

***PERICLIMENES SOROR* NOBILI, A PONTONIIN SHRIMP  
NEW TO THE AMERICAN FAUNA, WITH OBSERVATIONS  
ON ITS INDO-WEST PACIFIC DISTRIBUTION**

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**Résumé :** La découverte de la crevette pontiniine *Periclimenes soror* Nobili, dans les eaux américaines est notée. Les spécimens ont été capturés à l'île de Taboga, golfe de Panama, en association avec l'astérie *Oreaster occidentalis* Verrill, un nouvel hôte. Quelques détails de sa morphologie sont décrits et illustrés et sa distribution dans l'Indo-Pacifique occidental est examinée.

The small commensal shrimp *Periclimenes soror* was first described by Nobili in 1904 on the basis of eight specimens obtained from Djibouti in the Red Sea. At the time its association with asteroid echinoderms was not appreciated. These associations were subsequently noted by Edmondson (1935) and Gordon (1939) and the species has since been found in association with a variety of asteroids throughout the Indo-West Pacific region, where it is generally common on the coral reefs.

Recently, through the kindness of Dr. R.U. Gooding, I have been able to examine a small collection of shrimps from the west coast of America. These proved to be indistinguishable from *P. soror* Nobili, which is now recorded for the first time from this region, and is one of the few pontoniin shrimps occurring in both the Indo-West Pacific regions.

*Periclimenes soror* Nobili (Figs. 1-4)

*Periclimenes soror* Nobili, 1904 : 232 ; 1906 : 50, pl. 2, fig. 6 ; Gordon 1939 : 395-400, figs. 1-3 ; Jacquotte, 1964 : 180-181 ; Bruce, 1965a : 493 ; 1968 : 1167, 1168 ; 1971a ; 2, 8 ; 1971b : 3-7, fig. 1 ; 1972 : 64, 68 ; 1973 : 135 ; Castro, 1971 : 395-396 ; Hayashi, 1973.

*Periclimenes (Cristiger) frater* Borradaile, 1915 : 210 ; 1917 : 324, 364, pl. 53, fig. 6.

*Periclimenes (Cristiger) soror* Borradaile, 1917 : 363.

*Periclimenes (Periclimenes) soror* Kemp, 1922 : 141, (key), 165 ; Holthuis, 1952 : 9, 51-53, fig. 17 ; 1959 : 194 ; Monod, 1971 : 183, fig. 81.

*Periclimenes (Ancylocaris) frater* Kemp, 1922 : 170.

*Periclimenes bicolor* Edmondson, 1935 : 10-12, fig. 3.

*Periclimenes (Harpilius) frater* Holthuis, 1952 : 11.

*Periclimenes* sp. Eldredge, 1972 : 15.

**Material examined :** 59 spms. including 29 ovigerous ♀♀, Taboga Island, Panama, 8° 48' 16.5"N., 79° 33' 15"W. Stn. 688 Da, 40ft., Coll. R.U. Gooding, 29 Sept. 1971.

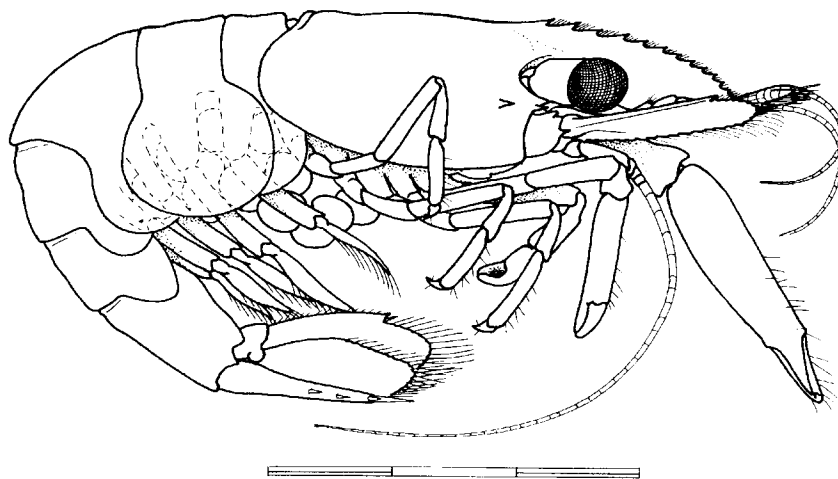


Figure 1 – *Periclimenes soror* Nobili, ovigerous female. Taboga Is., Panama. Scale in mm.

