

First Record of the Crab *Pilumnoides rotundus* Garth (Crustacea, Decapoda, Brachyura, Xanthidae *sensu lato*) from Off Southern California

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The xanthid crab genus *Pilumnoides* Lucas, 1844 (in Milne Edwards and Lucas 1844) includes eight species of mostly tropical crabs, four of which occur in the Americas (Guinot and MacPherson 1987). Only two species are known from the Pacific: *P. perlatus* (Poëppig, 1836), which ranges from Panama south to Peru and Chile, and *P. rotundus* Garth, 1940, which was originally described from seven specimens collected from two different islands in the Gulf of California and from Bahia San Francisquito on the eastern coast of the Baja California peninsula, Mexico (Garth 1940: 84–86, pl. 23, figs. 1–5). Since that time (Garth 1940), *P. rotundus* has been mentioned only rarely, and all range extensions save one have been to the south (see species synonymy below and also Guinot and MacPherson 1987: 231). The sole northern extension was to Cedros Island on the west coast of Baja California, Mexico, a site listed by Hendrickx (1995) as “unpubl. data” (see Discussion).

In this paper, we report *Pilumnoides rotundus* Garth for the first time from southern California (off San Diego). This extends the known range approximately 660 km northward from Bahia San Francisquito, Mexico, and over 1354 km northward measured from Cabo San Lucas at the southern extremity of the Baja California peninsula (assuming that the species extends that far south within the Gulf of California). Assuming that the unpublished Cedros Island, Mexico, record mentioned by Hendrickx (1995: 138) is valid, that site still lies some 530 km south of our collecting site. The new locality is the northern record for the genus in the Pacific.

Materials and Methods

The single male specimen was collected on 13 July 1994 at a depth of 69.5 m from the ship *Monitor III* at SDFT (San Diego Fish Trawl) station 1769, off the coast of San Diego, California, between La Jolla and Pacific Beach, an area encompassed by the San Diego River to the south and the La Jolla Submarine Canyon to the north. The collection resulted from a 10-min. otter trawl centered on latitude 32°48.05'N, longitude 117°19.60'W. Because the specimen was collected during a trawl, exact microhabitat and substrate conditions are not known. Fathometer readings on an initial pass, during which the trawl was not deployed (in order to lessen the risk of losing the trawl), indicated a sharp drop in depth at one point, such that some structure was likely present near to the area where the crab was collected. Trawl observations for that station included noting that

