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A Key to the Palaemonid Shrimp of the Eastern Pacific Region

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Abstract.—Since the publication of the keys in the monographic study of American palaemonid shrimp by Holthuis (1951, 1952), numerous range extensions have been found, two new genera and seven new species have been described, and a taxonomic revision has added three genera to the family in the eastern Pacific. An up-to-date annotated key is provided to the 48 eastern Pacific species.

Caridean shrimp of the family Palaemonidae are common in intertidal and shallow subtidal rocky habitats, particularly in marine tropical and subtropical regions. Many are commensals of larger marine invertebrates, while others are facultative cleaners of marine fishes (Reynolds 1977; McCourt and Thomson 1984). The large "river prawns" of the genus *Macrobrachium* are edible, and are being studied for their potential for aquaculture.

To date, the most comprehensive works on eastern Pacific palaemonids have been those of Holthuis (1951, 1952). Since the publication of these valuable monographs seven new species have been described, a species has been introduced from the Orient and numerous range extensions have been found. In addition, a recent taxonomic revision of the family includes those genera previously separated into a distinct family, the Gnathophyllidae, into the Palaemonidae as members of the subfamilies Gnathophyllinae and Hymenocerinae (Bruce 1986a).

Most of the eastern Pacific palaemonids belong to genera that are widespread in tropical and warm temperate regions. Species of *Chacella, Veleronia* and *Waldola* are endemic to the tropical eastern Pacific. Species of *Harpiliopsis, Fennera* (associated with corals, *Pocillipora* spp.), *Pontonides* and *Allopontonia* occur from the eastern Pacific into the tropical Indo-West Pacific, but not in the Caribbean. Species of *Anchistoides, Coutierea, Lipkebe, Troglocubanus* and *Tuleariocaris* have been found in the Caribbean region, but not in the eastern Pacific. Also absent from the eastern Pacific are species of *Leander,* associated with drifting *Sargassum* in other parts of the world.

While examining specimens at the Allan Hancock Foundation (AHF), University of Southern California, and the California Academy of Sciences (CAS), I found range extensions of five species. These range extensions are presented herein, along with up-to-date records of the species from the literature. Records for ranges are taken from Wicksten 1983 except as noted. Numbers at the end of sections refer to notes at the end of the key.

I thank A. J. Bruce, Northern Territory Museum of Arts and Sciences, Darwin, Australia, for his valuable advice and information on ranges.

Key to the Marine Palaemonid Shrimp of the Eastern Pacific

1. Mandible without incisor process. Third maxillipeds expanded, leaf-like 2
– Mandible usually with incisor process. Third maxillipeds not expanded, leaf-like 4
2. Last two articles of third maxilliped almost as broad as or broader than antepenultimate article, the latter distinctly broader than article preceding it. Dactyl of second leg serrate above. In life, colored brightly with contrasting red spots on white background .... *Hymenocera picta* Dana. Widespread in Indo-Pacific, Panama (Mortensen 1918, as *Hymenocera* sp.) (1)
– Last two articles of third maxilliped less than half as broad as the antepenultimate article; the latter about as broad as article preceding it. Dactyl of second pereopod not serrate above 3
3. Exopod of third maxilliped shorter than endopod. Dactyls of last three pereopods biunguiculate. (Robust, compact body, brightly colored in life) ..... *Gnathophyllum panamense* Faxon. Gulf of California to Galapagos
– Exopod of third maxilliped much longer than endopod. Dactyls of last three pereopods ending in simple claws. (Body not as robust, color inconspicuous) .... *Gnathophylloides mineri* Schmitt. Circumtropical, Isla Malpelo. Commensal with sea urchins (Abele 1975)
4. Posterior margin of telson with 2 pairs spines. Pleurobranch on third maxilliped 5
– Posterior margin of telson with 3 pairs spines. No pleurobranch on third maxilliped 27
5. Hepatic spine present, branchiostegal spine absent 6
– Hepatic spine absent, branchiostegal spine present or absent 18
6. Dactyls of last 3 pereopods biunguiculate. Strictly marine, rocky bottoms or among coral .... *Brachycarpus biunguiculatus* (Lucas). Circumtropical, Gulf of California to Colombia, Galapagos Islands
– Dactyls of last three pereopods simple. Fresh and estuarine waters on sand, mud, gravel and rocky rubble 7
7. Carpus of second pereopod distinctly shorter than merus 8
– Carpus of second pereopod as long as or longer than merus 10
8. Adult male with chelae of second pereopods very unequal in size and shape ....*Macrobrachium hancocki* Holthuis. Costa Rica to Colombia, Cocos Island, Galapagos (Holthuis 1952)
– Adult male with chelae of second pereopods equal in shape, usually equal in size 9
9. Small, up to 105 mm long. Second pereopods of male distinctly different in shape. Ventral surface of merus, carpus and palm of large chela with thick pubescence ....*Macrobrachium inca* Holthuis. Rivers and streams of Ecuador and Peru (Holthuis 1952)