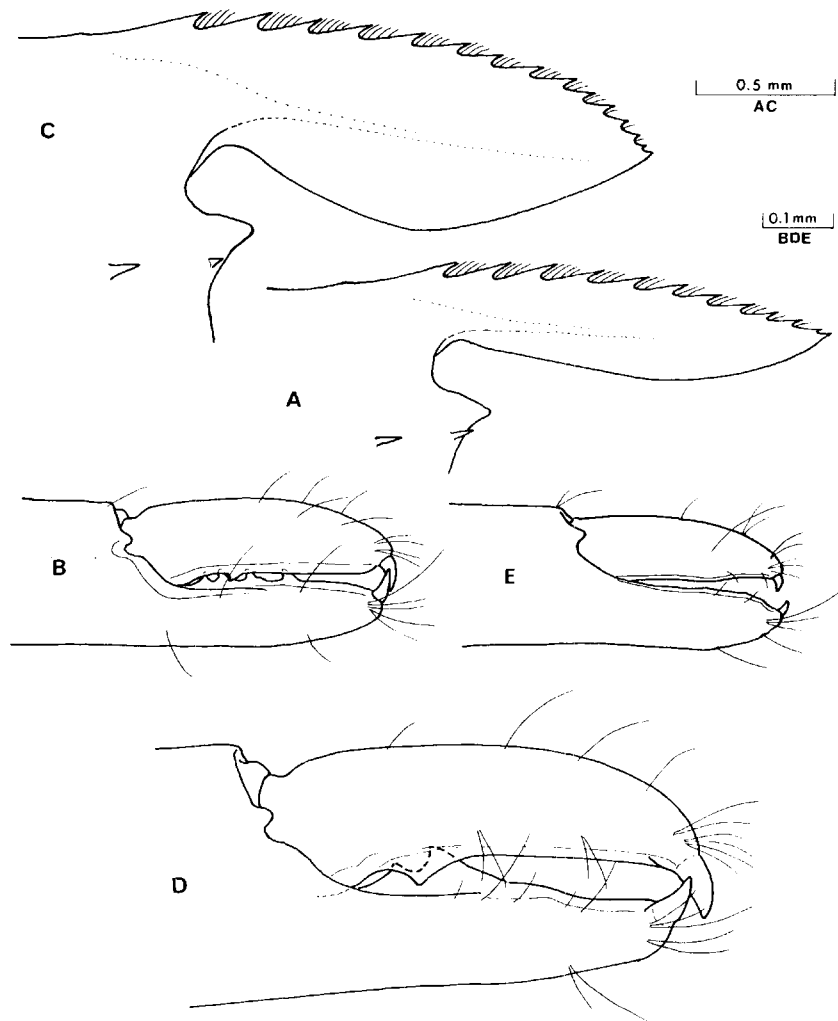


Figure 2 — *Periclimenes soror*, Nobili. ♂ (A : rostrum and orbit ; B : fingers of chela of major second pereiopod) ; ♀ (C : rostrum, and orbit ; D : fingers of chela of major second pereiopod ; E : fingers of chela of minor second pereiopod).

**Description :** The present specimens agree closely with the previously published description given by Nobili (1906), Kemp (1922), Gordon (1939), Holthuis (1952) and Bruce (1971a, b).

The rostral formula is  $\frac{10-14}{0}$ . In the ovigerous females the number of dorsal teeth varies from 10-14, with 69 % having 12 teeth. In the non-ovigerous females there are 10-12 dorsal teeth, of which 44 % have 11 teeth. In the males there are also 10-12 dorsal teeth, 50 % having 11 teeth. The two smallest males both have ten dorsal teeth. The lamina in the females is distinctly deeper than in the males, at all sizes, the length to maximum depth ratio being 2.5 : 1 in adult females and 4.5 : 1 in adult males.

The proximal segment of the antennular peduncle bears a pair of acute disto-lateral teeth as described.

The mandible is slender and feebly built. The incisor is narrow with a strong disto-lateral tooth. Five smaller slender teeth separate this tooth from the me-

dian tooth and four smaller teeth are bifid. In the dissected specimen, the right molar process is obliquely truncated with several distinct teeth densely surrounded by long stout setae. The posterior tooth is acute with several small denticles.

