Further records of species of *Gennadas* (Crustacea, Decapoda, Dendrobranchiata, Benthesicymidae) in the Mexican Pacific

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Abstract

Additional material of species of *Gennadas* was collected off western Mexico during the TALUD survey aboard the R/V "El Puma". *Gennadas sordidus* was by far the most common species collected and only a few specimens of the other three species, *G. incertus*, *G. propinquus* and *G. scutatus*, were obtained. New and previous records indicate that *Gennadas sordidus* is widely distributed along the west coast of Mexico, although there is only one record for it south of the Gulf of California. In this study it was collected in as many as 35 localities, both in the Gulf of California and off the west coast of Southern Baja California. Numbers of specimens also confirmed that it is the dominant species of *Gennadas* in the area. *Gennadas incertus* was found in six samples, all from off the west coast of northern Baja California. The other two species occurred each in two samples only, with sampling localities widely spread along the Baja California Peninsula. Compared with the rest of the eastern Pacific, the diversity of *Gennadas* in Mexican waters is intermediate (6 species) vs. 9 in Chile and 4 in the NW Pacific.

Key words: *Gennadas*, eastern Pacific, distribution Mexico

Introduction

Species of *Gennadas* occur in the pelagic realm worldwide. Until 1996, there were only few records of this genus in the Mexican Pacific. Previous to this year, *Gennadas scutatus* Bouvier, 1906 had been reported from of Clarion Island (Burkenroad 1938) and *G. sordidus* from the Gulf of California, off the Baja California west coast, and off the Revillagigedo Islands (Burkenroad 1938). Five other species, *G. bouvieri* Kemp, 1909, *G. capensis* Calman 1925, *G. incertus* (Balss, 1927), *G. propinquus* Rathbun, 1906, and *G. tinayrei* Bouvier, 1906 were collected far away from the Baja California Peninsula west coast, at "Seamount 350", and reported by Hanamura (1983). In 1996, Hendrickx & Estrada-Navarrete (1996) published the results of the analysis of a large series of pelagic shrimp samples and included four more species to the Mexican Pacific list: *G. capensis*, *G. incertus*, *G. propinquus*, and *G. tinayrei*. Most of the material reported by Hendrickx & Estrada-Navarrete (1996) was collected in the epipelagic zone (maximum depth of ca 200 m), with occasional samples taken between surface and ca 300 m. The material examined by these authors had been collected between 1977 and 1985. Another contribution on pelagic shrimps of western Mexico and that includes species of *Gennadas* was presented by Hendrickx (1993) and reported on new material of *G. incertus* and *G. sordidus*. Another contribution on pelagic shrimps of the northern Gulf of California was presented by Flores-Anduaga & Hendrickx (2014) but did not included species of *Gennadas*.

During a recent survey of the deep-water benthic fauna with a benthic sledge, specimens of *Gennadas* were captured during the ascent of the gear. This material is reported herein and represent important additions to the pelagic shrimps of western Mexico. Abbreviations used are: St., station; CL, carapace length; BS, benthic sledge.

Material and methods

Samples of pelagic shrimps were obtained on the continental slope along the Pacific coast of Mexico during the TALUD project using a benthic sledge (2.5 m width, 0.9 m high) equipped with a modified shrimp net (ca 5.5 cm
stretched mesh size) with a ca 2.0 cm (3/4") internal lining net. Dredging operations were primarily aimed at collecting benthic species, but the gear acted as midwater sampler during the ascent from the bottom. Samples corresponding to six cruises in the Gulf of California, off SW coast of Mexico and off the west coast of Baja California, from 2001 to 2012 were examined: TALUD III, August 1991; TALUD IV, August 2000; TALUD VII, June 2001; TALUD VIII, April 2005; TALUD IX, November 2005; TALUD X, February 2007; TALUD XII, March–April 2008; TALUD XV, July 2012; TALUD XVI–B, May 2014. During these cruises, a total of 155 localities were sampled, with gears operating between 304 and 2309 m depth (benthic samplers). Positional coordinates for each sampling station were plotted using a GPS navigation system. Total depth at each station was measured with an EdoWestern analogic recorder (TALUD III–VIII) or a digital recorder (TALUD IX–XV). Part of the material collected during this survey is deposited in the Regional Collection of Marine Invertebrates in Mazatlán Mexico, and this material is referred to by its catalogue number (EMU–number). Synonymy is restricted to references dealing with the eastern Pacific. Abbreviations used are: St., sampling station; CL, carapace length; IK, Isaacs Kidd mid water trawl; MN, micronecton net; BS, benthic sledge.

