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Plesionika sanctaecatalinae Wicksten, 1983 (Crustacea Decapoda Caridea Pandalidae) from off the west coast of Pacific Mexico

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Abstract

A large series of specimens of *Plesionika sanctaecatalinae* was obtained during sampling operations off the west coast of the Baja California Peninsula in 2012 and 2014 (TALUD cruises). This material was examined and compared to the original description, the holotype and two paratypes. Although the fresh material fit well with the type material examined, some discrepancies were noted in the illustrations of the original description, particularly regarding scaphocerite and the telson, and new illustrations are provided. The series of sample available from the TALUD cruises allow to increase considerably the number of localities known for this species in the California Current area. A series of unpublished records corresponding to material examined in the original description but not listed in details, allows for further increase of the number of reported localities where *P. sanctaecatalinae* has been collected. Its vertical distribution in the water column, however, remains unclear due to the fact that no discrete samples are available for this species.

Key words: *Plesionik*a, eastern Pacific, distribution, tegumental scales

Introduction

The genus *Plesionika* comprises of 91 species (De Grave & Fransen 2011), most probably benthic or benthopelagic and some living exclusively in the pelagic realm (Chace 1985; Hendrickx & Estrada-Navarrete 1996). Five species have been so far recorded in the Mexican Pacific: *P. beebei* Chace, 1937, *P. mexicana* Chace, 1937, *P. sanctaecatalinae* Wicksten, 1983, *P. trispinus* Squires & Barragán, 1976, and *P. carinirostris* Hendrickx, 1990 (Hendrickx 1990; Hendrickx & Estrada-Navarrete 1996; Wicksten & Hendrickx 2003). *Plesionika sanctaecatalinae* was described from an abundant material collected off southern California (Wicksten 1983). Since then, new records have been scarcely reported in literature.

During exploratory cruises aimed at collecting deep-water invertebrates and fishes, a small series of specimens of *P. sanctaecatalinae* were found among other decapod crustaceans collected with a benthic sledge. This material is reported herein. The complete series of specimens examined by Wicksten (1983) in the original description was also used in order to provide a clearer distribution pattern of this species off the west coast of the Baja California Peninsula.

Material and methods

The new material on which this study is based was collected by the R/V "El Puma" of the Universidad Nacional Autónoma de México (UNAM) in 2007–2014. Specimens of *Plesionika sanctaecatalinae* were captured in a total of 12 samples obtained during three sampling cruises off the west coast of the Baja California Peninsula; TALUD XV, southern part of the peninsula, July–August, 2012, 21 localities; TALUD XVI, northern part of the peninsula, July–August 2013, two localities due to technical failure; TALUD XVI-B, same area, May–June 2014, 24 localities). During these cruises, a benthic sledge (mouth aperture 2.35 m width, 0.9 m high), without opening-closing device, equipped with a modified shrimp net (ca 5.5 cm stretched mesh size) with a ca 2.0 cm (3/4")

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internal lining net was operated at depths between 296 and 2125 m. Depth was measured with a SIMRAD digital recorder. Samples of decapod crustaceans contained strictly benthic species captured at the bottom, pelagic species captured during the ascent of the sledge, and benthopelagic species. The size (carapace length, CL) was measured to the nearest 0.1 mm.

The information related to the material examined in the original description of *P. sanctaecatalinae* but not reported in details by Wicksten (1983; 34 samples from an equal number of localities) was graciously provided by this author. Logs of the "Velero IV" cruises were examined in order to double-check sampling depth (most samples were obtained with an Isaac-Kidds midwater sampler, IKMW). In a few cases, sampling depths were provided from a depth gauge. In most cases only the length of cable released during the sampling operation was available. The probable sampling depth was therefore estimated (e. in table 1) using cable length and a cable angle of 40º, which is on the average the angle used when sampling with an IKMW sampler.

Abbreviations used: St., sampling station; CL, carapace length; M, male; F, female; ovig. F, ovigerous female; MBPC, Marine Biodiversity Processing Center, Los Angeles County Museum of Natural History, USA; ICML-EMU, Instituto de Ciencias del Mar y Limnología, Regional Collection of Marine Invertebrates; USNM, United States National Museum, Smithsonian Institution, Maryland, USA.

Systematic section

Family Pandalidae Haworth, 1825

Plesionika sanctaecatalinae **Wicksten, 1983**
(Figs. 1–3)

Plesionika sp.—Ebeling *et al.* 1970: 12.
Plesionika martia semilaevis.—Wicksten 1978: 85, fig. 1; Méndez 1981: 104, pl. 18, figs. 316, 317.
Plesionika sanctaecatalinae Wicksten, 1983: 138, figs. 1–3; 2002: 137; Hendrickx & Estrada Navarrete 1989: 117 (list); 1996: 130 (key), 133, fig. 82; Hendrickx & Wicksten 1989: 72 (key), 80, fig. 7; Retamal & Soto 1993: 3; Retamal 1995: 2; Wehrtmann & Carvacho 1997: 49; Kameya *et al*. 1998: 92 (list); Guzman 2008: 38; De Grave & Fransen 2011: 450; Moscoso 2012: 59 (list); Hendrickx 2012: 500; Wicksten 2012: 99 (key), 104, fig. 26A.