– Larger, up to 233 mm long. Second pereopods of male similar in shape. Ventral surface of merus, carpus and palm of large chela without thick pubescence except along cutting edge of fixed finger .....
.. *Macrobrachium americanum* (Bate). Baja California and Sonora, Mexico to Peru and Galapagos Islands, usually in fresh water

10. Telson gradually tapering towards slender tip, which overreaches posterior telson spines .....
.. *Macrobrachium panamense* Rathbun. Honduras to Ecuador, fresh water (Holthuis 1952)

– Telson not gradually tapering towards slender tip, posterior telson spines overreaching posterior margin 11

11. Second chelae of male very unequal in size and shape. Smaller chela with fingers strongly gaping 12

– Second chelae of male equal or subequal in shape. Smaller of 2 chelae, if one is smaller, never with fingers gaping 13

12. Both cutting edges of fingers of larger second chela having one large tooth, with 1–2 small teeth proximal to it. Rostrum curved upward at tip . *Macrobrachium digueti* (Bouvier). Baja California and Sinaloa, Mexico south to Peru, usually in fresh water

– Cutting edge of movable finger only of larger second chela having one large tooth, with 3 small teeth proximal to it. Rostrum not curved upward at tip *Macrobrachium acanthochirus* Villalobos 1966. Oaxaca and Colima, Mexico, fresh water

13. Cutting edges of fingers of large chela of adult male with 1–2 large proximal teeth, edges distal to these entire 14

– Cutting edges of fingers of large chela of adult male with numerous denticles of about equal size, without 1–2 large proximal teeth 16

14. Fingers of second chela of adult male 0.8–1.0× as long as palm. Rostrum with proximal part of upper margin somewhat convex .....
... *Macrobrachium tenellum* (Smith). Southern Baja California and Sonora, Mexico south to Peru, usually in fresh water

– Fingers of second chela of adult male at most 0.6× as long as palm. Rostrum almost straight 15

15. Fingers of second chela of adult male 0.5–0.6× as long as palm. Carpus of first pereopod 2.0× as long as chela. Weak spinules on pereopods 2–5
..... *Macrobrachium rathbunae* Holthuis. Panama to Ecuador, fresh water (Holthuis 1952)

– Fingers of second chela of adult male 0.4× as long as palm. Carpus of first pereopod 2.9× as long as chela. Strong spinules on pereopods 2–5
.. *Macrobrachium cocoense* Abele and Kim 1984. Isla del Coco, Costa Rica

16. Large chela of adult male without feltlike pubescence .....
... *Macrobrachium transandicum* Holthuis. Western Colombia, fresh water (Holthuis 1952)

– Large chela of adult male with distinct pubescence on lower surface of palm and fingers 17

17. Rostrum high with distinct unarmed region in ultimate half of upper margin .....
.... *Macrobrachium gallus* Holthuis. Ecuador, fresh water (Holthuis 1952)

– Rostrum shallow, toothed to apex .....
..... *Macrobrachium occidentale* Holthuis. Sinaloa, Mexico to Panama, usually in fresh water

18. (5) Branchiostegal spine absent. Second pereopods of adult male strongly unequal in size and shape, spinulose. (Strictly fresh water) .....
..... *Cryphiops caementarius* (Molina). Peru and Chile, usually fresh water (Holthuis 1952)

– Branchiostegal spine present. Second pereopods of adult male equal in size and shape, not spinulose. (Fresh water or marine) 19

19. Mandible with palp 20

– Mandible without palp 25

20. Carpus of second pereopod distinctly shorter than chela. .....
..... *Palaemon ritteri* Holmes. San Diego, California to Ecuador and Galapagos Islands

– Carpus of second pereopod equal to or longer than chela 21

21. Rostrum greatly exceeding length of scaphocerite, armed dorsally with 5–7 teeth 22

– Rostrum barely exceeding length of scaphocerite, armed dorsally with 8–9 teeth 23

22. Rostrum with 9–12 teeth on ventral surface. Second pereopods over-reaching scaphocerite by less than length of chelae .....
..... *Palaemon gracilis* (Smith). Sinaloa, Mexico to Panama, usually in fresh water