Results

Systematic section

Benthesicymidae Bouvier, 1908

Gennadas incertus (Balss, 1927)


Material examined. 17 specimens. TALUD XVI–B. St. 4 (28°47’05”N 115°43’47”W), May 24, 2014, 1 M (CL 9.3 mm), BS operated at 1237–1284 m (EMU–10855–A); St. 5 (28°48’N 115°24’W), May 24, 2014, 1 M (CL 8.5 mm), BS operated at 772–776 m (EMU–10855–B); St. 8 (29°21’12”N 115°45’12”W), May 29, 2014, 1 M (CL 9.9 mm), BS operated at 1416–1480 m (EMU–10856); St. 11 (29°16’48”N 116°13’46”W), May 30, 2014, 1 M (CL 8.2 mm) and 6 F (CL 7.2–8.7 mm), BS operated at 1679–1698 m (EMU–10854); St. 19 (30°38’N 116°31’40”W), 1 M (CL 10.2 mm) and 1 F (CL 8.5 mm), May 25, 2014, BS operated at 1385–1433 m (EMU–10640); St. 26 (31°46’06”W, 116°58’21”W), 2 M (CL 8.9–9.1 mm) and 3 F (CL 8.2–11.0 mm; 1 damaged), May 26, 2014, BS operated at 982–989 m (EMU–10857).


Distribution in western Mexico. Previous records for this species are limited to the west coast of the Baja California Peninsula (Hendrickx & Estrada-Navarrete 1996). The material examined herein corresponds to the same area, from off the northwestern part of the Peninsula (Fig. 1).

Gennadas propinquus Rathbun, 1906


Material examined. Four specimens. TALUD XV, St. 2 (23°12’02”N 111°20’50”W), August 4, 2012, 1 M (CL 8.7 mm), BS operated at 1118–1150 m (EMU–10875). TALUD XVI–B, St. 16 (29°51’24”N 116°9’6”W), May 29, 2014, 1 M (CL 7.1 mm) and 1 F (CL 9.7 mm), BS operated at 1360–1425 m (EMU–10873–A); St. 20 (30°51’17”N 116°42’11”W), 2014, 1 F (CL 9.1 mm), BS operated at (EMU–10873–B).
FIGURE 1. Localities where species of Gennadas were collected during this survey.

**Distribution.** Indo–Pacific and East Atlantic. From Oregon, USA, to Panama, including the west coast of the Baja California Peninsula. "Seamount 350", about 750 nm west of Baja California (Hanamura 1983; Hendrickx & Estrada-Navarrete 1996).

**Distribution in western Mexico.** Gennadas propinquus has been reported only in the California Current area,
along the entire west coast of the Baja California Peninsula (Hendrickx & Estrada-Navarrete 1996). The material examined herein is from the same area. The absence of this species in the numerous samples obtained in a wide depth range in the Gulf of California and off SW Mexico confirms its restricted distribution in warm and cold temperate waters in northwestern Mexico.

**Gennadas scutatus Bouvier, 1906**


**Material examined.** Seven specimens. TALUD XV, St. 17 (26º20'24"N 114º13'07"W), July 31, 2012, 3 M (CL 7.6–8.9 mm) and 3 F (CL 7.2–9.1 mm), BS operated at 2111–2136 m (EMU–10880).

TALUD XVI–B St. 25 (31º48'N 116º55'28"W), May 26, 2014, 1 M (CL 8.9 mm), BS operated at 807–814 m (EMU–10881).

**Distribution.** Cosmopolitan. In the eastern Pacific, it is known from off the west coast of the Baja California Peninsula, Mexico (25ºN), to Lobos de Tierra Island, Peru, and Clarion Island (Burkenroad 1938; Hendrickx & Estrada-Navarrete 1996). Guzman (2008) reported it from off Chile. Based on the material examined herein the northernmost distribution limit is extended to 31º48'N 116º55'28"W.

**Distribution in western Mexico.** As in the case of the two previous species, *G. scutatus* has been reported only in the California Current area, but in this case it had not been previously collected from the northern cooler portion of this current in western Mexico (Hendrickx & Estrada-Navarrete 1996). The material examined herein however, provide one record in that cooler portion of the California Current (see Fig. 1).

**Remarks.** Records in the eastern Pacific are very scarce. The record from Peru was provided by Méndez (1981) and there is a doubtful record from off Panama (Boone 1930).