The characteristic first pereiopods are as described by Gordon (1939). The fingers of the chela are strongly subspatulate with denticulate cutting edges. The denticulations on the dactylus are more slender and acute than those on the fixed finger, which are broader and more truncated distally. The coxa bears a slender median ventral process, and the fourth thoracic sternite is unarmed.

The second pereiopods show considerable variation in size, much of which is probably the result of regenerative growth. In males the chelae are subequal and similar, and are much smaller and more slender than in the females. The cutting edge of the dactylus generally bears a single tooth at about one third of its length and that of the fixed finger may have up to four acute

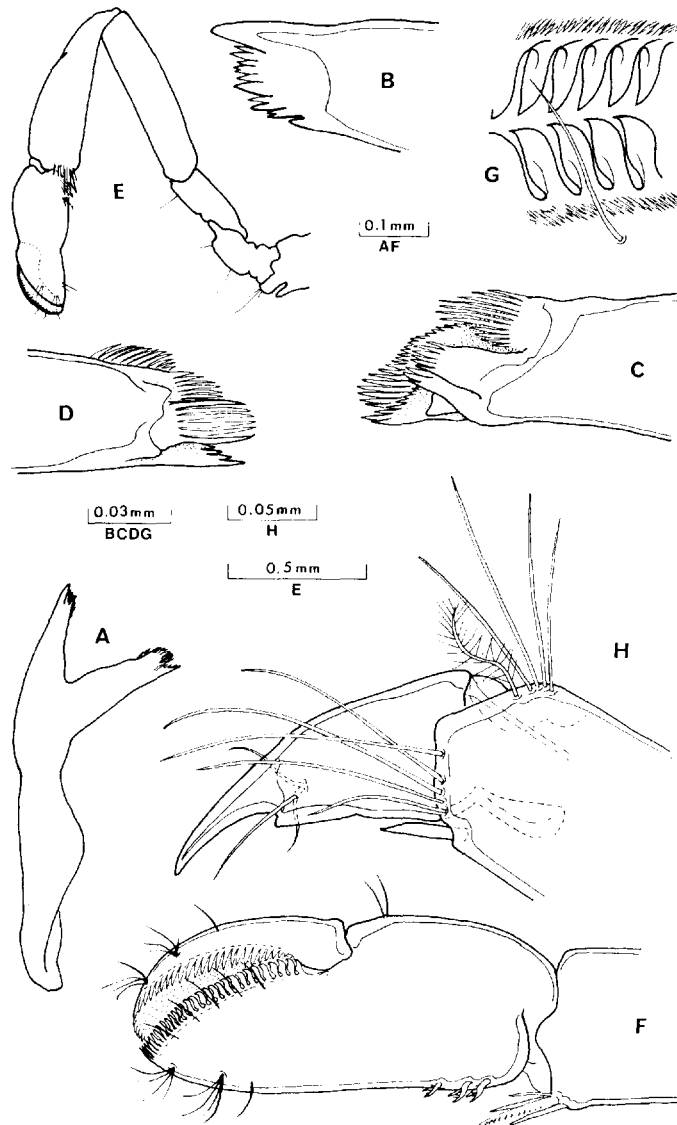


Figure 3 — *Periclimenes soror* Nobili. A : right mandible ; B : incisor process ; C : molar process, dorsal aspect ; D : molar process, ventral aspect ; E : first pereopod ; F : chela of first pereopod ; G : cutting edges of fingers of chela (dactylus on top) ; H : dactylus of third pereopod.

recurved teeth on the proximal two thirds. The tips of the fingers are acute and strongly hooked.

In the female, the second pereopods are often, when fully developed, unequal and dissimilar. The longer second pereopod generally has a single acute tooth proximally on the dactylus, opposing two large acute teeth on the fixed finger. On the smaller second pereopod the fingers have entire cutting edges without teeth. In both chelae the tips of the fingers are acute and strongly hooked.

The ambulatory pereopods are as described previously. The dactylus of the third shows a small but distinct acute accessory ventral tooth. On the fourth and fifth dactyls, this tooth is distinct but less acute. The corpus of the dactylus has a pair of medial setae and a single lateral seta distally, and the unguis is distinctly indicated. The distal end of the propod bears

several long simple setae, with a single plumose seta dorsally and a stout spine ventrally.

