



# Occurrence of *Lernanthropus pomatomi* Rathbun, 1887 (Copepoda: Lernanthropidae) and *Caligus schistonyx* Wilson, 1905 (Copepoda: Caligidae) Parasitizing *Pomatomus saltatrix* (Linnaeus, 1766) (Teleostei: Pomatomidae) in the Southern Gulf of Mexico

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## Abstract

Thirteen females of *Lernanthropus pomatomi* Rathbun, 1887 (Copepoda: Lernanthropidae) and one female of *Caligus schistonyx* Wilson, 1905 (Copepoda: Caligidae) were recorded in the Bluefish *Pomatomus saltatrix* (Linnaeus, 1766) (Teleostei: Pomatomidae) (420 mm SL, 1030 g) off the northern coast of the Yucatan Peninsula, Mexico, in the southern Gulf of Mexico. Records of *L. pomatomi* and *C. schistonyx* in this region are an extension of their geographic distribution to the tropics, since these parasitic copepods were originally described in *P. saltatrix* from the northern Gulf of Mexico and North-Western Atlantic Ocean. A summary of recorded *Lernanthropus* and *Caligus* species in Mexico is included. Studies on parasitic copepods in Mexico are more frequent in the Mexican Pacific; thus, it is recommended to further document the parasitic copepod diversity in marine fishes from the southern Gulf of Mexico and the Mexican Caribbean.

**Keywords** Actinopterygii · Ectoparasites · Siphonostomatoida · Yucatan Peninsula · Mexico

## Introduction

Parasitic copepods belong to the orders Cyclopoida, Harpacticoida, Monstrilloida, and Siphonostomatoida (Boxshall and Hayes 2019). Siphonostomatoida Thorell, 1859 contains 2,280 valid species distributed in 40 families (Boxshall and Hayes 2019; Walter and Boxshall 2024) with many species having preference to parasitize fishes (1,555 species) (Walter and Boxshall 2024). Within Siphonostomatoida, the family Lernanthropidae Kabata 1979 comprises eight genera, which includes *Lernanthropus* de Blainville, 1822 and Caligidae Burmeister, 1835 (Siphonostomatoida) with 30 genera, including *Caligus* Müller, 1875.

Worldwide, about 120 *Lernanthropus* and 270 *Caligus* species have been recorded parasitizing marine fishes, and some of these copepod species are very highly specific for certain fish species (Kabata 1993, Boxshall and Halsey

2004; Walter and Boxshall 2024). In Mexico, Morales-Serna et al. (2012) elaborated a comprehensive checklist of parasitic copepods of marine fishes, including 140 species recorded from 120 fish species. In this list, seven *Lernanthropus* and 20 *Caligus* species have been recorded in marine fishes, mainly from the Mexican Pacific, and few species have been recorded in the southern Gulf of Mexico and the Mexican Caribbean.

*Lernanthropus pomatomi* Rathbun 1887, a specific parasitic copepod of the Bluefish *Pomatomus saltatrix* (Linnaeus, 1766) (Teleostei: Pomatomidae), was first recorded in the northern Gulf of Mexico (Bere 1936) and in the North-Western Atlantic Ocean off the coast of Massachusetts (USA) (Anderson 1970). In Mexico, *L. pomatomi* has been recorded in snappers (*Lutjanus* spp.) (Teleostei: Lutjanidae) and in the Atlantic Horse Mackerel *Trachurus trachurus* (Linnaeus 1758) (Teleostei: Carangidae) in the Pacific Ocean off the Sinaloa and Nayarit coasts, respectively (Causey 1960).

In the Western Caribbean and the Gulf of Mexico, more than 26 *Caligus* species have been recorded (Cressey 1991). *Caligus schistonyx* Wilson 1905 was first described parasitizing the Menhaden *Brevoortia tyrannus* (Latrobe 1802)

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(Teleostei: Alosidae) off Massachusetts, USA and reported on the body surface of *P. saltatrix* (Wilson 1905), but it has never been recorded in Mexico. The aim of this work was to describe the first occurrence of *Lernanthropus pomatomi* and *Caligus schistonyx* in *P. saltatrix* off the northern coast of the Yucatan Peninsula, in the southern Gulf of Mexico. These records extend the geographic distribution ranges of these parasitic copepods to the tropics.