– Rostrum with 11–16 teeth on ventral surface. Second pereopods over-reaching scaphocerite by length of chelae or more .....
..... *Palaemon hancocki* Holthuis. Colombia and Ecuador

23. Apex of rostrum elongate, without teeth. Second pereopods at most reaching to end of scaphocerite .....
..... *Palaemon gladiator* Holthuis. Galapagos and Clipperton Islands (Holthuis 1952)

– Apex of rostrum not elongate, with teeth. Second pereopods exceeding end of scaphocerite 24

24. Three teeth on upper margin of carapace posterior to orbit, in line with rostrum. Rostrum with dorsal subapical tooth .....
... *Palaemon macrodactylus* Rathbun. San Francisco Bay, Elkhorn Slough, Malibu Lagoon and Los Angeles Harbor, California, introduced from Korea or Japan (Chace and Abbott 1980; Standing 1981). (2)

– One tooth on dorsal surface of carapace in line with rostrum. Rostrum without subapical teeth .....
..... *Palaemon peruanus* Holthuis. Coastal streams and rivers of Peru (Holthuis 1952)

25. (19) Fused part of 2 rami of dorsal antennular flagellum distinctly longer than free part of shorter ramus. (Rostrum with 6–8 dorsal teeth and 3–4 ventral teeth) .....
..... *Palaemonetes paludosus* (Gibbes). Estuarine parts of Colorado River drainage only. Widespread in eastern United States

– Fused part of 2 rami of dorsal antennular flagellum shorter than free part of shorter ramus. (Rostrum with 8–13 dorsal teeth and 2–4 ventral teeth) 26

26. Anterior margin of basal segment of antennular peduncle produced forward, overreaching anterolateral spine. Lower margin of rostrum not reaching level of antennular peduncle. Upper margin of rostrum with 8–11 teeth ..... *Palaemonetes hiltoni* Schmitt San Pedro, California to Gulf of California. (3)
– Anterior margin of basal segment of antennular peduncle not produced forward and not overreaching anterolateral spine. Lower margin of rostrum reaching level of antennular peduncle. Upper margin of rostrum with 11–13 teeth ..... *Palaemonetes schmitti* Holthuis. Panama
27. (4) Third maxillipeds without exopods. (Inhabiting only subtidal zones) 28
– Third maxillipeds with exopods. (Inhabiting intertidal to subtidal zones) 33
28. Pleura of third–fifth abdominal segments ending in pointed, toothlike tips. Rostrum without dorsal teeth .... *Pseudocoutierea elegans* Holthuis. Southern California to Colombia, Galapagos Islands
– Pleura of first–fourth abdominal segments rounded. Rostrum variable 29
29. Rostrum compressed, toothed 30
– Rostrum depressed, not toothed 31
30. Hepatic spine present, antennal spine absent. Rostrum not broadened over bases of eyestalks .... *Waldola schmitti* Holthuis. Southwestern Mexico to Colombia (Holthuis 1951)
– Hepatic spine absent, antennal spine present. Rostrum broadened over bases of eyestalks ....*Neopontonides dentiger* Holthuis. Sonora and Sinaloa, Mexico and Ecuador (Rios 1986)
31. Rostrum ending in distinct point, being triangular. Basal segment of antennular peduncle with strong spine at anterolateral angle .... *Pontonides sympathes* de Ridder and Holthuis. Galapagos, commensal with Antipatharia (de Ridder and Holthuis 1979)
– Rostrum broadly truncate. Basal segment of antennular peduncle without strong spine at anterolateral angle 32
32. Anterior margin of rostrum with teeth. Scaphocerite with distinct final tooth. Second pereopods unequal .... *Veleronia serratifrons* Holthuis. Ecuador, Galapagos Islands (Holthuis 1951). (4)
– Anterior margin of rostrum entire. Scaphocerite without or with indistinct final tooth. Second pereopods equal .... *Veleronia laevifrons* Holthuis. Gulf of California, Isla Malpelo, Ecuador, Galapagos. Commensal with gorgonians (Abele 1975; Wicksten and Hendrickx 1985)
33. (27) Hepatic spine present 34
– Hepatic spine absent 44
34. Rostrum broad, deep. Body strongly depressed. Third pereopod with dactyl twisted distally .... *Harpiliopsis depressa* (Stimpson). Gulf of California to Colombia,

Galapagos Islands; also widespread in Indo-Pacific Region. Commensal with corals. (5)

– Rostrum narrow, slender. Body not depressed. Third pereopods with dactyl not twisted 35

35. Second pereopods massive, dissimilar in size and shape. Rostrum barely exceeding eye, with at most one ventral tooth 36

