippolyte californiensis**</i>	<i>Alpheus malleator</i>
<i>Lysmata californica</i>	<i>Alpheus normanni</i>
<i>Palaemonella holmesi</i>	<i>Alpheus schmitti</i>
<i>Periclimenes infraspinis</i>	<i>Alpheus websteri</i>
<i>Synalpheus lockingtoni</i>	<i>Leptochela serratorbita</i>
Tropical Western America-	<i>Lysmata intermedia</i>
Indo-West Pacific:	<i>Pontonia margarita</i>
<i>Alpheus leviusculus</i>	<i>Synalpheus fritzmuelleri**</i>
<i>Alpheus lottini</i>	<i>Synalpheus herricki**</i>
<i>Harpiliopsis depressus</i>	<i>Trachycaris restrictus</i>
<i>Lysmata trisetacea</i>	<i>Typton tortugae</i>
<i>Nealpheopsis euryone</i>	
<i>Processa aequimana</i>	
<i>Synalpheus biunguiculatus</i>	
<i>Synalpheus charon</i>	
<i>Thor paschalis</i>	
<i>Thor spinosus</i>	

Key to symbols: * One or two records from California. TA: subspecies of species occurring in tropical western Atlantic. ** Only one or two records from the Gulf of California.

Note: The species of *Ogyrides* has not been identified.

specimens. The numbers of specimens and stations as well as the overall range is given for each of the more common species. For the more common palaemonids, I present records not provided by Holthuis (1951b, 1952b). Additional information on the stations of the *Velero III* can be found in the station list (Fraser 1943). Records of the *Velero IV* are available at the Allan Hancock Foundation. Data on the specimens from Scripps Institution of Oceanography can be found in the catalog of decapod crustaceans (Luke 1977).

Table B
Species Usually found in the Southern Gulf of California.

<i>Alpheus cylindricus</i>	<i>Harpiliopsis depressus</i>
<i>Alpheus leviusculus</i>	<i>Lysmata galapagensis</i>
<i>Alpheus lottini</i>	<i>Lysmata trisetacea</i>
<i>Alpheus malleator</i>	<i>Synalpheus biunguiculatus</i>
<i>Alpheus websteri</i>	<i>Synalpheus charon</i>
<i>Brachycarpus biunguiculatus</i>	<i>Synalpheus nobili</i>

FAUNAL RELATIONSHIPS

The majority of caridean species in the Gulf of California belong to widespread tropical groups (Table A). Of the 77 species recorded herein, 32 species and subspecies are known primarily from tropical eastern Pacific waters. Ten species normally range from México north to the coast of California. Two species (*Latreutes antiborealis* and *Hippolyte williamsi*) reach their northern limits in the Gulf of California, ranging south to Chile. Ten species also occur in the Indo-West Pacific region. Fifteen species are amphi-American in distribution, found in tropical regions of both the western Atlantic and the eastern Pacific. Three species (*Alpheus paracrinitus*, *Automate dolichognatha*, and *Brachycarpus biunguiculatus*) are pantropical in warm waters. One palaemonid (*Palaemonetes paludosus*) has been introduced from the eastern United States by human activity. Four species of *Macrobrachium* may be found in estuaries or lagoons along the tropical Pacific coast. *Alpheus sulcatus* has a very peculiar distribution; it is found in the Pacific from México to northern Perú, off western Africa, and in the Indo-West Pacific region.

Only one genus, *Pomagnathus* Chace, is endemic to the tropical eastern Pacific Ocean. However, Banner (1964) pointed to similarities between the structure of the mouth-parts and branchial formula of *Pomagnathus corallinus* and two other species, *Alpheus clippertoni* and *A. paragracilis*. Possibly, *Pomagnathus* in the future may be relegated to subgeneric status in the widespread genus *Alpheus*.

There are marked differences in the patterns of distribution of the two most common caridean families in the Gulf of California. Of the 24 species in the family Palaemonidae, 19 occur only in the eastern Pacific. Two are amphi-American, one has been introduced into fresh water, one is pantropical, and one extends into the Indo-West Pacific region. Of the 33 species of alpheidids, however, only 12 are confined to the eastern Pacific. Ten species are amphi-American, three subspecies of *Synalpheus* belong to amphi-American species, two species are pantropical, and five species extend into the Indo-West Pacific. *Alpheus sulcatus* occurs in the eastern Pacific, off western Africa, and in the Indo-West Pacific.

Why are alpheidids so widespread in comparison with the palaemonids, particularly in regard to amphi-American species? The last free connection between the tropical Atlantic and the eastern Pacific was in the Miocene, over 12 million years ago. Species with amphi-American distributions have not diverged morphologically since then. Perhaps palaemonids, particularly obligate commensals, have a faster rate of allopatric speciation than alpheidids. The scarcity of coral reefs, large sponges, or other suitable habitats may have affected species in the eastern Pacific. Interspecific competition or predation may also be important. Further information on the microhabitats, behavior, interspecific interactions, and genetics of these shrimp will help to explain these curious differences.