## Materials and Methods

On March 20, 2022, one Bluefish was acquired from a local fisher during a fishing tournament in Telchac, Yucatan (21°34'33"N, 89°30'19"W), Mexico, off the northern Yucatan Peninsula, in the southern Gulf of Mexico. Fish host was kept frozen and later analyzed in the laboratory of the Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Yucatan, where it was measured in standard length (SL) in millimeters (mm) using a ruled table and total weighed in grams (g) with an electronic scale. The Bluefish was identified as *Pomatomus saltatrix* (Linnaeus, 1766) (Teleostei: Pomatomidae) using the taxonomic keys and diagnosis by Collette (2002).

Copepods were found on the gill filaments of *P. saltatrix*, collected with pliers, and fixed in 70% ethanol labelled vials. In the laboratory, copepod specimens were cleared with lactophenol and glycerin 1:1 and examined under the stereomicroscope to identify them to species based on their morphology. The identification followed descriptions provided by Yamaguti (1963), Pillai (1967), Kabata (1979), and Wilson (1905).

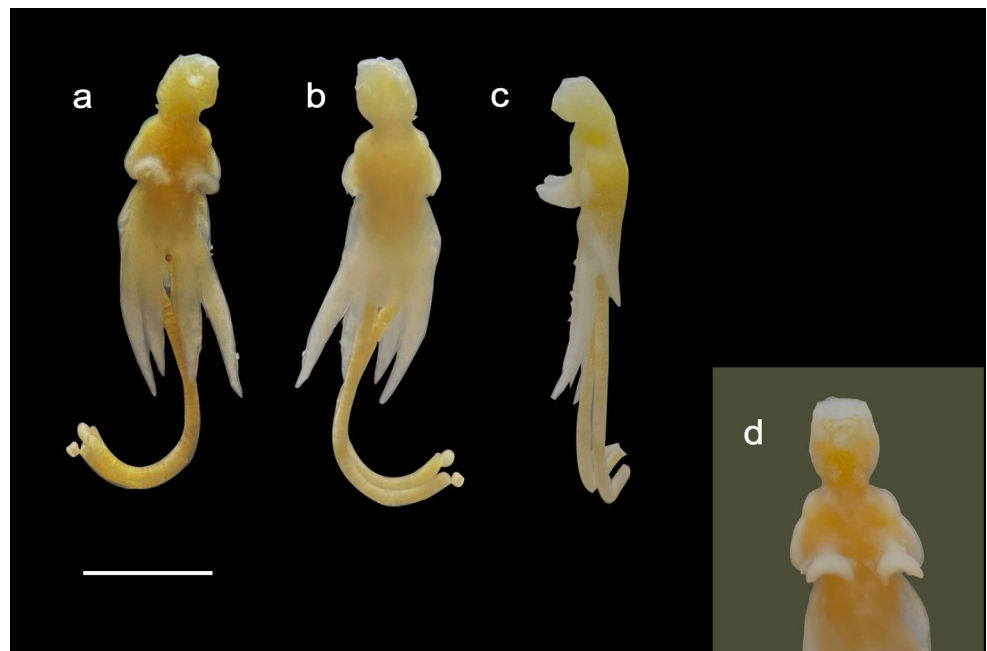
Each copepod's body length (millimeters) was measured using a caliper and given by the mean followed by the range in parentheses. Copepod sex was distinguished based on the presence of egg-tubes attached to copepod specimens. Actually, egg-tubes are conspicuous that can clearly be seen by the naked eye. Copepod specimens were deposited in the Crustacean collection (Crustáceos de Yucatán YUC-CC) of the Universidad Nacional Autonoma de Mexico (UNAM), with catalog numbers YUC-CC-255-11-007390 for *L. pomatomi* and YUC-CC-255-11-007391 for *C. schistonyx*.

## Results and Discussion

Bluefish *P. saltatrix* measured 420 mm SL and weighed 1030 g. Thirteen females of *Lernanthropus pomatomi* (Fig. 1) (5.6 mm, 5–7 mm long) were found attached to both gill filaments, and a single female *Caligus schistonyx* (Fig. 2) (4.5 mm long) was found on the right gill arch filament of the host. Copepod species sex was distinguished by the presence of egg-tubes (Figs. 1 and 2). The morphology of *L. pomatomi* specimens examined in this study corresponded to that described by Rathbun (1887), with elongated cephalothorax, narrow at front, convex and rounded at posterior corners, squared thorax with a shield at its back, feet of the third pair long and narrow like short sleeves to a man's coat, abdomen small, caudal segment elongated, egg-tubes elongated, dark brown. Thorax forms a squared figure with rounded corners, in lateral view cephalothorax thick near the front.