**Gennadas sordidus Kemp, 1910**


**Material examined.** 183 specimens. TALUD III. St. 13 (23º38'30"N 107º58'48"W), August 18, 1991, 2 M (CL 7.9–8.3 mm) and 5 F (CL 6.4–9.9 mm) (EMU–10877), and 8 juv. (CL 2.9–5.7 mm), 19 F (CL 5.7–10.9 mm) and 14 M (CL 3.9–10.4 mm) (EMU–10878) IK operated between surface and 720 m; St. 19 (25º12'N 109º07'W), August 20, 1991, 7 M (CL 5.18–10.0 mm) and 10 F (CL 5.81–8.40 mm), IK operated between surface and 410 m (total depth: 920 m) (EMU–9961) (id. J. Flores A.).

TALUD IV. St. 15 (23º23'30"N 107º47'48"W), August 24, 2000, 2 F (CL 7.9–10.2 mm), MN operated between surface and 1500 m (total depth: 2350 m) (EMU–10914–A); St. 18 (24º15'12"N 108º17'10"W), August 25, 2000, 2 M (7.4–9.0 mm) and 3 F (6.5–8.0 mm), BS operated at 908–944 m (EMU–5985–A); St. 19 (24º15'18"N 108º24'06"W), 1 juvenile, BS operated at 1196–1200 m (EMU–5985B); St. 22 (24º17'20"N 108º50'30"W), August 26, 2000, 1 M (CL 7.3 mm) and 1 F ( CL 9.8 mm), MN operated between surface and 1325 m (EMU–10914–B).

TALUD VII. St. 5 (22º00'24"N 106º39'54"W), June 5, 2001, 1 F (CL 6.5 mm), BS operated at 1490–1520 m; St. 19 (24º16'12"N 108º23'42"W), June 7, 2001, 2 M (CL 8.3–9.1 mm) and 3 F (CL 7.35–8.30 mm), BS operated at 1160–1180 m (EMU–6693); St. 20 (24º14'48"N 108º35'12"W), June 7, 2001, 8 M (CL 7.5–10.5 mm) and 6 F (CL 7.7–10.2 mm), BS operated at 1480–1520 m (EMU–5984); St. 27 (25º01'30"N 109º12'W), June 8, 2001, 2 M (CL 9.3–9.8 mm) and 4 F (CL 6.5–9.3 mm), BS operated at 1580–1600 m (EMU–6697); St. 34B (26º05'30"N 110º10'30"W), June 9, 2001, 2 M (CL 8.0–8.7 mm), BS operated at 1500–1520 m.

TALUD VIII. St. 13 (25º21'N 110º17'W), April 18, 2005, 2 F (CL 9.09–9.91 mm), BS operated at 1625 m (id. J. Flores A.) (EMU–9962); St. 15 (25º23'06"N 110º18'06"W), April 18, 2005, 2 M (CL 6.8–8.0 mm), BS operated at 1030 m; St. 16 (25º24'48"N 110º34'48"W), April 18, 2005, 1 M (CL 9.0 mm) and 1 F (CL 9.0 mm), BS operated at 1030 m; St. 17B (25º24'24"N 110º50'06"W), April 18, 2005, 4 F (CL 6.0–10.0 mm), BS operated at 700–750 m;
St. 20 (25°56′56″N 110°43′W), April 19, 2005, 1 M (CL 8.8 mm) and 2 F (6.0–8.9 mm), BS operated at 1140–1150 m; St. 21 (26°02′18″N 110°37′W), April 19, 2005, 2 M (8.2–9.0 mm) and 4 F (CL 5.0–8.9 mm), BS operated at 1380 m; St. 22 (26°03′42″N 110°23′54″W), April 19, 2005, 1 F (CL 9.1 mm), BS operated at 2200 m.