Within the Gulf of California, 12 species usually occur from Guaymas southward (Table B). Only *Betaeus longidactylus* is more common in the northern Gulf than to the south. Other common species tend to range throughout the Gulf.

Alpheus mazatlanicus, *Dasycaris kerstitchi*, *Pontonia longispina*, *Synalpheus goodei occidentalis*, *S. paulsonoides*, and *S. townsendi mexicanus* are known only from the Gulf of California. Lack of collecting in proper habitats may have prevented their discovery in other areas.

HABITAT GROUPS

The collector of shrimps often finds caridean species in specific habitats. In rocky intertidal areas, *Alpheus armillatus*, *A. sulcatus*, *Lysmata californica*, *Palaemon ritteri*, and *Synalpheus lockingtoni* are

common. *Betaeus longidactylus* may occur in tidepools in the northern Gulf. *Palaemon ritteri*, *Thor paschalis*, and *Hippolyte williamsi* may be found in clumps of the brown alga *Sargassum muticum*. On sandy bottoms, the processids (*Ambidexter* spp. and *Processa* spp.), *Leptochela serratorbita*, and the commensal shrimp *Pontonia pinnae* (in the pen shell *Pinna rugosa*) can be found. *Automate rugosa* recently has been found as part of the infauna of soft bottoms in the southern Gulf. Inhabiting rocky or mixed subtidal bottoms are *Alpheus normanni*, *Gnathophyllum panamense*, *Palaemonella holmesi*, *Periclimenes infraspinis*, and *Synalpheus nobilii*. Among branched corals (*Pocillopora* spp.) live *Alpheus lottini*, *Harpiliopsis depressus*, and *Synalpheus charon*.

ADDITIONAL SPECIES THAT MAY OCCUR IN THE GULF

Five species of carideans that occur off the west coast of México have not been reported from the Gulf of California. These are the palaemonids *Periclimenaeus hancocki* Holthuis, *Fennera chacei* Holthuis, and *Waldola schmitti* Holthuis (southwestern Mexican coast); and the crangonid *Neocrangon zacaе* (Chace) (Clarion Island, outer coast of Baja California) (Holthuis 1951b; Wicksten 1980).

KEY TO THE FAMILIES OF SHALLOW WATER CARIDEANS OF THE GULF OF CALIFORNIA

1. First pair of pereopods chelate or simple 2
 - First pair of pereopods subchelate family Crangonidae
2. Exopods on pereopods. Fingers of chelae with comb-like cutting edges ... family Pasiphaeidae
 - No exopods on pereopods. Fingers of chelae without comb-like cutting edges 3
3. Carpus of second pair of pereopods entire. (First pair of pereopods with well-developed chelae) 4
 - Carpus of second pair of pereopods subdivided into two or more segments. (First pair of pereopods chelate or not) 5
4. Third maxilliped expanded, operculiform. (Compact, brightly-colored body) family Gnathophyllidae
 - Third maxilliped not expanded or operculiform. (Body form various) ... family Palaemonidae
5. Chelae of first pair of pereopods very small or absent. (Rostrum upcurved, toothed, longer than carapace) family Pandalidae
 - Chelae of first pair of pereopods distinct, at least on one side. (Rostrum various) 6
6. Second pereopods unequal or equal. Rostrum short, entire or with bifid tip family Processidae
 - Second pereopods always equal in length. Rostrum toothed or reduced to short spine 7
7. Eyestalks elongate, reaching almost to end of antennular peduncle. First pair of pereopods shorter than and about as robust as second family Ogyrididae
 - Eyestalks never elongate, often hidden by carapace. First pair of pereopods often longer than or more robust than second 8
8. Chelipeds of first pereopods with dark tips, equal in size and shape. Rostrum with dorsal teeth family Hippolytidae
 - Chelipeds of first pereopods without dark tips, one often larger and heavier than other. Rostrum without teeth family Alpheidae

FAMILY PASIPHAEIDAE

Leptochela Stimpson, 1860

Leptochela serratorbita Bate

Leptochela serratorbita Bate, 1888: 859, pl. 134, fig. 1.—Chace 1937: 111.—Williams 1965: 41, fig. 33.—Chace 1972: 16.—Hendrickx, Wicksten, and van der Heiden 1983: 67.