Material examined. TALUD XV. St. 15, 25°18'50"N, 113°12'17"W, August 2, 2012, 1 F (damaged), BS operated at 1246–1309 m; St. 17, 26º20'24"N, 114º13'07"W, July 31, 2012, 1 M (CL 12.4 mm) and 2 H (CL 15.4 and ca. 12 mm), BS operated at 2111–2136 m (ICML–EMU–10989); St. 18, 26º25'N, 114º06'W, July 31, 2012, 1 F (CL 8.9 mm) and 1 ovig. F (CL 11.5 mm), BS operated at 1300–1460 m total depth (ICML–EMU–11016–A); St 24, 27°05'42"N, 114°35'30"W, August 1, 2012, 1 ovig. F (damaged), BS operated at 772–786 m (ICML–EMU–11016–B); St 25, 26°57'06"N, 114°34'31"W, August 1, 2012, 2 ovig. F (CL 12.6–13.2 mm), BS operated at 1370–1518 m (ICML–EMU–10988–A). TALUD XVI. St. 3, 28º40'N, 115º49'36"W, July 31, 2013, 1 F (damaged), BS operated at 1397–1408 m (ICML–EMU–10988–B). TALUD XVI B. St. 1, 28º27'24"N, 115º48'55"W, May 23, 2014, 1 F (CL 10.7 mm), BS operated at 2038–2054 m (ICML–EMU–10988–C); St. 3, 28º42'36"N; 115º50'42"W, May 23, 2014, 1 M (CL 11.3 mm) and 2 F (CL 14.3–15.3 mm), BS operated at 1350–1365 m (ICML–EMU–11023); St. 4, 28º47'5"N, 115º43'47"W, May 24, 2014, 2 M (11.6–14.6 mm), 1 F (CL 11.1 mm), and 1 ovig. F (CL 9.4 mm), BS operated at 1237–1284 m (ICML–EMU–11026); St. 6, 29º08'9"N, 115º33'26"W, May 24, 2014, 2 F (CL 12.0–14.3 mm) and 1 ovig. F (CL 13.5 mm), BS operated at 1004–1102 m (ICML–EMU–11025–A); St. 9, 29º20'53"N, 115º51'W, May 31, 2014, 1 F (CL 12.8 mm), BS operated at 1848–1860 m (ICML–EMU–11025–B); St. 17, 29º54'18"N, 116º01'30"W, May 29, 2014, 1 M (CL 12.6 mm) and 2 F (CL 11.6–12.7 mm), BS operated at 734–774 m (ICML–EMU–11024); St. 20, 30º51'26N, 116º42'11"W, May 26, 2014, 1 M (CL 12.2 mm), 4 F (CL 11.5–13.4 mm), and 1 ovig. F (CL 13.7 mm), BS operated at 2075–2090 m (ICML–EMU–11027); St. 22, 30º49'47"N, 116º35'54"W, May 28, 2014, 1 F (CL 12.6 mm), BS operated at 1480–1560 m (ICML–EMU–10988D); St. 26, 31°46'3"N, 116°58'12"W, May 26, 2014, 1 F (CL ca. 11 mm), BS operated at 982–989 m (ICML–EMU–11028).

Additional material examined. Holotype, male (CL 19.0 mm), off Santa Catalina Island, California, USA (ex–AHF 6053). Paratype, male (CL 13.2 mm), same locality (USNM–191164). TALUD X, St. 13, 27°49'46"N, 111º43'18"W, February 11, 2007, 1 F (CL 13.8 mm), BS operated at 668–704 m (ICML–UNAM–10089).