– Second pereopods more slender, similar in size and shape. Rostrum exceeding eye, with 0–3 ventral teeth 38

36. Smaller second pereopod with dactyl short and high, almost semicircular. Rostrum with more than two dorsal teeth but without subterminal ventral tooth near apex .....
.. *Periclimenaeus hancocki* Holthuis. Baja California and Guerrero, Mexico; Panama, Isla Malpelo, among sponges and corals (Rios 1986). (6)

– Smaller second pereopod with dactyl elongate, never semicircular. Rostrum with at least two dorsal teeth, with or without subterminal ventral tooth 37

37. Rostrum with subterminal ventral tooth. Merus of third pereopod with spinules .....
.... *Periclimenaeus spinosus* Holthuis. Baja California, Costa Rica, among sponges or corals (Rios 1986)

– Rostrum without subterminal ventral tooth. Merus of third pereopod without spinules .....
..... *Periclimenaeus pacificus* Holthuis. Panama, Colombia, Galapagos (Holthuis 1951)

38. Dorsal surface of rostrum straight to slightly concave, with 2–3 ventral teeth anterior to eye. Spine of scaphocerite exceeding distal end of blade 39

– Rostrum arched over eye on dorsal surface, with 0–3 ventral teeth, all near apex. Spine of scaphocerite falling short of distal end of blade .. 40

39. Second pereopods equal in size and shape. Rostrum straight .....
..... *Palaemonella holmesi* (Nobili). Southern California to Ecuador

– Second pereopods unequal in size and shape. Rostrum slightly concave
..... *Palaemonella assymetrica* Holthuis. Galapagos (Holthuis 1951)

40. With large, freely mobile hepatic spine. Second pereopods robust. (Dactyls of other pereopods simple. Rostrum with 7–10 dorsal teeth and 1 ventral tooth .....
..... *Allopontonia iaini* Bruce. Western Pacific and Indian Ocean, Gulf of California. Commensal with sea urchins (Kerstitch 1987; Bruce 1987)

– With smaller, immobile hepatic spine. Second pereopods more delicate. (Dactyls of other pereopods simple or biunguiculate. Rostrum with variable numbers of dorsal and ventral teeth 41

41. Dactyls of last 3 pereopods simple 42

– Dactyls of last 3 pereopods biunguiculate 43

42. Third abdominal segment with pronounced hump. Lower margin of rostrum straight .. *Periclimenes lucasi* Chace. Gulf of California to Panama

– Third abdominal segment without pronounced hump. Lower margin of rostrum convex ..... *Periclimenes veleronis* Holthuis. Ecuador (Holthuis 1951)

43. Rostrum without ventral teeth. Chela of second pereopod stout .....
... *Periclimenes soror* Nobili. Gulf of California to Panama, widespread in Indo-Pacific region, Red Sea (Bruce 1976; Wicksten and Hendrickx 1985). (7)
– Rostrum with 1–2 ventral teeth. Chela of second pereopod slender ...
..... *Periclimenes infraspinis* (Rathbun). Southern California to Costa Rica and Galapagos Islands
44. (33) Blade of scaphocerite rudimentary. (Rostrum spiniform, without teeth. Commensal with sponges) 45
– Blade of scaphocerite well developed. (Rostrum and associations various) 48
45. Outer margin of uropodal exopod serrate .....
..... *Typton serratus* Holthuis. Gulf of California, southwestern Mexico and Galapagos
– Outer margin of uropodal exopod entire 46
46. Dactyls of both second pereopods not semicircular, generally elongated. Carpus of second pereopod without lower spinules .....
..... *Typton hephaestus* Holthuis. Southwestern Baja California, Gulf of California
– Dactyls of both second pereopods semicircular, upper margins strongly convex. Carpus of large second pereopod with spinules on lower border
..... 47
47. Antennal spine broad and tooth-shaped when seen from side. First pereopod slender, merus about equal in length to carpus .....
..... *Typton tortugae* McClendon. Gulf of California, Bermuda, Florida, Virgin Islands (Chace 1972)
– Antennal spine clearly spiniform when seen from side. First pereopod robust, merus 1.4× length of carpus .....
..... *Typton crosslandi* Bruce. Galapagos Islands (Bruce 1978)
48. Carapace with prominent dorsal teeth. (Commensal with antipatharians)
.....*Chacella kerstitchi* (Wicksten). Gulf of California (Bruce 1986b). (8)
– Carapace without dorsal teeth. (Usually commensal with mollusks or ascidians, possibly sponges) 49
49. Rostrum compressed, with 3–4 dorsal teeth .....
..... *Fennera chacei* Holthuis. Sinaloa, Mexico to Colombia, Galapagos, tropical Indo-West Pacific. Commensal with corals, *Pocillopora* spp. (Holthuis 1951; Patton 1966; Garth 1973). (9)
– Rostrum depressed, with at most two subapical teeth 50
50. Dorsal spines of telson small, inconspicuous 51
– Dorsal spines of telson large, well developed 52
51. Eyes, when extended laterally, reaching beyond antennal spines. Scaphocerite without final tooth. Dactyls of fifth pereopods much stouter than those of third pereopods. Commensal with gastropods .....
..... *Pontonia chimaera* Holthuis. Sonora, Mexico and Panama
– Eyes, when extended laterally, not reaching antennal spines of carapace. Scaphocerite with small final tooth. Dactyls of fifth pereopods similar to those of third pereopods. Commensal with pelecypods .....
.....*Pontonia pinnae* Lockington. Gulf of California to Panama. (10)