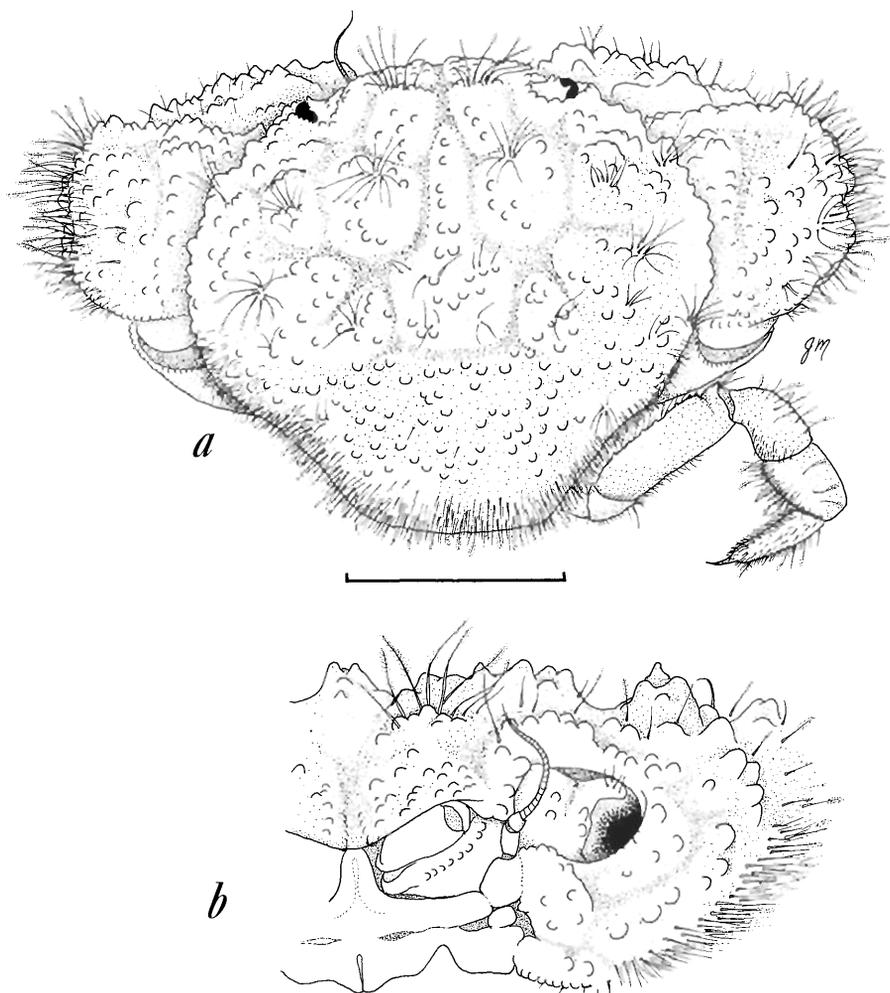


Fig. 1. *Pilumnoides rotundus* Garth, male collected off San Diego, California (LACM 94-94.1). a, dorsal view of carapace, chelipeds, and right third walking leg. b, frontal view of left orbital region. Scale bar = 5.0 mm for Fig. a only.

the brown alga genus *Laminaria* was present. Illustrations were completed using a Wild M5APO dissecting stereomicroscope with attached camera lucida. The specimen (originally Southern California Bight Pilot Project [SCBPP] voucher specimen number C-8; now LACM 94-94.1) has been deposited in the Crustacea collections of the Natural History Museum of Los Angeles County. Comparisons were made with Garth's (1940) original type series.

Pilumnoides rotundus Garth, 1940
(Figs. 1-3)

Pilumnoides rotundus Garth 1940: 84, pl. 23, fig. 1-5 [Gulf of California and Baja California, Mexico].—Del Solar and Alamo 1970: 3 [Banco de Mancora, Peru].—Del Solar et al. 1970: 33 [Peru].—Fonseca 1970: 55 [Peru] (list).—Guinot and MacPherson 1987: 231, Fig. 4H, 6C-D; pl. I, J-L.—Hendrickx

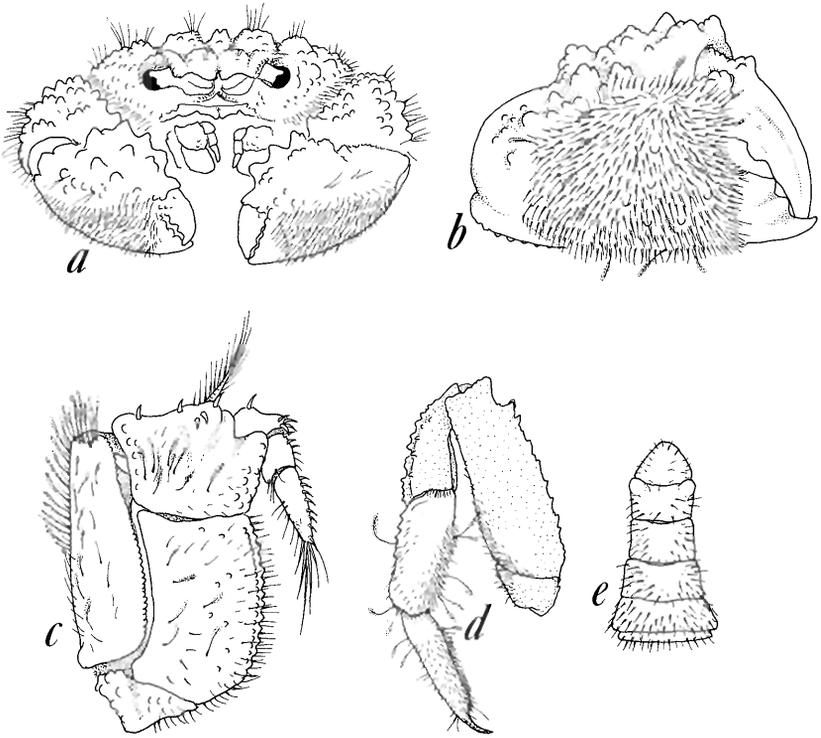


Fig. 2. *Pilumnoides rotundus* Garth, male collected off San Diego, California. a, frontal view of chelipeds in situ. b, frontal view of right chela, tilted more upright than as seen in fig. a. c, right third maxilliped, outer view. d, left second walking leg, ventral (functionally dorsal) view. e, abdomen in situ (basal two somites obscured because of curve of cephalothorax).

1992: 7 [Gulf of California, Mexico] (list).—Hendrickx 1993:313 [Mexico] (list).—Hendrickx 1995: 138 [Cedros Island, western coast of Baja California, Mexico] (list).

Material examined.—LACM 94–94.1, male, California, off San Diego, between La Jolla and Pacific Beach, latitude 32°48.05'N, longitude 117°19.60'W, 69.5 m, coll. 13 July 1994, 69.5 m, SDFT station 1769. LACM 37–132.1 (holotype, female, formerly AHF type number 374, Mexico, Gulf of California, San Esteban Island, *R/V Velero* Station 729–37, 35 fathoms [68 m], coll. 27 March 1937), and LACM 36–78.4 (allotype male, formerly AHF Type No. 374a, Mexico, Gulf of California, south end of Tiburon Island, *R/V Velero* Station 564–36, 8–10 fathoms [15–19 m], coll. 10 March 1936) examined for comparison. Size of San Diego specimen (LACM 94–94.1).—Carapace width 11.3 mm, carapace length 10.2 mm.

