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PARASTEPHOS ESTERLYI, A NEW SPECIES OF COPEPOD (STEPHIDAE: CALANOIDA: CRUSTACEA) FROM SAN DIEGO BAY, CALIFORNIA

Abraham Fleminger

Abstract.—*Parastephos esterlyi,* the third species of the genus, is described from San Diego Bay, California. It resembles *P. occatum* Damkaer but differs in its longer body, in the symmetrical and shorter genital segment having different armament including a pair of spines flanking the genital antrum, and in the details of the fifth legs in both males and females.

Copepods of the family Stephidae do not in general occur in routine zooplankton samples. Based on capture records and comments in the literature Damkaer (1971) suggests that they are hyperbenthic in habitat, living just above the sea floor in or near the neritic zone and on occasion swimming up into the water column. Three genera are known. *Stephos,* with about 19 described species and a distribution encompassing the northern and southern hemisphere, is the most diverse and widespread. The remaining two genera are based on isolated records of a few species from the northern hemisphere. *Parastephos* consists of *P. pallidus* Sars, reported from the Norwegian and Scottish coasts (Sars 1903; Scott 1903) and *P. occatum* Damkaer, from Dabob Bay and Puget Sound, Washington (Damkaer 1971). The genus *Miostephos* is also represented by two known species, one from Cuba, *M. cubrobex* Bowman (1976) and one from Bermuda, *M. leamingtonensis* Yeatman (1980). I now report a new species of *Parastephos* collected in routine plankton tows taken with an open conical net in shallow water (depth ~ 2 m) at the southern end of San Diego Bay, Chula Vista, California.

Abraham Fleminger died on 13 January 1988, before this paper was set for publication. His life's work was the systematics, biogeography, and evolution of marine copepods, and the curatorship of the Scripps Institution of Oceanography collection of zooplankton. The present contribution exemplifies the building blocks from which he synthesized larger structures.

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Parastephos esterlyi, new species
Figs. 1–19

Material examined.—A. 1 male, 1 female, San Diego Bay, 21 Mar 1979, 0120 hrs., 32°36.6′N, 117°06.3′W (net tow taken within intake channel of South Bay Electrical Generating Plant, Chula Vista, California). B. 1 male, San Diego Bay, 21 Oct 1979, 2246 hrs., 32°37′N, 117°07′W (net tow taken about 1.6 km west of South Bay Electrical Generating Plant, Chula Vista, California). C. 5 males, 9 females, 3 st. V copepodids, San Diego Bay, 23 Jan 1980, 2302 hrs., 32°37′N, 117°07′W (same locality as B above). Specimens deposited in the National Museum of Natural History (USNM), Washington, D.C.

Types.—Female holotype USNM 234190 selected from C above; paratypes, all remaining adult specimens, USNM 234191–234192.

Measurements.—See Table 1.

Description.—The new species is most similar morphologically to *P. occatum* though slightly larger in length and differing in details of the genital segment, in the length

Table 1.—Measurements following procedures of Fleminger (1967).

Adult	Total length, mm				Prosome-Urosome length ratio	
	$\bar{x}$	Range	s	No.	Med.	Range
Female	1.267 ± 0.043 (95% CL)	1.14–1.33	0.0561	9	2.12:1	1.9–2.25:1
Male	1.225 ± 0.016	1.21–1.26	0.0177	7	2.33:1	2.19–2.55:1

of the first antenna relative to the urosome, and in the fifth pair of legs relative to the length of the urosome. All references to morphology of *P. occatum* and *P. pallidus* are based on published descriptions of the two species.