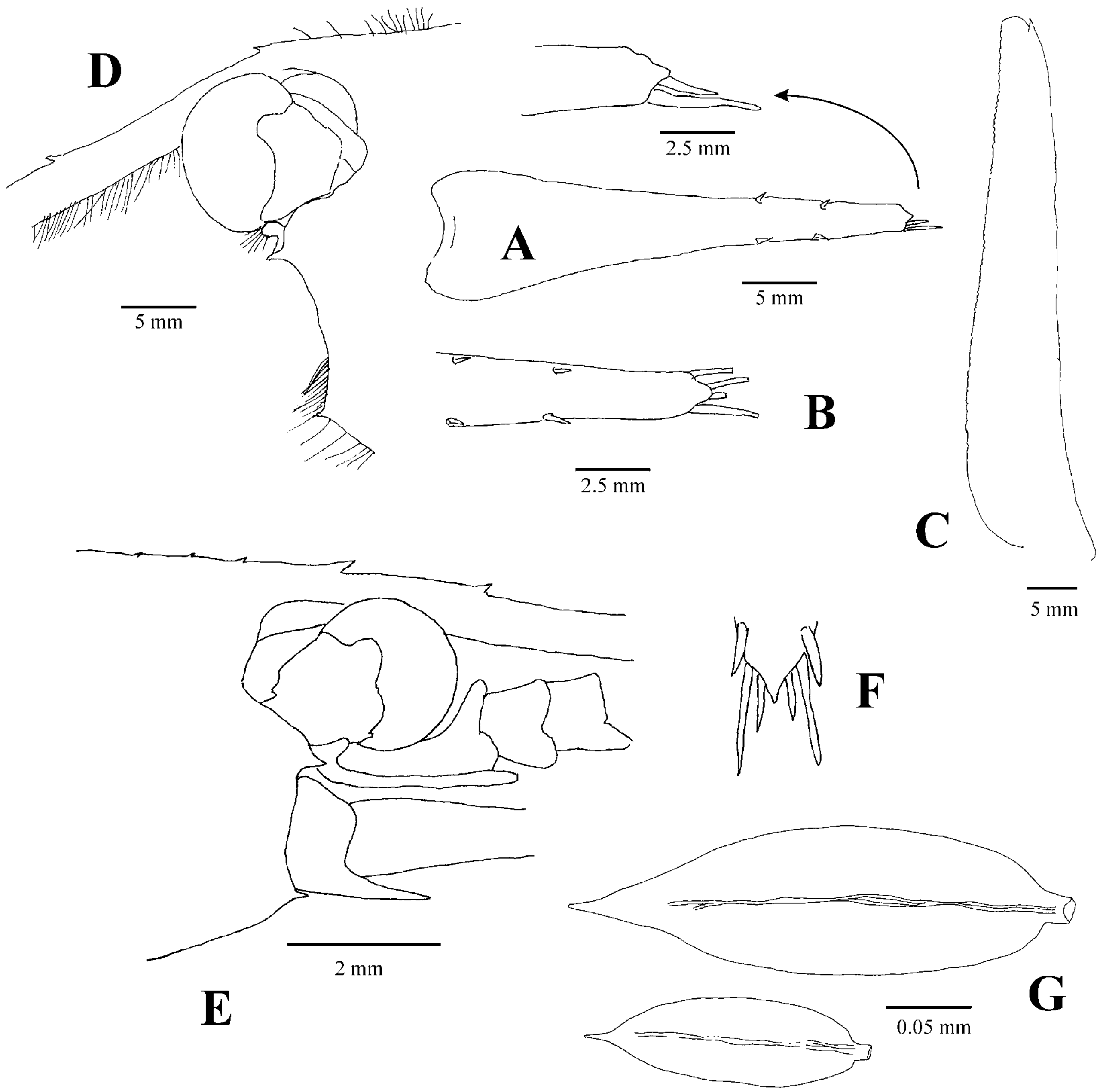

FIGURE 1. *Plesionika sanctaecatalinae* Wicksten, 1983. A, C–D, holotype (LACMNH ex–AHF 6053). B, paratype (USNM–191164). E–F, ICML–EMU–11025–A. G, ICML–EMU–10988–A. A. Telson, dorsal view and tip (enlarged). B. Tip of telson, dorsal. C. Scaphocerite, dorsal. D. Anterior part of carapace, lateral. E. Anterior part of carapace, lateral. F. Tip of telson, dorsal. G. Large and small tegumental scales.

Taxonomic remarks. The fresh material collected during the TALUD cruise was compared with the original description and part of the type material. The TALUD specimens fit well with the description of Wicksten (1983; text). The small proximal spines on the dorsal margin of the rostrum are more or less developed among specimens and occasionally more widely spaced (Fig. 1 D, E). The illustrations provided by Wicksten (19839) were based on specimens that originally were preserved in 10% formalin and later transferred to ethanol, which might have resulted in some distortion. Wicksten (Fig. 2C) showed a basally very wide telson, with 3 pairs of dorsal spines in the distal half, and 2 pairs of spines, of equal length, at or near the tip. Examination of the type (AHF-6053) and of one of the paratypes (USNM-191164) indicates that the telson is not basally as wide as illustrated (Fig. 1 A). The tip of the telson is damaged, but on both specimens 2 pairs of spines are clearly visible, the outer much longer and stouter than the inner pair (Fig. 1A, B). A similar illustration was provided by Hendrickx & Estrada-Navarrete (1996) (see Fig. 2A), but with the more distal pair of small dorsal spines clearly set close to the tip. This distal pair of small spines was not observed on the type material examined and it is assumed it fell off. The next two (more proximal) dorsal pairs of spines are present in the types. The scaphocerite illustration provided by Wicksten (1983: Fig. 2A) presents an abrupt narrowing near half-length and is clearly narrower in its distal half, the distal third being less than half the width of the proximal half. The scaphocerite of the holotype (Fig. 1C), however, narrows much more gently, with no abrupt shoulder that gives a bottle-neck appearance to the scaphocerite illustrated by Wicksten (1983).The scaphocerite illustrated by Hendrickx & Estrada-Navarete (1986) also shows a progressive narrowing of this appendage towards the tip (see Fig. 2 B).