MATERIAL. MÉXICO: Off Puerto Refugio, Isla Ángel de la Guardia (29 January 1940, 94–100 m, rock and gravel, sta. 1057-40, 1 specimen).—Bahía de los Angeles (2 March 1937, 46–74 m,

sand; sta. 535-36, 1 specimen).—Bahía de Mazatlán (11 April 1980, 8 m, fine sand, sta. C10, VV8; 1 specimen; 29 April 1980, 27 m, muddy sand, sta. C11, VV1; 1 specimen; 20 April 1980, 10 m, fine sand, sta. C19, VV8, 1 specimen; all collected by ship *FC-1*, EMU).—Bahía Tenacatita, Colima (8 May 1939, 4–15 m, mud, sta. 964-49, 2 specimens).—COSTA RICA: Port Parker (24 March 1939, surface, sta. 934-39, 1 specimen).

HABITAT. Sandy or muddy bottoms, surface to 110 m. May be attracted to night lights.

TYPE LOCALITY. Saint Thomas, Virgin Islands.

DISTRIBUTION. North Carolina to Bay of Campeche and Antigua Island; southern Gulf of California to Costa Rica.

FAMILY PALAEMONIDAE

Key to the Species

1. Posterior margin of telson with 2 pairs spines. Pleurobranch on third maxilliped 2
 - Posterior margin of telson with 3 pairs spines. No pleurobranch on third maxilliped 10
2. Hepatic spine present, branchiostegal spine absent 3
 - Hepatic spine absent, branchiostegal spine present 7
3. Dactyls of last 3 pereopods biunguiculate. Strictly marine, rocky bottoms or among coral *Brachycarpus biunguiculatus* (Lucas)
 - Dactyls of last 3 pereopods simple. Fresh and estuarine waters on sand, mud, gravel, and rocky rubble 4
4. Carpus of second pereopod distinctly shorter than merus. Second pereopods of male stout, with numerous small spines and stiff setae *Macrobrachium americanum* Bate
 - Carpus of second pereopods as long as or longer than merus. Second pereopods of male stout or slender 5
5. Second chelae of adult male equal or subequal in shape, second pereopods long and slender, chelae with velvet-like pubescence *Macrobrachium tenellum* (Smith)
 - Second chelae of adult male very unequal in size and shape, second pereopods stout, chelae with setae, but no velvet-like pubescence 6
6. Second chelae of adult male with large spines on dorsomesial borders, movable finger of larger chelae with 13 teeth on cutting edge. Third pereopod relatively smooth, with few setae *Macrobrachium digueti* (Bouvier)
 - Second chelae of adult male with small spines on dorsomesial borders, movable finger of larger chela with 6 teeth on cutting edge. Third pereopod with relatively stiff, spinose setae *Macrobrachium occidentale* Holthuis
7. Mandible with palp 8
 - Mandible without palp 9
8. Carpus of second pereopod shorter than propodus. Rostrum equal to or slightly greater than length of scaphocerite. Widespread marine species, on sand or rock *Palaemon ritteri* Holmes
 - Carpus of second pereopod longer than propodus. Rostrum greatly exceeding length of scaphocerite. In lagoons *Palaemon gracilis* (Smith)
9. Fused part of 2 rami of dorsal antennular flagellum distinctly longer than free part. (Rostrum with 6–8 dorsal teeth and 3–4 ventral teeth). Estuarine parts of Colorado River drainage only *Palaemonetes paludosus* (Gibbes)
 - Fused part of 2 rami of dorsal antennular flagellum shorter than free part. (Rostrum with 8–11 dorsal teeth and 2–3 ventral teeth). In bays, lagoons, or estuaries *Palaemonetes hiltoni* Schmitt
10. Third maxillipeds without exopods. (Inhabiting only subtidal zones) 11
 - Third maxilliped with exopods. (Inhabiting intertidal to subtidal zones) 12
11. Pleura of third-fifth abdominal segments ending in pointed, toothlike tips. Rostrum without dorsal teeth *Pseudocoutierea elegans* Holthuis
 - Pleura of third-fifth abdominal segments rounded. Rostrum with 11 dorsal teeth *Neopontonides dentiger* Holthuis