**TALUD IX.** St. 2 (24°38′42″N 109°17′36″W), November 11, 2005, 2 F (CL 7.5–8.9 mm), BS operated at 2195–2300 m (EMU–8241); St. 10 (24°56′24″N 110°16′42″W), November 12, 2005, 1 M (CL 9.0 mm) and 2 F (CL 6.5–7.0 mm), BS operated at 969–1225 m; St. 15 (25°21′27″N 110°18′18″W), November 13, 2005, 3 M (CL 8.1–9.7 mm) and 3 F (CL 8.0–10.5 mm), BS operated at 1985–2290 m (EMU–8235); St. 16 (24°23′48″N 110°36′42″W), November 13, 2005, 1 M (CL 10.2 mm) and 1 F (CL 10.1 mm), BS, depth unknown but > 500 m (EMU–8236); St. 17 (25°19′54″N 110°47′42″W), November 13, 2005, 2 M and 2 F, BS operated at 626–846 m; St. 18 (25°49′38″N 110°34′45″W), November 13, 2005, 2 M (CL 7.0–9.95 mm), BS, depth unknown but > 500 m (EMU–9963); St. 20–B (25°58′07″N 110°40′04″W), November 14, 2005, 1 M (CL 8.5 mm), BS operated at 1229–1343 m; St. 21–B (26°04′42″N 110°34′48″W), November 14, 2005, 1 M (CL 6.8 mm), BS operated at 1349–1369 m.

**TALUD X.** St. 5 (28°14′50″N 112°24′53″W), February 9, 2007, 1 damaged specimen (CL ca 8.5 mm), BS operated at 820–837 m; St. 8 (28°05′56″N 112°26′50″W) 1 M (CL ca 9 mm) and 2 F (CL ca. 9 mm), BS operated at 975–1007 m (EMU–8200–B); St. 9 (27°48′30″N 112°17′12″W), February 10, 2007, 4 M (CL ca 8.5 mm), BS operated at 1396–1422 m; St. 13 (27°44′53″N 111°43′18″W), February 11, 2007, 1 M (CL 8.0 mm) and 3 F (CL 8.2–11.1 mm) and 5 F (CL 7.2–9.8 mm), BS operated at 905–943 m (EMU–8091); St. 14 (27°40′24″N 111°39′54″W), February 11, 2007, 4 F (CL 6.5–8.5 mm), BS operated at 1528–1530; St. 17 (27°08′N 111°44′10″W), February 12, 2007, 2 F (CL 8.8–10.4 mm) (EMU–8093–A), and 2 M (CL ca 8 mm) and 2 F (CL ca 7 mm) (EMU–8093–B), BS operated at 1289–1326; St. 18 (27°09′06″N 111°46′54″W), February 12, 2007, 1 M (CL 9.6 mm), BS operated at 1526 m (EMU–8200–A); St. 19 (27°36′08″N 114°13′07″W), July 31, 2012, 1 F (CL ca 9 mm), BS operated at 2111–2136 m (EMU–10876–B).

**TALUD XII.** St. 26 (18°33′27″N 104°28′21″W), April 1, 2008, 1 F (CL 8.2 mm), BS operated at 2125–2165 m.

**TALUD XV.** St. 2 (23°12′02″N 111°20′50″W), August 4, 2012, 1 M (CL 8.6 mm), BS operated at 1118–1150 m (EMU–10869); St. 3 (23°09′55″N 111°20′W), August 4, 2012, 1 F (CL ca 7 mm), BS operated at 1395–1465 m (EMU–10874–A); St. 5E (23°05′22″N 110°27′54″W), August 5, 2012, 1 F (CL 10.1 mm), BS operated at 948–954 m (EMU–10874–B); St. 13 (25°02′12″N 112°54′06″W), July 30, 2012, 2 M (CL 7.1–9.4 mm) and 1 F (CL 8.6 mm), BS operated at 1210–1245 m (EMU–10876–A); St. 15 (25°18′50″N 113°12′17″W), August 2, 2012, 2 F (CL ca 7 mm; damaged), BS operated at 1246–1309 m (EMU–10874–C); St. 17 (26°20′14″N 114°13′07″W), July 31, 2012, 1 F (CL ca 9 mm), BS operated at 2111–2136 m (EMU–10876–B).

**TALUD XVI–B.** St. 1 (28°27′24″N 110°43′W), May 23, 2014, 1 M (CL 10.2 mm), BS operated at 2038–2054 m (EMU–10869).

**Distribution.** Indo–Pacific. In the eastern Pacific it has been recorded in the San Pedro Basin, California, USA, along the Baja California Peninsula, off the Revillagigedo Islands, and within the Gulf of California north to Tiburón Island; also reported from "Dowd Tablemount", off SW Mexico and off Chile (Burkenroad 1938; Hanamura 1983; Hendrickx & Estrada-Navarrete 1996; Gúzman & Wicksten 2000; Guzmán 2008; Wicksten 2012).