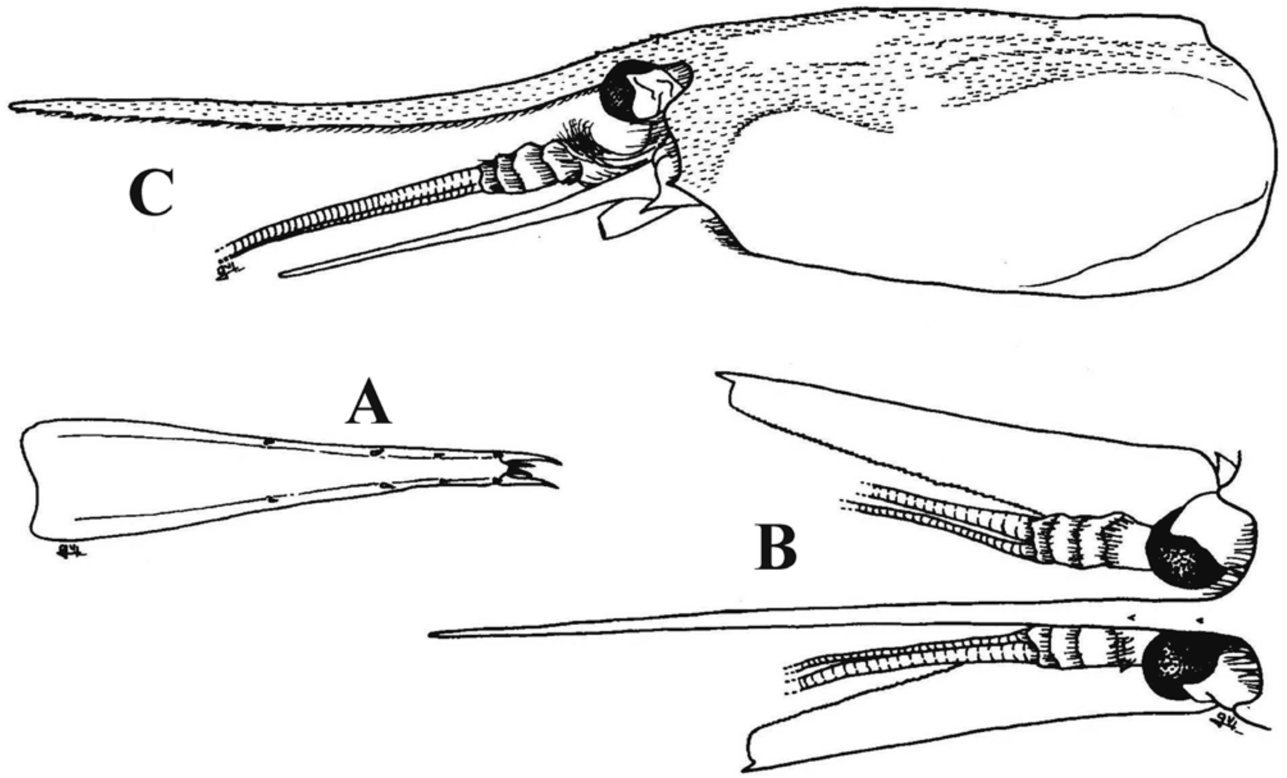

FIGURE 2. *Plesionika sanctaecatalinae* Wicksten, 1983, F, CL 14.8 mm (ICML–EMU–5439). A. Telson, dorsal view. B. Cephalic appendages and rostrum, dorsal view. C. Carapace, lateral view (from Hendrickx & Estrada-Navarrete 1986).