12. Hepatic spine present 13
 – Hepatic spine absent 16
13. Rostrum broad, deep. Body strongly depressed. Third pereopod with dactyl twisted distally *Harpiliopsis depressa* (Stimpson)
 – Rostrum narrow, slender. Body not depressed. Third pereopods with dactyl not twisted .. 14
14. Dorsal surface of rostrum straight, with 3 ventral teeth anterior to eye. Spine of scaphocerite exceeding blade *Palaemonella holmesi* Nobili
 – Rostrum arched over eye on dorsal surface, with 2–3 ventral teeth, all near apex. Spine of scaphocerite falling short of distal end of blade 15
15. Dactyls of last 3 pereopods biunguiculate. Third abdominal segment without pronounced hump *Periclimenes infraspinis* (Rathbun)
 – Dactyls of last 3 pereopods simple. Third abdominal segment with pronounced hump *Periclimenes lucasi* Chace
16. Blade of scaphocerite rudimentary. (Rostrum spiniform, without teeth) 17
 – Blade of scaphocerite well developed. (Rostrum various) 19
17. Outer margin of uropodal exopod entire 18
 – Outer margin of uropodal exopod serrate *Typton serratus* Holthuis
18. Dactyls of both second legs semicircular, upper margin strongly convex. Carpus of large second leg with spinules on lower border *Typton tortugae* McClendon
 – Dactyls of both second legs not semicircular, generally elongated. Carpus of second leg without lower spinules *Typton hephaestus* Holthuis
19. Carapace with prominent dorsal teeth. (Commensal with antipatharians) *Dasycaris kerstitchi* n. sp.
 – Carapace without dorsal teeth. (Commensal with mollusks or ascidians) 20
20. Dorsal spines of telson small, inconspicuous 21
 – Dorsal spines of telson large, well developed 22
21. Eyes, when extended laterally, reaching beyond antennal spines. Scaphocerite without final tooth. Dactyls of fifth pereopod much stouter than those of third pereopod. In gastropods *Pontonia chimaera* Holthuis
 – Eyes, when extended laterally, not reaching antennal spines of carapace. Scaphocerite with small final tooth.
 – Dactyls of third and fifth pereopods similar. In pelecypods *Pontonia pinnae* Lockington
22. Dactyls of last 3 pereopods broad, posterior margins distinctly convex. Usually commensal in pearl oyster (*Pinctada mazatlanica*) *Pontonia margarita* Smith
 – Dactyls of last 3 pereopods slender, posterior margins straight. Commensal in *Pinna* sp. or found among rocks 23
23. Dorsal spines of telson very long and slender, anterior pair reaching beyond base of posterior part. Among rocks *Pontonia longispina* Holthuis
 – Dorsal spines of telson short, anterior pair reaching at most to middle of distance between both pairs. Commensal in *Pinna* sp. *Pontonia simplex* Holthuis

Subfamily Palaemoninae

Palaemon Weber, 1795

Palaemon ritteri Holmes

Palaemon ritteri Holmes, 1895: 21, figs. 29–35.—Holmes 1900: 216.—Rathbun 1904: 29.—Schmitt 1921: 34, fig. 1.—Hult 1939: 6.—Holthuis 1950a: 8.—Holthuis 1952b: 163, pl. 44, figs. a–g.—Word and Charwat 1976: 163.—van der Heiden and Hendrickx 1979: 38.—Brusca 1980: 250, fig. 14.2.—Chace and Abbott 1980: 569.

MATERIAL. Approximately 195 specimens from 38 stations, outer coast of Baja California from Estero de Punta Banda to Bahía Magdalena; Gulf of California from La Paz to San Felipe, Puerto Peñasco to Guaymas.

HABITAT. Shore to 40 m, among rocks and algae. Most specimens have been collected in the intertidal zone.

TYPE LOCALITY. San Diego, California.

DISTRIBUTION. San Diego, California; outer coast of Baja California from Estero de Punta Banda south, Gulf of California, west coast of tropical México, Panamá, Colombia, Isla Cocos, Ecuador, Galápagos Islands.

COLOR IN LIFE. Translucent with oblique dark brown bars (Holthuis 1952b).

REMARKS. *Palaemon ritteri* is one of the most common shrimps of the Gulf of California. It occurs regularly from the southern coast of Baja California, throughout the Gulf of California, and further south along the western American coastline. There have been no reports of it from California, U.S.A. since the collection of the type specimen.

A specimen taken at Coloraditos (11–14 April 1979) was parasitized by an epicarid isopod.

Palaemon gracilis (Smith)

Leander gracilis Smith, 1871: 97.

Palaemon gracilis Holthuis 1950a: 7.—1952b: 183, pl. 45, figs. f-1.—van der Heiden and Hendrickx 1979: 48.—Hendrickx, Wicksten, and van der Heiden 1983: 68.

MATERIAL. Laguna Caimanero, Sinaloa (1978, M. E. Hendrickx, 4 specimens, AHF and EMU).

HABITAT. Fresh to estuarine waters.

TYPE LOCALITY. Estero at Realejo, western Nicaragua.

DISTRIBUTION. Laguna Caimanero; "fresh waters of western America from Nicaragua to south Panama" (Holthuis 1952b).

REMARKS. The specimens from Laguna Caimanero are the only ones known from México. The animal may occur in other coastal lagoons of the southern Gulf of California.

Palaemonetes Heller, 1869

Palaemonetes hiltoni Schmitt

Palaemonetes hiltoni Schmitt, 1921: 36, pl. 12, fig. 5.—Holthuis 1950a: 10.—1952b: 227, pl. 53, figs. n-s.—Hendrickx, Wicksten, and van der Heiden 1983: 69.