In the dissected male, the endopod of the first pleopod bears three plumose setae laterally and six short curved spines on the proximal half of the medial border. A small lobule is also present distally on the medial border.

The appendix masculina on the male second pleopod is slightly longer than the appendix interna and bears four slender, finely setulose spines distally.

**Population structure** (fig. 5) Of the 59 specimens, all were considered to be adults. The appendix masculina was well developed even in the smallest males (C.L. 1.2mm.) The sex ratio of this sample is almost unity, with 29 ♂♂ and 30 ♀♀. Of the females, 19 (63 %) were

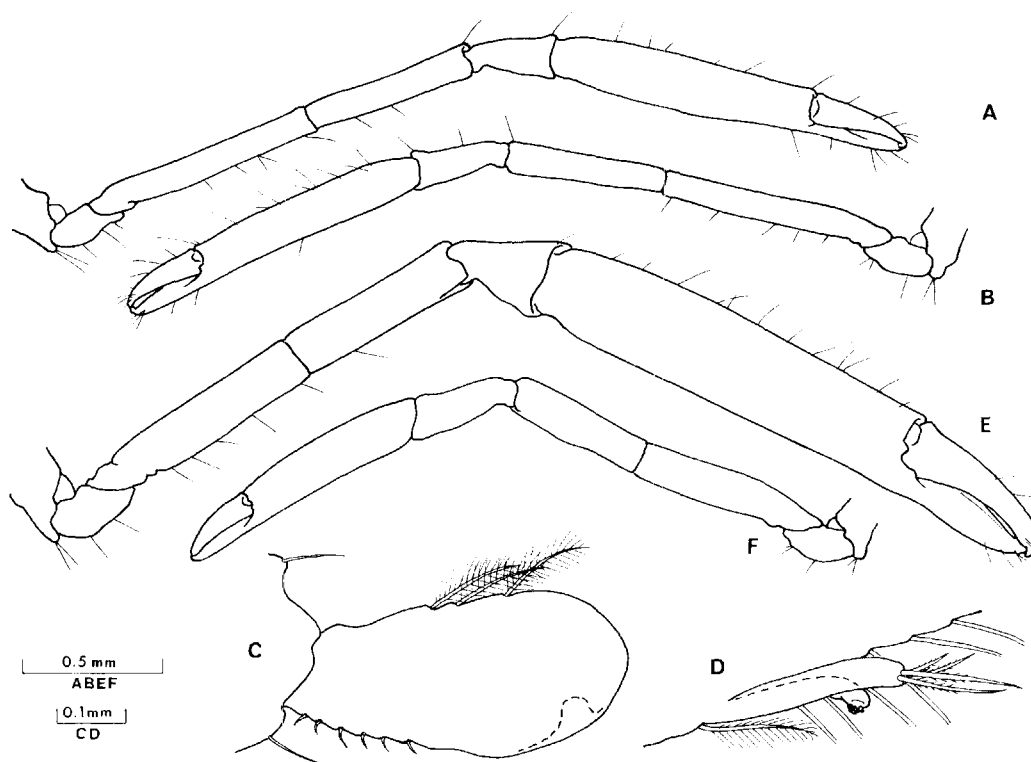


Figure 4 – *Periclimenes soror* Nobili. ♂ (A : major second pereiopod ; B : minor second pereiopod ; C : endopod of first pleopod ; D : appendix masculina and appendix interna of second pleopod ; ♀ (E : major second pereiopod : F : minor second pereiopod).

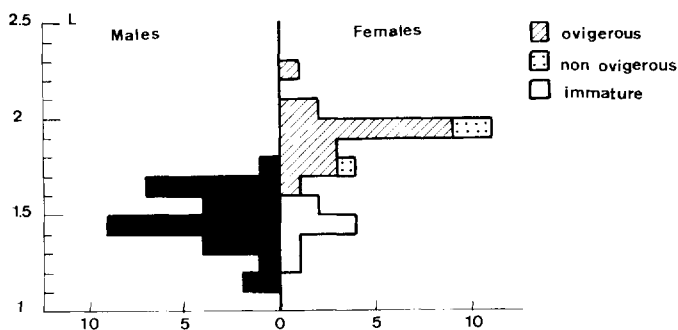


Figure 5 – *Periclimenes soror* Nobili. Size distribution. ♂ = 28 specimens ; juvenile ♀, ovigerous ♀♀ post ovigerous ♀♀ = 31 specimens ; L = Carapace length (in mm)

ovigerous, 13 (43%) with undeveloped ova and 6 (20%) with eyed ova.