52. Dactyls of last 3 pereopods broad, posterior margins distinctly convex .... (Usually commensal with pelecypods) *Pontonia margarita* Smith. Gulf of California to Colombia and Galapagos, North Carolina to Florida (Chace 1972)
– Dactyls of last 3 pereopods slender, posterior margins straight. (Commensal with pelecypods or not) 53
53. Dorsal spines of telson very long and slender, anterior pair reaching beyond base of posterior part. (Host not known) .... *Pontonia longispina* Holthuis. Gulf of California
– Dorsal spines of telson shorter, anterior pair reaching at most to middle of distance between both pairs 54
54. Antennal spine present. Commensal in *Pinna* spp. .... *Pontonia simplex* Holthuis. Gulf of California, southwestern Mexico
– Antennal spine absent. Commensal in ascidians or other species 55
55. Anterior pair of dorsal telson spines reaching to or beyond base of posterior pair .... *Pontonia californiensis* Lockington. Carmel, California to southern California, usually along offshore islands. (Holthuis 1951; Standing 1981)
– Anterior pair of dorsal telson spines not reaching base of posterior pair 56
56. Second pereopods dissimilar in size and shape .... *Pontonia spighti* Fujino. Costa Rica, commensal in ascidians (Fujino 1972)
– Second pereopods similar in size and shape .... *Pontonia pusilla* Holthuis. Panama and Ecuador (Holthuis 1951)

Notes

Numbers in parentheses after couplet numbers refer the reader to previous choices, enabling the user to "back up" in case of errors or questions.

1. The recent revision of the Palaemonidae by Bruce (1987) includes the genera *Gnathophyllum* and *Gnathophylloides* in the family as part of the subfamily Gnathophyllinae. Species of *Hymenocera* are placed in the subfamily Hymenocerinae.

2. *Palaemon macrodactylus* was taken at Malibu Lagoon, Los Angeles County, 1 November 1984, Don Galli, in brackish areas among algae and rocks, 3 specimens, AHF.

3. *Palaemonetes hiltoni* has not been reported from southern California since its description in 1921. The area where it was collected, the coast of San Pedro, has been extensively modified during construction of the port of Los Angeles. The species probably no longer regularly occurs along the coast of southern California.

4. De Ridder (1980) provided detailed information on population structure, host associations, morphology and coloration in the two species of *Veleronia.*

5. For purposes of this paper, *Harpiliopsis depressa* (Stimpson) and *H. spinigera* (Ortmann) are considered to be synonyms. A. J. Bruce (pers. comm.) reports that the two species may be distinguished in life by the color pattern, but this information does not accompany the preserved specimens on which information on range is based.

6. *Periclimenaeus hancocki* was collected at Santa Lucia Bay, Guerrero, Mexico, 13 Sept. 1946, Carl Hubbs station H46-244, 2 specimens, AHF.

7. *Periclimenes soror* has been taken at two additional places in the Gulf of California: Isla Partida, off Isla Espiritu Santo, no date, B. Marquardt, 1 specimen; S. of "No Name Bay," SW end of Isla Espiritu Santo, 1 m, 19 Aug. 1965, A. Villalobos sta. D-34, 5 specimens, CAS.

8. *Chacella kerstitichi,* known previously only from the holotype, has been collected at Isla San Pedro Nolasco, Sonora, Mexico, 20 m, on *Antipathes galapagensis,* 21 June 1988, A. Kerstitch, 3 specimens, AHF.

9. *Fennera chacei* was taken at Marchena Island, Galapagos, 37 m, 3 Dec. 1934, *Velero III* station 311-35, 3 specimens, AHF.

10. See Campos-Gonzalez 1988 for details of host relationships in *P. pinnae* and *P. margarita.*

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