MATERIAL. Laguna Caimanero, Sinaloa (1978, A. Menz, many specimens, AHF, EMU, USNM).

HABITAT. Coastal lagoons or estuaries.

TYPE LOCALITY. San Pedro, California.

DISTRIBUTION. Southern California and western México. The species has not been found in southern California in recent years.

Palaemonetes paludosus (Gibbes)

Hippolyte paludosa Gibbes, 1850b: 197.

Palaemonetes paludosus.—Holthuis 1950a: 10.—1952b: 207, pl. 51, figs. e-j.—St. Amant and Hulquist 1969: 252.

MATERIAL. Río Hardy, Río Colorado, Baja California (26 March 1972, D.A. Thomson and party, 11 specimens).

HABITAT. Shallow fresh water.

TYPE LOCALITY. St. Andrews, Charleston County, South Carolina.

DISTRIBUTION. Fresh waters east of Alleghenies, New Jersey to Florida, U.S.A. Introduced into other areas.

REMARKS. The specimens from Río Hardy undoubtedly were introduced.

Macrobrachium Bate, 1868

Macrobrachium americanum Bate

Macrobrachium americanum Bate, 1868: 363, pl. 30.—Holthuis 1950a: 12.—1952b: 128, pl. 31, figs. d–e.—van der Heiden and Hendrickx 1979: 48.—Holthuis 1980a: 87.—Méndez 1981: 73, fig. 245.—Hendrickx, Wicksten, and van der Heiden 1983: 68.

Palaemon jamaicensis Semper, 1868: 585.—Faxon 1895: 148.

Macrobrachium jamaicensis.—Rathbun 1910: pl. 51, fig. 1.—Schmitt 1924: 386.—Boone 1931: 146, pl. 51.—Sivertsen 1933: 5.—Hult 1939: 5. (See Holthuis, 1952b for a more extensive synonymy).

MATERIAL. Laguna Caimanero, Sinaloa (1979, A. Menz, 1 specimen, EMU).

HABITAT. Fresh water, occasionally upper reaches of estuaries.

TYPE LOCALITY. Lake Amatitlán, Guatemala.

DISTRIBUTION. In fresh water from La Paz and Cabo San Lucas, Baja California Sur; Guaymas, Sonora; Laguna Caimanero, south to northern Perú, Isla Cocos, Galápagos Islands.

Macrobrachium tenellum (Smith)

Palaemon tenellum Smith, 1871: 98.

Macrobrachium tenellum.—Holthuis 1950a: 19.—1952b: 54, pl. 10–11, figs. a, b.—van der Heiden and Hendrickx 1979: 48.—Holthuis 1980a: 105.—Méndez 1981: 73, fig. 233. (See Holthuis, 1952b for a more complete synonymy).

MATERIAL. MÉXICO: Laguna Caimanero, Sinaloa (1979, A. Menz, 1 specimen, EMU).—Tapo Botadero, Sinaloa (September 1978, A. Menz, 2 specimens, EMU).—Bahía Tangola Tangola, Oaxaca (16 March 1933, in fresh water, sta. 119-33, 1 specimen).—Laguna Coyuca, near Acapulco, Guerrero (9 September 1946, sta. 1556-46, 1 specimen; 16 September 1946, sta. 1567-46, 1 specimen).—COSTA RICA: Puerto Culebra (12 March 1933, shore, along slough, sta. 115-33, 1 specimen; 13 March 1933, sta. 117-33, 1 specimen).—Estero Camaronero, Quepos (15 January 1982, 1 m, R. Du Bois, P. Phillips, and D. Lynch, 3 specimens).—EL SALVADOR: Estero La Barra de Santiago (7 September 1980, Mirta Aida Aquino Torres, 3 specimens).

HABITAT. Fresh water streams and pools, occasionally in upper reaches of estuaries.

TYPE LOCALITY. Polvon, western Nicaragua.

DISTRIBUTION. Mulege and La Paz, Baja California Sur; vicinity of Mazatlán south to northwestern Perú.

COLOR IN LIFE. Gray, with red spots on both sides of the abdominal segments (M. A. Aquino Torres, pers. comm.).

Macrobrachium digueti (Bouvier)

Palaemon Digueti Bouvier, 1895: 159, fig. 2.

Macrobrachium digueti.—Holthuis 1950a: 13.—1952b: 103, pl. 26, figs. a–e.—van der Heiden and Hendrickx 1979: 48.—Méndez 1981: 73, fig. 225.—Hendrickx, Wicksten and van der Heiden 1983: 68. (See Holthuis 1952b for a more complete synonymy.)

MATERIAL. Laguna Caimanero, Sinaloa (1979, A. Menz, 1 specimen, EMU).