The males range in carapace length from 1.2-1.8mm., with a mode at 1.5 mm. The females range from 1.3-2.3mm. and show two modes, at 2.0mm. for the ovigerous females and 1.5 for the non-ovigerous. The smallest ovigerous female has a C.L. of 1.7 mm. and the non-ovigerous females above this size appear to be in breeding condition and have recently hatched ova. The smaller females are probably not yet fully mature.

The absence of juvenile specimens may be due to a restricted breeding season, which seems unlikely at the

latitude of capture, or to be due to their escape from capture.

In on female, C.L. 2.0mm., there were 70 ova present, at an advanced stage of development, measuring approximately 0.5 x 0.4 mm.

Specimens have been deposited in the Collections of the Smithsonian Institution (Washington), the British Museum (Natural History), (London) the Museum national d'Histoire naturelle (Paris), and the Rijksmuseum van Natuurlijke Historie (Leiden).

**Distribution** (fig. 6.) The species is now recorded for the first time from the west coast of America.

The published records from the Indo-West Pacific region are as follows :

*A) Indian Ocean and Red Sea.*

Djibouti, Gulf of Aden (Nobili, 1904, 1906) ; Mombasa, Kenya ; Mayotte, Comoro Is ; Aldabra and Cerf Is., Mahé, Seychelles Archipelago (Bruce, 1971a) ; Tulear, Madagascar (Jacquotte, 1964 ; Monod, 1971) ; Egmont Is. (6° 39'S, 71° 21'E), Six Isles, Chagos Is. (Borradaile, 1915, 1917, erroneously referring Egmont Reef to Seychelles Is.)

*B) Austro-Malaysia.*

Bali (Gordon, 1939) ; Badjo, Flores, Indonesia (Hol-

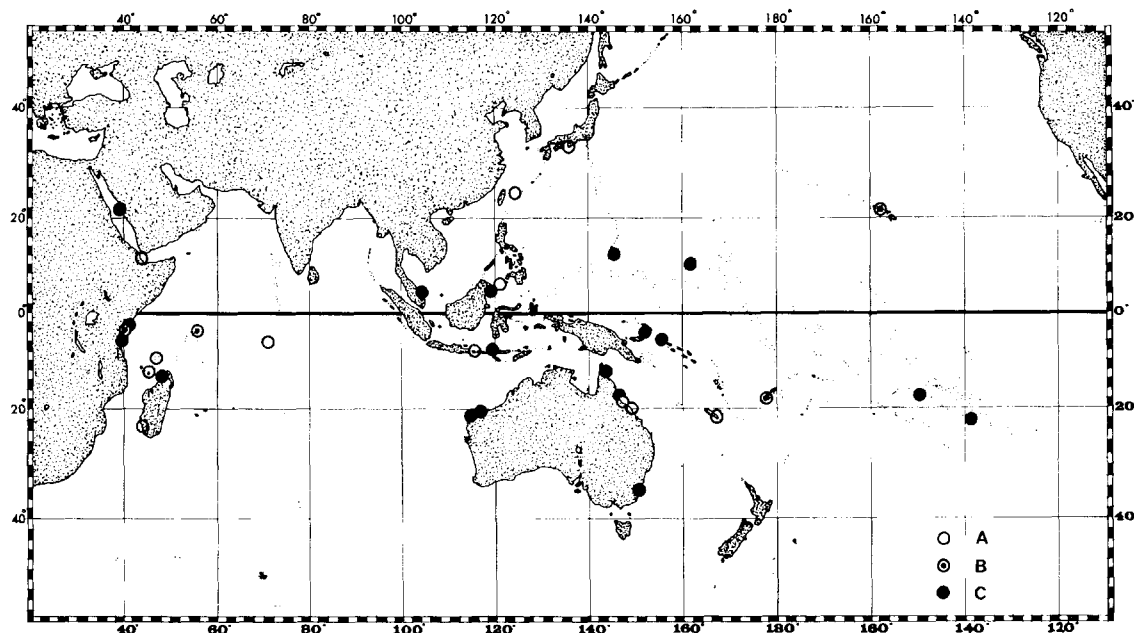


Figure 6 – *Periclimenes soror* Nobili. Indo-West Pacific distribution (A : Published records ; B : additional records ; C : new records).