Numerous tegumental scales were observed on fresh material of *P. sanctaecatalinae* available from the TALUD cruises (Fig. 3 A–C). De Grave & Wood (2011) provided an extensive review on the occurrence of tegumental scales in caridean shrimps noting that, including their study, these scales have been previously reported in 63 species (22 of *Plesionika*) belonging to seven families and 17 genera. They emphasized the fact that scales possess a narrow stalk, inserted into a pore, and are easily lost by abrasion. The presence of tegumental scales was not noted by Wicksten (1983) who indicated that the carapace wears minute punctae. It is therefore assumed that the "punctae" observed by Wicksten (1983) correspond to the pores visible after scales were lost by abrasion or due to preservation in formalin. The illustration of *P. sanctaecatalinae* provided by Hendrickx & Estrada-Navarrete (1986) shows the rostrum and part of the carapace covered by what seems to be setae (see Fig. 2C). This material was re-examined and some scales are still observable on dorsolateral and dorsal spots of the carapace and on part of the rostrum, thus matching the position of the "setae" illustrated by Hendrickx & Estarda-Navarrete (1986). In addition, the distal part of the eye peduncle presents some groups of scales and the dorsal face of the scaphocerite blade is also covered with scales (Fig. 3 D). Based on these new observations and the 1986 drawing, it is therefore established that *P. sanctaecatalinae* bears leaf-like tegumental scales on at least the upper half of the carapace, on the rostrum, on part of the eyestalk and of the blade of the scaphocerite. No scales were observed on the abdomen. Scales are leaf-like (Fig. 1 G), with margins entire and a conspicuous midline.

As pointed out by De Grave & Wood (2011), abrasion of tegumental scales in pandalids is commonly extensive. Specimens that featured large areas with scales also tend to have lost large parts of their scale coverage when examined again several years later, although they had remained undisturbed in their collection jars.

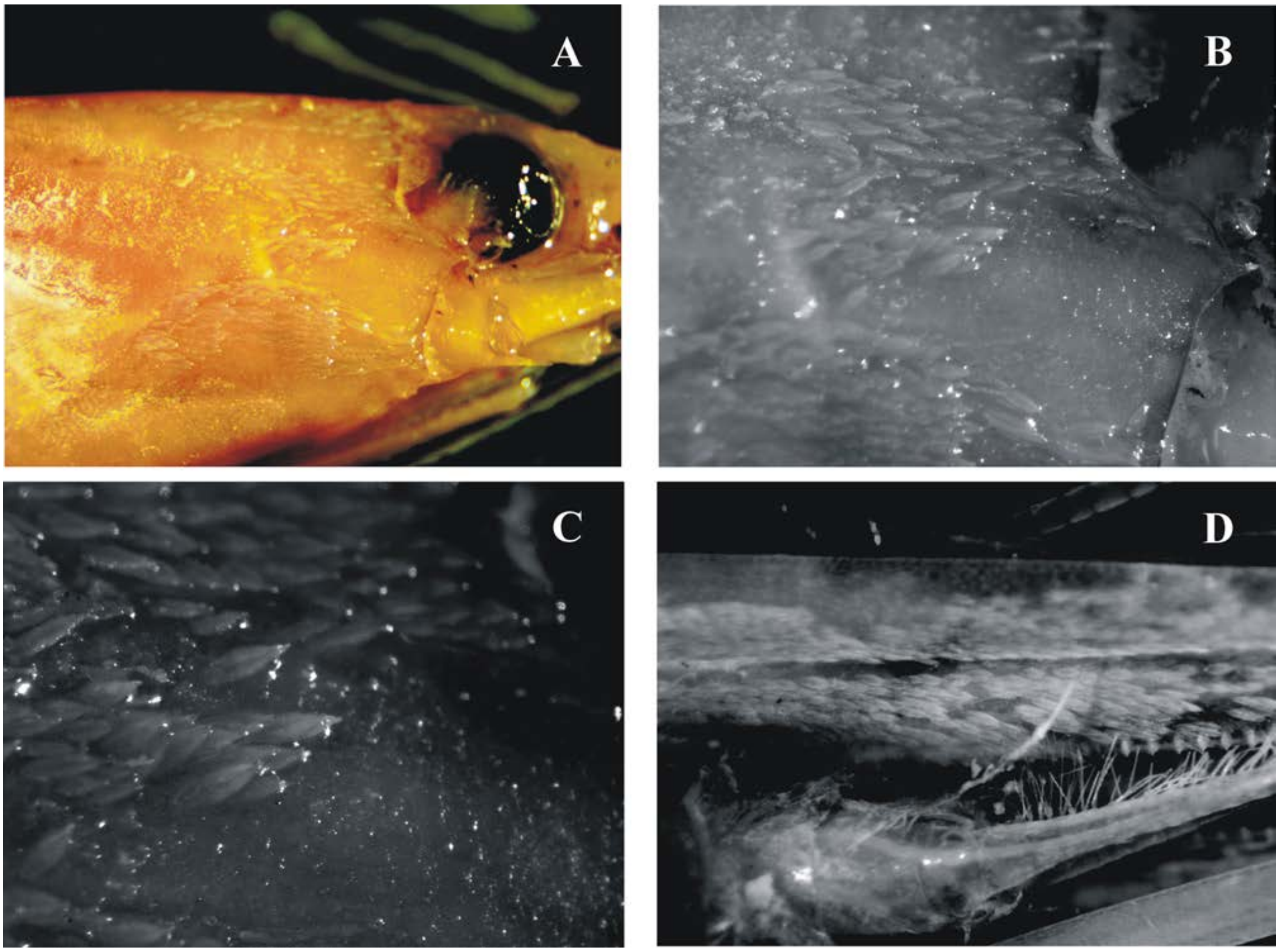

FIGURE 3. *Plesionika sanctaecatalinae* Wicksten, 1983, ovig. F, CL 13.2 mm (ICML–EMU–10988–A). A. Anterior part of carapace, lateral, with tegumental scales. B. Same, detail of tegumental scales. C. Same, further detail. D. Scaphocerite blade, dorsal, with tegumental scales.