HABITAT. Fresh water, occasionally into upper reaches of estuaries.

TYPE LOCALITY. Río Mulege, Baja California Sur.

DISTRIBUTION. Mulege, California Sur; Laguna Caimanero, Sinaloa south to Perú.

Macrobrachium occidentale Holthuis

Macrobrachium occidentale Holthuis, 1950b: 95.—1952b: 74, pl. 17, figs. a–e.—Hendrickx, Wicksten, and van der Heiden 1983: 68.

MATERIAL. Río Baluarte, Sinaloa (November 1978, 2 specimens, collection of Estación Mazatlán).

HABITAT. Fresh water.

TYPE LOCALITY. Río de los Esclavos, Guatemala.

DISTRIBUTION. Río Baluarte, Guatemala, El Salvador, Panamá.

Brachycarpus Bate, 1888

Brachycarpus biunguiculatus (Lucas)

Palaemon biunguiculatus Lucas, 1849: 45, pl. 4, fig. 4.

Brachycarpus savignyi Bate, 1888: 795, pl. 129, fig. 4.

Palaemonella orientalis Rathbun, 1906: 925.

Brachycarpus biunguiculatus.—Holthuis 1950a: 12.—1952b 3, pl. 1, figs. a–q.—Abele 1975: 70.—Corredor 1978: 35.

MATERIAL. MÉXICO: S of Punta Arena, Gulf of California (2 February 1971, 3–5 m, rocks; *Searcher* sta. 44, 1 specimen).—S end Isla Cerralvo (7 February 1971, 10–12 m, *Searcher* sta. 46, 1 specimen).—Punta Chileno, Cabo San Lucas (22–25 July 1981, 5–10 m, rocks and coral; A. Kerstitch, 9 specimens).—Shepard's Rock, Cabo San Lucas (20 July 1981, 15 m, cliff; A. Kerstitch, 4 specimens).—Isla Clarion (27 March 1954, L. Pinkas and D. Joseph, 1 specimen).

HABITAT. Shore to 10 m, rocks and coral bottoms.

TYPE LOCALITY. Oran and Bone in Algeria.

DISTRIBUTION. Bermuda, Florida, Caribbean Sea; Mediterranean, Red Sea, Liberia, Ceylon, Tahiti, Oahu, Molokai, Wake Island; southern Gulf of California, Costa Rica, Panamá, Isla Gorgona, Isla Cocos, Galápagos Islands.

COLOR IN LIFE. Dark blue green, mottled with whitish (Holthuis 1952b). Translucent, red striped (A. Kerstitch color slide).

Subfamily Pontoniinae

Palaemonella Dana, 1852

Palaemonella holmesi (Nobili)

Periclimenes holmesi Nobili, 1907: 5.—Chace 1937: 132.

Anchista tenuipes Holmes, 1900: 216.

Periclimenes tenuipes.—Rathbun 1904: 34, fig. 12.—Schmitt 1921: 39, fig. 24.

Palaemonella holmesi.—Holthuis 1951b: 13, pl. 3, figs. a–h; pl. 4, figs. a–i.—1952a: 7.—Word and Charwat 1976: 165.—Abele 1976: 270.—Brusca 1980: 252, fig. 14.8.—Chace and Abbott 1980: 569.

MATERIAL. CALIFORNIA, U.S.A.: Inner San Pedro Harbor (14 September 1977, Los Angeles Harbor Project, 1 specimen).—MÉXICO: Bahía San Gabriel, Isla Espíritu Santo (15 March 1949, 2 m, coral; sta. 1737-49, many specimens).—Bahía Salinas, Isla Carmen (20 March 1949, 13 m, algae; sta. 1755-49, 1 specimen).—1 mi. WSW Punta Perico, Isla Carmen (21 March 1949, 13–20 m, sand; sta. 1759-49, 2 specimens).—Off Cabo Tortola, Bahía Tortuga, Baja California (6 March 1949, 2–7 m, mud; sta. 1707-49, 1 specimen).—20 mi. SE of El Desemboque, Sonora (4 February 1968, L. T. Findley, many specimens).—Isla Las Animas, Sonora (9 September 1978, 6 m, A. Kerstitch, 1 specimen).—Isla Blanca, Guaymas (16 June 1978, A. Kerstitch, 1 specimen).—W shore Isla Socorro (26 August 1946, sta. H46-226, 1 specimen).

HABITAT. Subtidal sandy or rocky bottoms, 2-90 m.

TYPE LOCALITY. Santa Catalina Island, California.

DISTRIBUTION. Shallow coastal waters of western American coast from southern California to Ecuador. Rare north of western México.

COLOR IN LIFE. Semi-translucent, pale brown (Holthuis 1951b).