this 1952) ; Green Island, Fairfax Island, Queensland, Australia (Bruce, 1971a)

#### C) Pacific Ocean.

Noumea, New Caledonia (Bruce, 1968) ; Viti Levu, Fiji (Bruce, 1972) ; Okinawa Is. and Kushimoto, Japan (Hayashi, 1973) ; Guam, (Eldredge), Oahu, Hawaii (Edmondson 1925 ; Castro, 1971).

D) Further locality records (from material in the author's collection).

- 1 – Jeddah, Saudi Arabia (per M. Williams).
- 2 – Zanzibar I. : Zanzibar Harbour, Migombani, Mazizini, Mangapwani ; Chango I. ; Pange, Nyange, Pwakuu, Fawatu and Danzi reefs.
- 3 – Tanganyika : Maziwi I., off Pangani.
- 4 – Kenya : Leven Reef, Mombasa ; Ras Iwatine, Bamburi, Malindi, Kikambala, Kurwetu, Jadini, Shimoni and Wasin Is.
- 5 – Madagascar : Nosi Bé (coll. W. Macnae).
- 6 – Seychelles Is. : Anse la Mouche, Baie Ternay and Cerf Is., Mahé.
- 7 – Malaysia : Pulau Perhentian Besar (coll. R.U. Gooding).
- 8 – Indonesia : Pulau Pari, Sumbawi Islands (coll. R.U. Gooding).
- 9 – Sabah : Darvel Bay (coll. J.S. Pearse).
- 10 – Australia : Chapman I. and Beaver Reef, Queensland. (coll. R.U. Gooding and J. Bloomfield) ; Kendrew Is., Dampier Archipelago and Exmouth,

Western Australia (coll. N. Coleman) ; Cuwatong, New South Wales (coll. N. Coleman).

- 11 – Marshall Islands : Eniwetok (coll. J.W. Knudsen) ; Mariana Is. : Guam (coll. L.G. Eldredge).
- 12 – New Britain : Rabaul (coll. J.S. Pearse).
- 13 – Bougainville Island : Kicta (coll. J.S. Pearse).
- 14 – Hawaii : Waikiki, Oahu. (coll. D.M. Devaney).
- 15 – Society Is : Tahiti.
- 16 – Tuamotu Is. : Mururoa (coll. B. Salvat).

**Hosts :** The Panamaian specimens of *Periclimenes soror* were found in association with the oreasterid starfish *Oreaster occidentalis* Verrill, which constitutes a new host record for this shrimp. The 59 specimens were obtained from seven hosts. The specimen from New South Wales was found on *Placaster decanus* (Müller & Troschel) [Echinasteridae], at a depth of 30 fms, an association that represents a new record at family level.

The Indo-West Pacific echinoderms hosts of *Periclimenes soror* have been recently reviewed (Bruce, 1975) and the above records provide no further additions. The known hosts are *Choriaster granulatus* Lütken ; *Culcita novaeguinae* Müller & Troschel, *C. schmideliana* (Retzius), *Pentaceraster hawaiiensis* (Fischer), *P. horridus* (Grey), *P. mammillatus* (Audouin), *P. tuberculatus* (Müller & Troschel) ; *Protoreaster lincki* (Blainville), *P. nodosus* (L.) [Oreasteridae] ; *Linckia multifora* (Lam.) [Ophidiasteridae] ; *Acanthaster planci* (L.) [Acanthasteridae] ; *Mithrodia bradleyi* Verrill, *M. clavigera* (Lam.) [Mithrodidae]. Many of the recent records have been derived from the recent interest in *Acanthaster planci* (L.), the now notorious Crown-of-

Thorns. In general it appears that *P. soror* is primarily an associate of oreasterid starfish, which is confirmed by the association of the Panamanian specimens with another starfish host of that family. *Bathymetric Range*. The majority of specimens mentioned in this report have been obtained from shallow water, either from pools on exposed reefs at low water or from 2-4 m. below low water level. The record of the Panamanian specimens from 40 ft. is of particular interest as it is deeper than usual but the Hawaiian specimens mentioned here were obtained from a depth of 170 ft., in association with *Pentaceraster hawaiiensis*. In the western Indian Ocean, *P. soror* appears to be replaced in deeper water by *Zenopontonia noverca* (Kemp) (Bruce, 1975).