**Distribution in western Mexico.** As reported previously, *G. sordidus* is widely distributed throughout the southern and central Gulf of California, and along the west coast of the Baja California Peninsula (Hendrickx & Estrada-Navarrete 1996). Material examined herein includes the first record of this species for SW Mexico (18°33′27″N 109°17′36″W) (Fig. 2).

**Remarks.** Hendrickx & Estrada-Navarrete (1996) reported new material of this species from 22 localities throughout western Mexico, except along the SW coast and north of Tiburón Island, Gulf of California. All their specimens had been captured with small and medium–sized pelagic gear operating from the surface to a minimum depth of 165 m and a maximum depth of 300 m. Wicksten (2012) provided a depth range of 0–915 m corresponding to the deeper midwater trawl in which *G. sordidus* has been caught. There is, however, no precise information related to the depth of residence of *G. sordidus* except for the data provided by Hendrickx & Estrada-Navarrete (1996) indicating that it occurs in the epipelagic zone and maybe slightly deeper.
*Gennadas sordidus* had previously been reported from five Mexican localities by Burkenroad (1938). Material examined herein came from as many as 38 localities, 31 within the Gulf of California, 6 off Baja California, and one off SW Mexico (Fig. 2), and *G. sordidus* is therefore and by far the most common and abundant species of the genus in western Mexico. In this study, 76 males and 107 females were collected providing an overall sex ratio of 1:1.4 in favor of females.

![FIGURE 2](image-url)

**FIGURE 2.** Localities where specimens of *Gennadas sordidus* Kemp, 1910, were collected during this survey.

**Discussion**

The genus *Gennadas* is represented in western Mexico by six species (Hendrickx & Estrada-Navarrete 1996) and an additional species, *G. bouvieri*, has been reported from Seamount 350, about 750 nm west of the Baja California Peninsula by Hanamura (1983). During this survey, four species were collected. According to previous records, *Gennadas sordidus* is clearly the most common species occurring off the west coast of Mexico and the new
material examined herein fully confirms this. It has been recorded over ca 10 degrees of latitude along the Mexican Pacific. The other three species reported herein feature a much more restricted distribution pattern off Mexico. Indeed, *G. incertus*, *G. propinquus* and *G. scutatus* are found only in the California Current, and there is one record in the vicinity of the Revillagigedo Archipelago for the later (Burkenroad 1938). Hendrickx & Estrada-Navarrete (1996) reported few specimens of *G. capensis* (one male) and of *G. tinayeri* (two females) collected in the California Current, but these species were not found again during the present survey.

No species of *Gennadas* have been recorded from the northern Gulf of California. The northern Gulf is mostly shallow, but north of 29ºN there are several areas where the depth is >400 m. There are no clear explanations why no species of *Gennadas* were found in this northernmost section of the Gulf. Current patterns or competition with other pelagic species might prevent the species of *Gennadas* to extend their distribution to this area. Two species, *Maryproessa pippinae* (Wicksten & Mendéz, 1985) and *Pasiphaea americana* Faxon 1893, are the most common pelagic shrimps in the northern Gulf of California (Hendrickx 2012; Flores-Anduaga & Hendrickx 2014).

In the northeastern Pacific, from the Mexican border to Alaska, only four species of *Gennadas* have been reported: *G. incertus*, *G. propinquus*, *G. sordidus* and *G. tinayeri* (Table 1). Comparatively, Guzman & Wicksten (2000) and Guzmán (2008) reported nine species from off Chile, including all the species reported elsewhere in the eastern Pacific, except *G. bouvieri* (but note that this species was collected far away from the American continent) and *G. capensis*.

**TABLE 1.** Presence of species of *Gennadas* in the eastern Pacific. Sources: (1) Austin 1985; (2) Wicksten (2012); (3) Hendrickx & Estrada-Navarrete (1996); (4) Moscoso (2012); (5) Guzmán (2008).

<table>
<thead>
<tr>
<th>Species</th>
<th>NW Pacific (1)</th>
<th>California-Oregon (2)</th>
<th>Mexico (3)</th>
<th>Peru (4)</th>
<th>Chile (5)</th>
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<td><em>G. bouvieri</em> Kemp, 1909</td>
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<td><em>G. tinayeri</em> Bouvier, 1906</td>
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*Gennadas scutatus* is the only species reported from off Peru (Moscoso, 2012). In this area it was collected in one sample from 0–50 m depth, thus indicating that this species can live in a very shallow habitat, at least during part of the day. Retamal & Jara (2002) reported only one species for Chile, *G. brevirostris* Bouvier, 1905, but Guzman & Wicksten (2000) later reported the presence of *G. incertus*, *G. propinquus*, *G. sordidus*, *G. scutatus* and *G. tinayeri* in an area located between 10º and 22º S, and Guzmán (2008) added three more species to the Chilean fauna: *G. barbari* Vereschaka, 1990, *G. gilchristi* Calman, 1925, and *G. kempi* Stebbing, 1914.