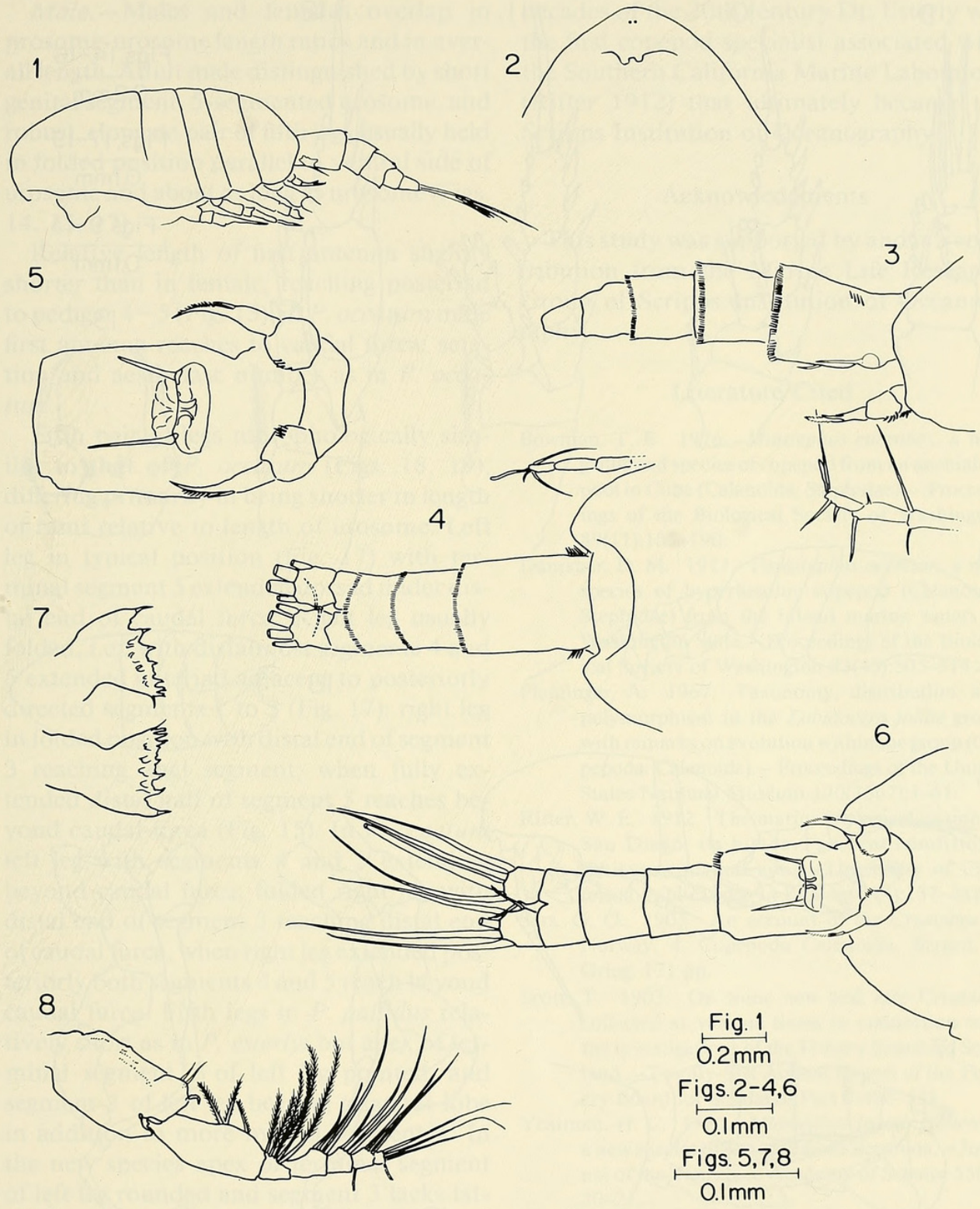
Female.—Cephalosome vaulted in lateral view (Fig. 1); rostrum without elongate filaments but indicated by pair of small knobs seen in ventral view (Fig. 2). Posteriormost pediger bearing leg pairs 4 and 5 with distal ends symmetrial and rounded in lateral view (Fig. 3). Urosome about half length of prosome, with 4 segments and caudal furca (Figs. 1, 3, 4); genital segment longest, being slightly shorter than combined lengths of urosome segments 2 and 3 (Figs. 1, 3, 4); in *P. occatum,* genital segment longer than combined lengths of urosome segments 2, 3 and 4. In dorsal view gential segment in new species virtually symmetrical, several fine hairs occur in anteroposterior row on either side of proximal end (Fig. 4); in dorsal view of *P. occatum* genital segment asymmetrical and with anterolateral semi-encircling ridge on both sides, bordered by row of fine spinules. In lateral view genital segment of new species not protuberant ventrally (Fig. 3) as in *P. occatum.* In ventral view genital antrum (genital opening) with pair of elongate spines of unequal length extending posteriorly from left and right posterior border of antrum beneath antrum's cover plate (Figs. 5, 6); these spines not reported in descriptions of *P. occatum* and *P. pallidus.* Setation of furcal rami as in *P. occatum,* 4 posteriorly directed setae, middle 2 being more robust, and a fifth short seta extending ventrally from medial border (Fig. 6).