## DISCUSSION

The discovery of *Periclimenes soror* in the Gulf of Panama increases slightly the rather small number of pontoninid shrimps that are found in both Indo-West Pacific and the Eastern Pacific region. The species at present known, in addition to *P. soror*, are *Harpiliopsis depressus* (Stimpson) and *Fennera chacei* Holthuis. The distribution of the three species may be summarized as follows :

- *Periclimenes soror* Nobili. Throughout Indo-West Pacific region and gulf of Panama.
- *Harpiliopsis depressus* (Stimpson). Throughout Indo-West Pacific region and eastern America from Gulf of California, Costa Rica, Panama and Colombia. (Holthuis, 1951).
- *Fennera chacei* Holthuis. First found in Eastern Pacific region, from Mexico, Costa Rica, Panama and

Colombia (Holthuis, 1951) Subsequently reported from the Indo-West Pacific region by Patton (1960) from the Great Barrier Reef, Australia, and Bruce (1965a) from Ceylon and Farquhar I. in the Indian Ocean.

The first two species have probably originated in the Indo-West Pacific region and reached the American east coast by the transportation of pelagic larvae by the Equatorial Counter Current. Both *P. soror* and *H. depressus* hatch as normal Stage I pontoninid larvae. *F. chacei* has only been reported so far from a few scattered Indo-West Pacific localities, but it is likely that its presence has been very largely overlooked on account of its very small size and cryptic colouration. It seems highly probable that a careful study of the fauna from the region of the Gulf of Panama might provide further evidence of the presence of species of Indo-West Pacific origin.

It has been noted previously that *P. parasiticus* Borradaile and *P. soror* may prove to be synonymous (Holthuis, 1959 ; Bruce, 1975). In this event, Borradaile's 1898 name would have priority over that of Nobili.

The number of widely distributed tropical shallow water caridean shrimps is small and is summarized in Table 1.

From this table it can be seen that seven species are commensals of other invertebrates and are essentially part of the coral reef fauna. Four species are associates of corals and two of echinoderms. *Thor amboinensis* may be found in association with a variety of coelenterate orders. Some of the species, for example *Gnathophylloides mineri* and *Thor amboinensis*, show discontinuous (Chace, 1972 ; Bruce, 1974b). Others show continuity but indicate the effectiveness of the New

Table 1 : Synopsis of the zoogeographic ranges of some widely distributed tropical carideans

	Indian Ocean	West Pacific Ocean	East Pacific Ocean	West Atlantic Ocean	East Atlantic Ocean	Mediterranean Sea	Remarks
PALAEMONIDAE							
1. <i>Leander tenuicornis</i> (Say)	+	+	-	+	+	+	free-living
2. <i>Brachycarpus bitungulatus</i> (Lucas)	+	+	+	+	+	+	free-living
3. <i>Periclimenes soror</i> Nobili	+	+	+	-	-	-	commensal
4. <i>Harpiliopsis depressus</i> (Stimpson)	+	+	+	-	-	-	commensal
5. <i>Fennera chacei</i> Holthuis	+	+	+	-	-	-	commensal
GNATHOPHYLLIDAE							
6. <i>Gnathophyllum americanum</i> Guérin	+	+	-	+	+	-	free-living
7. <i>Gnathophylloides mineri</i> Schmitt	+	+	-	+	-	-	commensal
ALPHEIDAE							
8. <i>Alpheus lottini</i> Guérin	+	+	+	-	-	-	commensal
9. <i>Synalpheus charon</i> (Heller)	+	+	+	-	-	-	commensal
HIPPOLYTIDAE							
10. <i>Thor amboinensis</i> (De Man)	+	+	-	+	-	-	commensal

World land Barrier (Briggs, 1967) and none of these species is found on both sides of the barrier. It appears probable that these species have originated in the Indo-West Pacific region and spread both eastwards and westwards, but further collecting may indicate that some of the species are truly circumtropical in their distributions.

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