Comparison with Previous Illustrations

The species has been illustrated only twice previously, once when first described (Garth 1940) and again when the genus was revised by Guinot and MacPherson (1987). Our single male from off San Diego (Figs. 1–3) agrees in almost all respects with both of these studies, with the following exceptions.

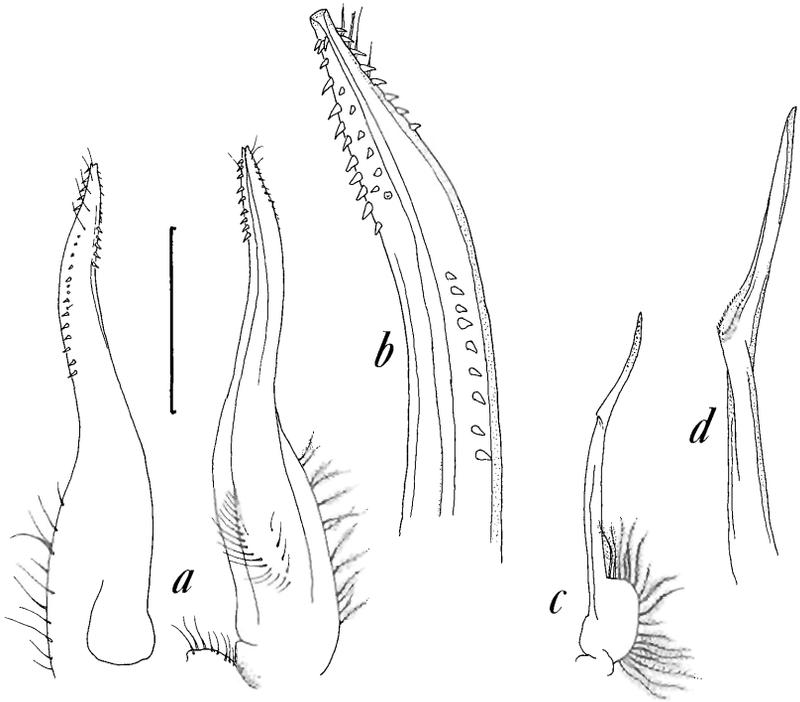


Fig. 3. *Pilumnoides rotundus* Garth, male collected off San Diego, California. a, first pleopod, inner (left) and outer or posterior (right) views. b, higher magnification of tip of first pleopod. c, second pleopod, outer (posterior) view. d, higher magnification of tip of second pleopod. Scale bar = 1.0 mm for Figs. a, c.

Carapace: Garth's figure of the female holotype (Garth 1940: pl. 23, fig. 1), carapace length 7.4 mm, carapace width 8.8 mm (LACM 37-132.1; former AHF 374), has larger anterolateral teeth, and the overall impression is not as rounded as in the San Diego specimen (Fig. 1a). The carapace in the female paratype (USNM 78736, carapace width 8.3 mm) photographed by Guinot and MacPherson (1987: pl. 1, fig. K) is much closer to our Fig. 1a. Garth's figure of the carapace does not show the characteristic distally plumose setae found in clumps scattered over the anterior areolations of the carapace (Figs. 1a, b, 2a), and these are not visible in Guinot and MacPherson's photograph either. The fronto-orbital region of the carapace figured by Garth (1940: pl. 23, fig. 5) differs from that in our specimen (Figs. 1b, 2a) only in the detailed granulation of the epistome and in the setation (which Garth did not illustrate).

Chelipeds: Garth's dorsal view of the holotype (Garth 1940: pl. 23, fig. 1) agrees with ours (compare to Figs. 1a, 2a, b), but unfortunately Garth's figure of the frontal view of the chela of the holotype (Garth 1940, pl. 23, fig. 2) shows it with rather few short setae, thereby minimizing one of the most salient features of the species. Similarly, Guinot and MacPherson's photograph (1987: pl. 1, fig. L) of the chela of the female paratype (USNM 78736) seems to have been taken with the appendages out of water, such that the setae are matted. The overall appearance is therefore quite different from our figures (especially 2a, b), which were drawn with the specimen submerged to allow the setae to stand out.

Third maxillipeds: Garth's figure (1940: pl. 23, fig. 4) is similar in shape to that in our specimen (Fig. 2c), but does not show the small, clear, corneous spines arising from the distal borders of the carpus and merus.