Geographic distribution. From off Santa Barbara Island, California, USA to Arica and Iquique, Chile. Gulf of California, Mexico, to about 29ºN (Wicksten 1983, 2012; Hendrickx 2012). This species, however, has not been reported between the southern Gulf of California and northern Peru. In Mexico the species has been reported from off the northern part of the Baja California Peninsula (Fig. 4), and in the northern and southern Gulf of California (Hendrickx & Estrada-Navarrete 1996; Hendrickx 2012; this study). Material reported herein increases the southernmost distribution limit along the west coast of the Baja California peninsula by about 3.5 degrees of latitude (Fig. 4).

In addition to the Velero IV material reported in details by Wicksten (1983; the type specimens, all from localities in southern California), a large series of additional specimens, also collected by the Velero IV off California and Baja California, was briefly cited: 57 specimens from 34 stations (see Wicksten 1983: 142). This additional material was almost exclusively captured with an IKMWT operating from surface to a minimum depth of 695 m and a maximum depth of 2550 m (Table 1). Of these samples, 19 were taken off western Mexico, far away from the coast in a more oceanic environment than in the case of the TALUD material (Fig. 4), with the most remote sampling locality about 230 nm (425 km) offshore.

Vertical distribution. As emphasized earlier, material originally used for the description of *Plesionika sanctaecatalinae* was collected almost exclusively with an IKMWT. Because the material was collected between 1960 and 1969, we can assume that the IKMWT used during the Velero IV surveys was not equipped with an automatic opening-closing device and was single-net. Discrete samples corresponding to selected bathymetric ranges were therefore not available. Consequently, the exact depth range at which the material of the Velero IV (and, for this matter, of the TALUD cruises, during which a non-closing benthic sledge was used) entered into the net remains impossible to determine. In both cases, the gear was in use from surface to an approximate (most

Velero IV samples) or to a well-defined (a few Velero IV samples and all TALUD samples) maximum depth (see Table 1 and the Material examined section). The shrimps were therefore captured at unknown moments and depths. From the TALUD cruises, we can deduce that the shrimps were captured in an overall depth range of 0 to 2136 m, with the shallowest sample obtained between 0 and 272 m (see the Material examined section). In the case of the Velero IV material, the overall sampling depth range was from 0 to about 2550 m, with the shallowest sample obtained between 0 and 685 m (see Table 1). Unfortunately, the log data of the Velero IV cruises do not include the total depth (i.e., surface to bottom) at each sampling station, thus making impossible to estimate how close to (or how far) from the bottom the IKMWT was operating. Furthermore, there are significant differences between the depth information in the ship log book and depths on the labels in the samples (see Table 1). Based on this biased information, it is therefore impossible to define the depth range at which *P. sanctaecatalinae* occurs.

Other records provided in publications refer to the original description data (e.g., Retamal 1995: range, 812–3877 m; Hendrickx & Estrada-Navarrete 1996: range, 500–4000 m) or are equally imprecise (e.g., Hendrickx 2012: in benthic sledge, between surface and 1165 m). One record indicates the presence of *P. sanctaecatalinae* in shallow water, between 0 and 300 m, in a locality with 335 m total depth (Hendrickx & Estrada-Navarrete 1996), but again it could have been captured in the epipelagic zone or close to the bottom.