First antenna with 24 segments; setation and aesthetasc number as in *P. occatum* but overall length shorter, reaching posteriad to midlength of genital segment (Figs. 3, 4) as in *P. pallidus;* first antenna in *P. occatum* reaches posteriad to anal segment.

Setation and morphology of other cephalic appendages similar to those of *P. occatum.* Small differences in appearance of gnathobase of mandible (Fig. 7) and maxilliped (Fig. 8) relative to those in *P. occatum* (Damkaer, 1971:fig. 2e) appear to reflect angle of view when figure of mandible was drafted and sexual differences in maxilliped, respectively.

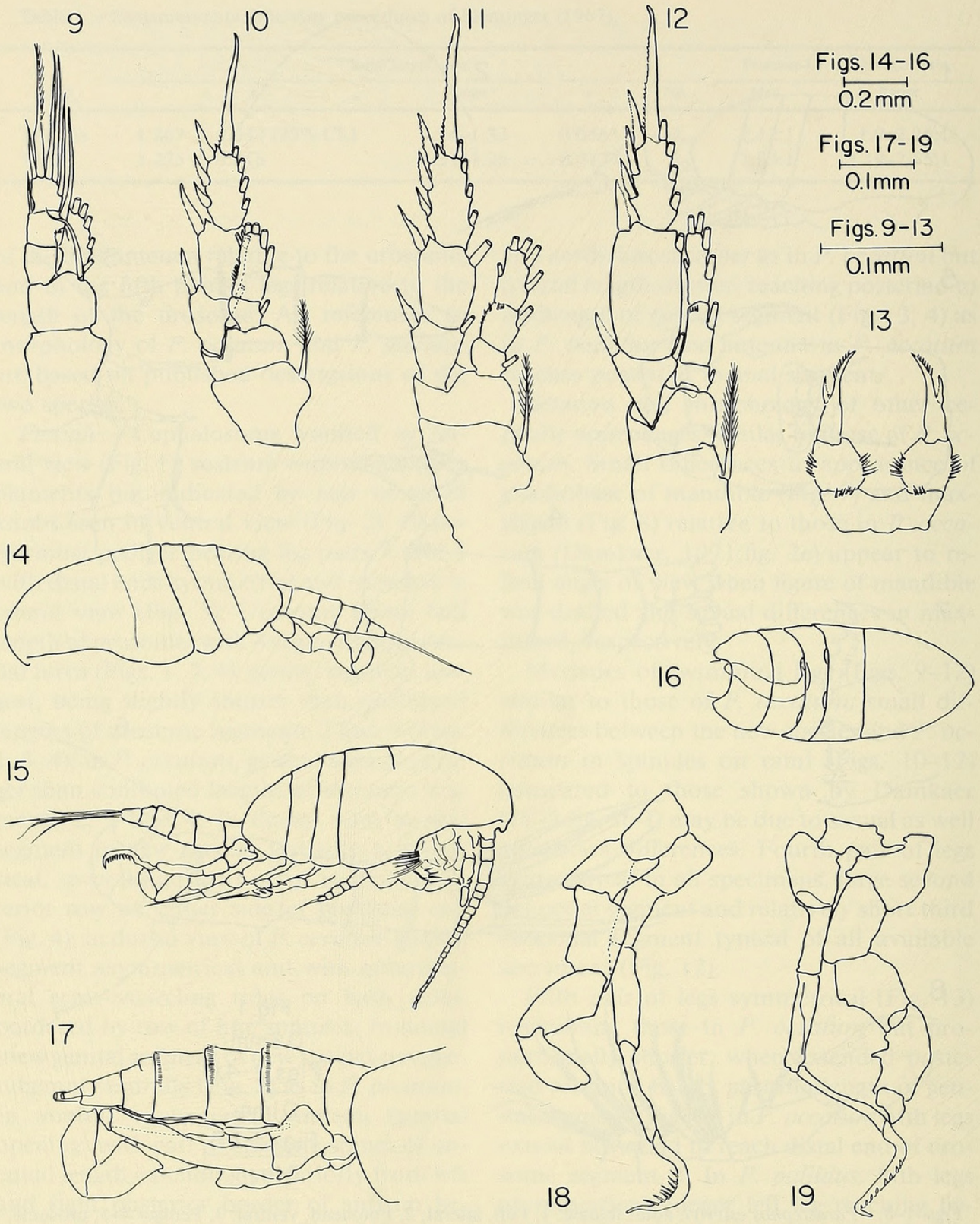
Meristics of swimming legs (Figs. 9–12) similar to those of *P. occatum;* small differences between the new species and *P. occatum* in spinules on rami (Figs. 10–12) compared to those shown by Damkaer (1971:fig. 3c–f) may be due to sexual as well as species differences. Fourth pair of legs symmetrical in all specimens, large second exopodal segment and relatively short third exopodal segment typical of all available specimens (Fig. 12).