Although *G. sordidus* is very common and widely distributed off the Pacific coast of Mexico, it was not commonly found in samples containing other species of *Gennadas*: only once each with *G. propinquus* and *G. scutatus*. Because samples available were taken from surface to a maximum depth ranging from 410 to 2350 m, it is virtually impossible to determine at which moment during the ascent of the gear the specimens were caught, i.e., at which depth. Samples of *Gennadas* reviewed by Hendrickx & Estrada–Navarrete (1996) were almost always taken in the upper 200–300 m in the water column and these authors reported the presence of six species, thus indicating that at least during part of their life cycle these species occur in relatively shallow water. *Gennadas bouvieri* is known to reside between 750–875 m during the day and to migrate to 250–474 m at night. *Gennadas capensis* has been captured in mid water between 250 and 630 m depth (Kensley et al. 1987). Aizawa (1974) reported variation of several hundreds meters between day (400–900 m) and night (100–200 m) for *G. incertus*. 
Gennadas propinquus also migrates to surface during the night (Krygier & Pearcy 1981). In the Mexican Pacific, however, there is no comprehensive study related to migration patterns of species of Gennadas or to their depth of residence. The very wide Oxygen Minimum Zone (OMZ) that affects the vertical distribution of both pelagic and benthic species off western Mexico (see Helly & Levin 2004; Hendrickx & Serrano 2010; 2014; Serrano 2012) certainly plays a critical role in the vertical distribution of Gennadas.

The absence of G. incertus, G. propinquus and G. scutatus in samples taken off SW Mexico (roughly between 21°N and 18°N) and the unique record of G. sordidus in this area is somewhat puzzling. All have been recorded from further south, off Chile (see Table 1), and one would expect to find them in the intermediate latitudes, between western Mexico and South America. Species of Gennadas are mostly mesopelagic (Criales & McGowan 1993, Rivera & Guzman 2002) and are known to perform ample vertical migrations. Heffernan & Hopkins (1981) observed concentration of Gennadas at 650–850 m in the day and at 150–400 m during the night, and Criales & McGowan (1993) noticed that adults and juveniles have previously been reported as strong diel vertical migrators aggregated at depths of 550–950 m during the day and 75–425 m at night. Information available for several species of Gennadas occurring off western Mexico also indicates a clear vertical migration pattern (see above). As stated earlier, western Mexico is under the influenced of a very wide OMZ. Average depth at which oxygen concentration falls below the critical value of 0.2 ml/l in the upper boundary of the OMZ varies considerably in this area. It is much shallower off SW Mexico (as shallow as 50 m depth) than in the Gulf of California (as shallow as 100–150 m) and off western Baja California (Hendrickx & Serrano 2010). The OMZ itself is also much wider off SW Mexico, with an ample, almost anoxic central core (Hendrickx & Serrano 2010). This might explain the scarcity of records of G. sordidus and the absence of records of other species of the genus in this area where vertical migrations through the OMZ core could be strongly limited due to severe hypoxic or even anoxic conditions encountered below the upper boundary of the OMZ. The branchial filaments of G. sordidus, however, are particularly dense and well developed, thus indirectly indicating an increase in the capacity of extracting dissolved oxygen from the surrounding water as noted in other benthic and pelagic species adapted to oxygen deprivation (Childress & Seibel 1998; Levin 2003; Ekau et al. 2010). This increase of gills surface might enable G. sordidus to invade, at least partly, the core of the OMZ that extends virtually along the entire Pacific coast of Mexico, except in the northern Gulf of California (Helly & Levin 2004; Hendrickx & Serrano 2010; 2014). Other adaptations might also occur with species of Gennadas (e.g., enhanced ventilatory ability, shorter diffusion distance from water to blood), including the presence of hemocyanin with high affinity for oxygen as observed in Gnathophausia ingens Dohrn (Sanders & Childress, 1990). There is, however, no information on respiratory physiology in this genus and the real impact of this peculiar physiological barrier on vertical migration of pelagic shrimps is virtually unknown in the area. A series of discrete, large samples collected at different depths is urgently needed in order to try to understand the dynamics of these organisms.

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