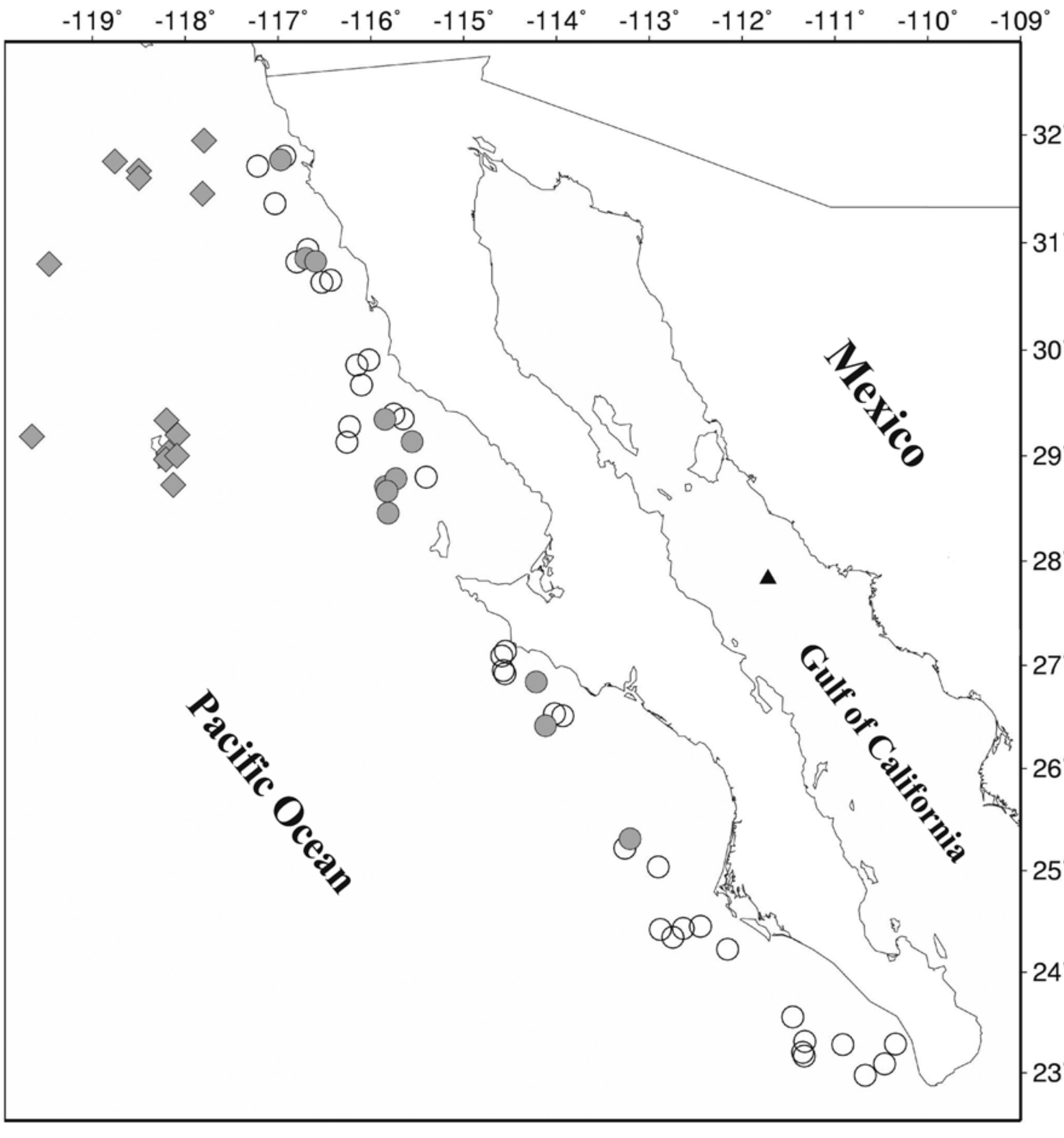

FIGURE 4. Localities off the Baja California peninsula where *Plesionika sanctaecatalinae* has been collected. (●) Present study. (♦) Records from the Velero IV cruise (see Table 1). Stations sampled during this study without specimens of *P. sanctaecatalinae* (○). Additional record within the Gulf of California also indicated (▲).

TABLE 1. Additional specimens of *Plesionika sanctaecatalinae* collected by the Velero IV off California and Baja California, briefly cited by Wicksten (1983), and kept in the holdings of the Los Angeles County Museum of Natural History (MBPC). LOG, information obtained from the logbook of the Velero IV cruise: SD, sampling depth (see text for details); NA, not available.