Fifth pair of legs symmetrical (Fig. 13) resembling those in *P. occatum* but proportionally shorter, when extended posteriad reaching barely past midlength of genital segment (Fig. 3); in *P. occatum* fifth legs extend posteriad to reach distal end of urosome segment 2. In *P. pallidus,* fifth legs asymmetrical, longer left leg reaching beyond midlength of urosome segment 2. Segment 3 of fifth legs with lateral spine. Origin of lateral spine relative to length of segment 3 distinctive; in *P. esterlyi* slightly more than half the length of segment 3 lies distal to insertion of lateral spine (Fig. 13); in *P. occatum* more than two thirds of length of segment 3 lies distal to insertion of lateral



Figs. 1–8. *Parastephos esterlyi,* adult female: 1, Left, lateral; 2, Forehead, ventral; 3, Pediger 4–5, urosome, fifth legs, distal ends of first antennae, right lateral; 4, Pediger 4–5, urosome, distal ends of first antennae, dorsal; 5, Genital segment, fifth legs, ventral; 6, Pediger 4–5, urosome, fifth legs, ventral; 7, Gnathobase of mandible, posterior; 8, Right maxilliped, lateral.

spine; in shorter right leg of *P. pallidus* more than four fifths of length of segment 3 lies distal to insertion of lateral spine. Distal end of segment 3 with larger spinules along lateral margin, fewer smaller spinules along medial margin; lateral spine on segment 3 with spinules along medial and lateral margins.



Figs. 9–13. *Parastephos esterlyi,* adult female: 9, First swimming leg, posterior; 10, Second swimming leg, posterior; 11, Third swimming leg, posterior; 12, fourth swimming leg, posterior; 13, Fifth legs.

Figs. 14–19. *Parastephos esterlyi,* adult male: 14, Left, lateral; 15, Right, lateral; 16, Prosome, dorsal; 17, Pediger 4–5, urosome, fifth legs, right lateral; 18, Fifth legs, posterior; 19, Fifth legs, anterior.

Male.—Males and females overlap in prosome-urosome length ratios and in overall length. Adult male distinguished by short genital segment, 5-segmented urosome, and robust, elongate pair of fifth legs usually held in folded position parallel to ventral side of urosome and about as long as urosome (Figs. 14, 15, 17).

Relative length of first antenna slightly shorter than in female, reaching posteriad to pediger 4~5 (Fig. 15); in *P. occatum* male first antenna reaches to caudal furca; setation and aesthetasc number as in *P. occatum.*

Fifth pair of legs morophologically similar to that of *P. occatum* (Figs. 18, 19), differing primarily in being shorter in length of rami relative to length of urosome. Left leg in typical position (Fig. 17) with terminal segment 5 extended dorsad under distal end of caudal furca. Right leg usually folded, i.e., with distalmost segments 4 and 5 extended anteriad adjacent to posteriorly directed segments 1 to 3 (Fig. 17); right leg in folded position with distal end of segment 3 reaching anal segment; when fully extended distal half of segment 5 reaches beyond caudal furca (Fig. 15). In *P. occatum* left leg with segments 4 and 5 extending beyond caudal furca; folded right leg with distal end of segment 3 reaching distal end of caudal furca, when right leg extended posteriorly both segments 4 and 5 reach beyond caudal furca. Fifth legs in *P. pallidus* relatively short as in *P. esterlyi* but apex of terminal segment 5 of left leg pointed, and segment 3 of left leg bearing a lateral lobe in addition to more medial segment 4. In the new species apex of terminal segment of left leg rounded and segment 3 lacks lateral lobe (Fig. 18).

Etymology.—This species is named to honor C. O. Esterly and his pioneering studies on the copepods of the California Current. During the course of the first three decades of the 20th century Dr. Esterly was the first copepod specialist associated with the Southern California Marine Laboratory (Ritter 1912) that ultimately became the Scripps Institution of Oceanography.

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