Periclimentes Costa, 1844

Periclimentes infraspinis (Rathbun)

Urocaris infraspinis Rathbun, 1902: 31, fig. 10.—Schmitt 1921: 37, fig. 22.

Periclimentes infraspinis.—Chace 1937: 132.—Holthuis 1951b: 46, pl. 13, figs. a-l.—1952a: 9.—Word and Charwat 1976: 167.—Brusca 1980: 250, fig. 14.3.—Chace and Abbott 1980: 569.—Hendrickx, Wicksten, and van der Heiden 1983: 70.

MATERIAL. MÉXICO: Scammon's Lagoon, Baja California (14 September 1953, sta. KG5, 1 specimen).—W side Roca Marcial, Gulf of California (17 March 1949, 5–17 m, sta. 1742-49, 2 specimens).—Estero Soldado, Sonora (10 January 1973, 1 m, L. T. Findley, 1 specimen; 21 April 1973, 1 m, W. W. Reynolds and party, 2 specimens).—Window Rock, Guaymas (24 June 1978, 31 m, among antipatharians, A. Kerstitch, 1 specimen).—Bay of Mazatlán (August 1979, 9 m, sand, 3 specimens, EMU).

HABITAT. Shallow water to 150 m, among rock, sand or algae. Occasionally associated with black coral (*Antipatharia*).

TYPE LOCALITY. Bahía Concepción, Baja California.

DISTRIBUTION. San Diego, California to Costa Rica and Galápagos Islands.

COLOR IN LIFE. Semitranslucent, pale brown (Holthuis, 1951b).

Periclimentes lucasi Chace

Periclimentes lucasi Chace, 1937: 133, fig. 8.—Holthuis 1951b: 54, pl. 16, figs. a-k; pl. 19, figs. f-h.—1952a: 12.—Brusca 1980: 250, fig. 14.4, pl. 5.

MATERIAL. MÉXICO: Bahía San Juanico, Baja California (2 March 1937, 29 m, sand and kelp; sta. 616-37, 1 specimen).—S of Isla Tortuga, Gulf of California (13 March 1936, 39 m, volcanic sand; sta. 576-36, 1 specimen).—Bahía Empalme, Sonora (19 November 1946, shore, mud, sand and rocks; 1 specimen).—Isla Catalina, San Carlos, Sonora (17 June 1978, 18 m, with cerianthids; A. Kerstitch, 8 specimens).—Bahía Santa Lucia, Acapulco, Guerrero (1–2 February 1954, 2–7 m, rock, sand and mud; sta. 2596-54, 1 specimen).

HABITAT. Sandy and muddy bottoms, subtidally to 90 m, occasionally associated with cerianthids.

TYPE LOCALITY. Bahía San Lucas, Gulf of California.

DISTRIBUTION. Baja California, Gulf of California to southern Panamá, in shallow littoral waters.

COLOR IN LIFE. Translucent, with fine lemon yellow and purple lines on frontal appendages (Holthuis 1951b).

Harpiliopsis Borradaile, 1917

Harpiliopsis depressa (Stimpson)

Harpilius depressus Stimpson, 1860: 38.—Chace, 1937: 135.

Harpiliopsis depressus.—Holthuis 1951b: 70, pl. 21, figs. a–i, pl. 22, figs. a–f.—1952a: 16.—Chace 1962: 608.—Abele and Patton 1976: 37.—Abele 1976: 270.

MATERIAL. MÉXICO: Isla Espíritu Santo (15 March 1949, among coral; sta. 1737-49, many specimens).—Punta Chileno, Cabo San Lucas (22–25 July 1981, 5–10 m, rock and coral; A. Kerstitch, 6 specimens).—Shepard's Rock, Cabo San Lucas (20 July 1981, 15 m, rock; A. Kerstitch, 7 specimens).—Isla María Cleofa (18 March 1956, shore, sta. KW17, 8 specimens).—Isla Isabel (22 March 1956, shore, sta. KW28, 9 specimens).—ISLA COCOS: Wafer Bay (3 June 1973, shore, among *Porites* sp., University of Southern California field party, 1 specimen).

HABITAT. Shallow water, among corals.

TYPE LOCALITY. Hawaii.

DISTRIBUTION. Red Sea, Seychelles, Malay Archipelago, Polynesia, Gulf of California to Colombia, Galápagos Islands.

COLOR IN LIFE. Translucent to pale green, dark blue-black, sometimes striped with deep blue on pale gray background (Holthuis 1952a, Abele 1976, color photograph by A. Kerstitch).

REMARKS. I have treated all these specimens of *Harpiliopsis* as belonging to *H. depressus*. However, A. J. Bruce and L. Abele (pers. comm.) have suggested that a second species, *H. spinigera* Ortman, also may be present in the area. The two species seem to differ in color patterns. Unfortunately, I have notes on living colors only for one lot of specimens. The animals seem to vary considerably in their abdominal spination, armature of the chelipeds, and placement of rostral teeth. Examination of a large series of specimens from throughout the eastern Pacific and Indo-West Pacific may be necessary to determine the correct designation of the species of *Harpiliopsis*.