Abdomen, ambulatory legs, pleopods: Garth's figure of the abdomen of the male allotype (Garth 1940: p. 23, fig. 3) agrees with our specimen (Fig. 2e), with the exception that our illustration shows a relatively shorter and slightly more triangular terminal article (possibly a result of the angle of the illustration) and lacks the dense fringing setae of this article depicted in Garth's figure. Neither Garth (1940) nor Guinot and MacPherson (1987) illustrated an individual ambulatory leg (our Fig. 2d), although Garth's written account agrees fully with our specimen. Guinot and MacPherson's figures of the first and second male pleopods (their figs. 6C–D) are in almost complete agreement with our own illustrations (Fig. 3); there are a few more distal setae on the first pleopod of our specimen (Figs. 3a, b) and the spines are illustrated with basal sockets (such that they articulate with the pleopod) in our Fig. 3b, vs. appearing fused to the cuticle of the pleopod in Guinot and MacPherson's (1987) fig. 6C.

Remarks.—*Pilumnoides rotundus* Garth is immediately recognizable and differs from any crab previously reported from California waters in having the following combination of characters: carapace almost completely circular (even more so than in *Cancer oregonensis*; see Nations 1975, fig. 30-1), deeply eroded, markedly granulate; chelipeds massive, with 3 or 4 large, nodulose teeth along dorsal border; ventral half of chelae with thick mat of distally plumose setae; distally plumose setae occurring also in clumps on carapace and scattered on other appendages; merus of ambulatory pereopods with sharply granulate dorsal border.

Additionally, according to Garth (1940: 85), the species exhibits the following colors when living: "Carapace dull ochraceous buff with varicolored granules, most chrome orange, some carmine red, and others bright cadmium orange. Ground color of chelae reed [sic] yellow with granular spines scarlet red. Fingers sayal brown. Merus of ambulatory legs yellowish cream buff with two broad bands of orange. Carpus and propodus orange red, dactylus white, touched with red at base." Our specimen was not closely examined until some time after preservation, when most of the coloration had faded.

Discussion

Habitat and Distribution

Garth (1940) briefly discussed the habitat of the original series as follows: 35 fathoms [68 m], shell (female holotype); 8–10 fathoms [15–19 m], kelp, coralline (male allotype); 165 fathoms [319 m], shale and mud (four paratypes), and 125 fathoms [242 m], shale, rock, and mud (ovigerous female paratype). Guinot and MacPherson (1987) reiterated this with only minor modifications ("10 a 300 m, sur fonds de coquillages, de roques, de vase, d'Algues"). Thus, specific habitat information is not available from previous collecting data. The single crab that forms the basis of our report was collected during a short benthic trawl over a variety of sediment types (see Materials and Methods); no details of specific habitat are available. The collecting depth of 69.5 m is well within the previously reported depth range (10 to 300 m) for the species.

The Cedros Island site mentioned by Hendrickx (1995) is based on observations

in letters to Hendrickx from J. Garth (M. Hendrickx, pers. comm.). These observations included reports of *P. rotundus* from Cedros Island, Natividad Island (27°55'N), and Dewey Canal (27°42'N), and are probably trustworthy (M. Hendrickx, pers. comm.).

This report marks the northern record of the genus in the Americas and, with the exception of *Pilumnoides inglei* Guinot and MacPherson in Great Britain, the northern record of the genus worldwide. Additionally, the specimen is the largest yet reported for this species.

Possible Mechanisms of Arrival in Southern California

Recent years have seen a number of typically tropical species occurring in southern California, and the finding of *Pilumnoides rotundus* may fit into this category. These observations have included sightings by Scripps Institution of Oceanography divers of the Cortez Angelfish (pers. comm.), the presence of at least one Central American shrimp species in local waters (Southern California Association of Marine Invertebrate Taxonomists, unpubl. data), and previously undescribed scyphozoans believed to have come from more southern waters (Martin and Kuck 1991). The Martin and Kuck (1991) report might also suggest the possibility of rafting via a scyphozoan host, although xanthids are not known to do this. Whether these occurrences are direct results of El Niño events are unclear. The 1982–1983 El Niño event was this century's strongest; one result was that the Pacific Equatorial Current reversed direction and extended eastward for 8000 miles to the coasts of North, Central and South America (Canby 1984). During or shortly after this El Niño event there were reports of barracudas off the coast of Oregon and tropical vertebrates and invertebrates along the western coasts of North and South America (Canby 1984; Wooster and Fluharty 1985; Martin and Kuck 1991).

Another possibility is that the species was carried northward as a larval stage in ballast waters (e.g., see Carlton 1985). The depth range of the species and the fact that its source of origin (the Gulf of California, Mexico) is relatively close may indicate that the species has always been present along the coast of southern California but has been previously overlooked. It is of interest that Hendrickx (1995) lists the species from Cedros Island, on the west coast of Baja California, Mexico, only as recently as 1995, such that a recent northward expansion may be indicated.

Acknowledgments

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