Velero IV Station	MBPC catalogue	Latitude	Longitude	Date	Depth (m) MKW	Depth (m) LOG	Max. SD (m)
2135	16329	33°14'27"	118°34'7"	23-jul-52	1182-1314	1302.11	1213.00
7371	16330	33°26'24"	33°26'24"	28-jun-61	825-834	817.47	753.00
8114	16331	33°10'9"	118°25'26"	22-aug-62	1209-1279	1197.86	ND
8115	16332	33°15'45"	118°27'0"	22-aug-62	1200-1320	1307.59	ND
8116	NA	33°22'35"	118°50'28"	23-aug-62	1316-1318	1305.76	ND
8117	16333	33°17'16"	118°40'0"	23-aug-62	1318-1320	1307.59	ND
8120	16334	33°16'18"	118°37'46"	05-sep-62	1311-1326	1298.45	961.00
8240	NA	33°16'57"	118°35'26"	25-oct-62	1200-1246	1234.44	e. 685
9905	16335	29°11'0"	119°39'0"	8-aug-64	2585-2769	2743.20	e. 1570
9960	NA	33°12'48"	118°29'25"	04-sep-64	1255-1292	1243.58	e. 1175
10540	16336	28°43'30"	118°7'40"	06-may-65	1846-3692	3657.60	e. 2550
10541	16337	29°1'40"	118°10'40"	07-may-65	1209-2769	2743.20	e. 1950
10543	16338	28°57'48"	118°12'24"	07-may-65	2031-2585	2560.32	e. 1080
10666	16339	30°48'0"	119°27'50"	26-aug-65	3138-3646	3566.16	e. 1950
10676	16340	29°11'48"	118°5'0"	28-aug-65	3138-3452	3108.96	e. 1950
10677	16341	29°0'0"	118°5'30"	28-aug-65	3046-3775	3063.24	e. 785
10696	16342	33°10'45"	118°28'15"	09-sep-65	1015-1283	1271.02	e. 2160
10897	16343	31°40'0"	118°30'0"	5-jan-66	1569-2262	2176.27	e. 785
10905	16344	29°20'0"	118°12'0"	6-jan-66	3249-3434	3401.57	e. 1950
10975	16345	32°40'6"	120°35'12"	16-feb-66	3230-3729	3200.40	e. 2550
11507	16346	31°27'10"	117°49'0"	19-may-67	1874-2049	2029.97	e. 2550
11586	16347	31°56'36"	117°47'58"	26-jul-67	1348-1846	1353.31	e. 1370
11624	16348	31°35'52"	118°30'10"	17-aug-67	1108-1938	2194.56	e. 1175
11627	16349	31°45'0"	118°45'30"	17-aug-67	2123-2262	2011.68	e. 685
11692	16350	32°37'48"	118°15'8"	11-oct-67	1791-1809	1508.76	e. 1370
11703	NA	32°38'20"	118°13'12"	24-feb-61	1680-1865	1682.50	e. 1370
12335	16352	32°33'0"	118°5'45"	25-aug-68	1015-1846	1828.80	e. 1570
12344	16353	32°30'15"	118°8'56"	27-aug-68	1569-1846	1828.80	e. 785
12390	16354	32°36'15"	118°11'15"	10-oct-68	1846-1938	1828.80	e. 1950
13043	16355	33°16'15"	119°3'20"	21-may-69	1135-1726	1106.42	e. 1950

Discussion

Plesionika sanctaecalinae is without any doubt an important element of the decapod crustaceans communities inhabiting the California Current area. The material obtained during the present survey allows to almost double the number of records in this area. Its overall distribution range, from Santa Barbara Island (ca 34ºN), California, USA, to Iquique, Chile (ca 20ºS) (Wicksten 2012), is close to 54 degrees of latitude. However, in the southern part of its distribution range it has been recorded only from off Peru (about 6–18ºS) and Chile (Iquique) (Wicksten 1983; Hendrickx & Wicksten 1989; Retamal & Soto 1993; Guzman 2008). The absence of records between the southern Gulf and Peru is rather puzzling. As in the case of species of *Gennadas* (see Hendrickx 2015), this could be related to the presence of a shallow upper boundary of the Minimum Oxygen Zone (OMZ) and a wide OMZ core where anoxic or almost anoxic conditions prevail (Helly & Levin 2004; Hendrickx & Serrano 2010). In this region, including the southern part of the California Current area, off southern Baja California, conditions within a large section of the epipelagic and the entire mesopelagic fringes are not suitable for active, oxygen-demanding swimmers like species of *Plesionika*. The low-oxygen core of the OMZ would also prevent deeper pelagic and benthopelagic species to migrate into the meso- and epipelagic fringes. On the contrary, in the northern portion of the California Current area off Baja California, where most records of *P. sanctaecatalinae* were obtained (see Fig. 4), the OMZ tends to narrow significantly, with its upper boundary located in deeper water and with higher dissolved oxygen concentrations in the core than in the southern portion off Baja California and off SW Mexico (Helly & Levin 2004; Papiol *et al*., 2016). From present results, it seems clear that *P. sanctaecatalinae* tends to be more frequent off the northern half of the peninsula (9 out of 24 samples) than in the southern part (3 out of 21 samples) (Fig. 4).

Considering the information available at this moment, it is not possible to estimate the depth range at which *P. sanctaecatalinae* occurs. A series of discrete samples using an opening-closing multiple-net structure, covering the entire 0–2500 m depth range, should be obtained to solve this issue. Besides, many pelagic and benthopelagic caridean shrimps are known to perform dial vertical migrations and some species are known to migrate from one depth stratum to another during their growth (Pearcy *et al*. 1977; Sanders & Childress 1990; Arntz & Krygier 1991), and valuable information could also be obtained on these processes in the case of *P. sanctaecatalinae*.

Acknowledgments

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