Typton Costa, 1844

Typton hephaestus Holthuis

Typton hephaestus Holthuis, 1951b: 159, pl. 49, figs. 0–p.—1952a: 19.

MATERIAL. MÉXICO: Scammon's Lagoon, Baja California (13 September 1953, 6–8 m, rocks; sta. KG-3, 1 specimen).

HABITAT. Subtidal, among rocks.

TYPE LOCALITY. Southern Gulf of California (24°12'N, 109°55'W).

DISTRIBUTION. The species is known only from these two records.

Typton serratus Holthuis

Typton serratus Holthuis 1951b: 167, pl. 53, figs. a–l.—1952a: 19.

MATERIAL. MÉXICO: Puerto Refugio, Isla Ángel de la Guardia (26 January 1940, 15–38 m, sand and sponge; 1 specimen).—Acapulco, Guerrero (September 1946, sta. H46-252, 1 specimen).

HABITAT. Among sponges, subtidal.

TYPE LOCALITY. Tagus Cove, Isla Isabela (Albemarle Island), Galápagos Islands.

DISTRIBUTION. Gulf of California, Acapulco, and Galápagos.

COLOR IN LIFE. Light Chinese orange, articulations of fingers darker (Holthuis 1951b).

Typton tortugae McClendon

Typton tortugae McClendon, 1911: 19.—Holthuis 1951b: 153, pl. 48, figs. a–c.—1952a: 19.

RECORD IN LITERATURE. Southern Gulf of California (24°12'N, 109°55'W, *Albatross* sta. 2826, 1 specimen, Holthuis 1951b).

HABITAT. In sponges, shallow water to 20 m.

TYPE LOCALITY. Tortugas, Florida.

DISTRIBUTION. Bermuda, Florida, and Gulf of California.

Dasycaris Kemp, 1922

Dasycaris kerstitchi new species

Fig. 2

DESCRIPTION. Carapace smooth. Dorsal surface with 2 prominent teeth, the anterior one the larger. Small knob posterior to orbit. Antennal spine present. Antero-lateral margin rounded. Rostrum missing from this specimen.

Abdominal segments smooth. Pleura of first 2 segments rounded. Third segment not produced in dorsal midline, with pleura bluntly pointed. Pleura of fourth and fifth segments produced ventrally. Sixth segment shorter than telson, with sharp posterolateral point. Telson 3× as long as broad, with 2 pair marginal spines and 3 pair spines on posterior margin.

Eye large. Cornea oblique, hemispherical and not conoidally produced. Eyestalk rounded, with very large median knob.

Antennular peduncle slightly shorter than scaphocerite. Basal segment about 2× as long as wide, sides subparallel. Stylocerite sharp, less than 0.5× length of basal segment. Distolateral border with broad, triangular tooth. Statocyst well developed. Second segment about 0.3× length of basal segment. Distal segment about equal to second segment. Lower flagellum biramous, with rami fused proximally. Aesthetascs present on this flagellum. Upper flagellum broken.

Antenna with basicerite unarmed. Carpocerite subcylindrical, short and stout, reaching about 0.5× length of scaphocerite. Antennal flagellum broken, but exceeding at least length of carapace. Scaphocerite without lateral spine, 2.5× as long as wide.

Mandible without palp. Molar process with stout, blunt teeth, incisor process laminar, with small teeth. First maxilla with long setae along edges of endites. Second maxilla with nonsetose palp and well-developed scaphognathite. First maxilliped with small palp. Basal and coxal endites forming lamina. Large caridean lobe, large epipod, and exopod present. Second maxilliped with terminal segment having rows of long and short setae. Coxa with elongated epipod. Exopod present. Third maxilliped slender. Antepenultimate segment fused with basis, about 4× as long as wide, with curved margins. Penultimate segment less than 0.5× length of antepenultimate, 2× as long as wide. Ultimate segment shorter than penultimate, 2× as long as wide, setose. Epipod, exopod, and arthrobranch present.

First pereopod slender, exceeding end of scaphocerite by about 0.5× length of carpus and length of chela. Palm of chela subcylindrical, 2× as long as wide. Fingers simple, slightly gaping. Carpus about 6× as long as wide. Merus about equal to carpus, ischium about 0.5× length of merus, basis about equal to ischium. Coxa short and stout.

Second pereopods missing.

Third pereopod with strongly curved dactyl, about 3× as long as basal width. Dactyl simple, without basal process, with slight swelling in middle of flexor margin. Propodus about 5× as long as