The morphology of specimen of *C. schistonyx* examined in this study corresponded to that described by Wilson

**Fig. 1** *Lernanthropus pomatomi* in (a) ventral, (b) dorsal, and (c) lateral views, (d) a closer view at ventral side. Scale bar: 1 mm



**Fig. 2** *Caligus schistonyx* in (a) ventral, (b) dorsal, and (c) lateral views. Scale bar: 1 mm



(1905), with a peculiar longer carapace than body, ovate, strongly narrowed anteriorly, frontal plates wide, posterior sinuses narrow and inclined to median axis, carapace with a grooving in which a thoracic area quadrilateral, anterior corners with a pair of parallel grooves extend diagonally forward and outward. It is important to remark that *L. pomatomi* and *C. schistonyx* are host-specific, which means that these copepods show a preference for the fish *P. saltatrix*.

In Mexico, previous records of *Lernanthropus* (7) and *Caligus* (20) species have been found parasitizing about 40 marine fish species, but mainly from the Mexican Pacific, and only three *Lernanthropus* and three *Caligus* species had been recorded in the southern Gulf of Mexico (sGoM) and the Mexican Caribbean (MC) so far (Table 1). However, this work adds new records with four species for each genus in each of the aforementioned regions (Table 1).

In the sGoM and the MC, *Lernanthropus* species recorded so far are *L. gisleri* on the Snook *Centropomus undecimalis* (Bloch, 1792) (Teleostei: Centropomidae) off the Veracruz coast and *L. belones* on *Strongylura timucu* (Walbaum, 1792) (Teleostei: Belonidae) off the Yucatan coast, both in the sGoM (Causey 1960; Morales-Serna et al. 2012, 2017), and *L. chachi* on *Haemulon* spp. (Teleostei: Haemulidae) off the MC. *Lernanthropus pomatomi* is now added to this record list for Mexico (Table 1). Unidentified *Lernanthropus* species have been recorded in the Black grouper *Mycteroperca bonaci* (Poey, 1860) (Teleostei: Serranidae) off the Yucatan coast (sGoM) (Espínola-Novelo et al. 2013, 2015) and in the Schoolmaster snapper *Lutjanus apodus* (Walbaum, 1792) (Teleostei: Lutjanidae) off the Quintana Roo coast (MC) (Hernández-Olascoaga et al. 2022) (Table 1).

*Caligus* species recorded are *C. haemulonis* in *Bagre marinus* (Mitchill, 1815) (Teleostei: Ariidae) (Causey 1960) and *Haemulon plumieri* (Demarest, 1823) (Teleostei:

Haemulidae) (Suarez-Morales et al. 2010) off the coast of the MC, and *C. pelamydis* in *Scomberomorus cavalla* (Cuvier, 1829) (Teleostei: Scombridae) off the Veracruz coast (Causey 1960) and *C. trachynoti* in *Trachinotus carolinus* (Linnaeus, 1766) (Teleostei: Carangidae) off the Yucatan coast (Sánchez-Ramírez and Vidal-Martínez 2002), both in the sGoM (Table 1). *Caligus schistonyx* is now added to this record list for Mexico (Table 1).

The occurrence of *L. pomatomi* and *C. schistonyx* in the sGoM, off the northern coast of the Yucatan Peninsula, represents a geographic distribution extension of these parasitic copepod species to the tropics since their first record was in the Northern Western Atlantic Ocean off the Massachusetts coast (Anderson 1970). Whether *L. pomatomi* and *C. schistonyx* are common parasitizing marine fishes off the coast of the Yucatan Peninsula or they are distributed in the entire Gulf of Mexico requires scientific endorsement. It is recommended to further document the parasitic copepod diversity associated to marine fish species in the region to better understand the diversity and distribution of these copepods and their ecological interactions with hosts.

**Table 1** List of *Lernanthropus* and *Caligus* species, and their fish species host, recorded in the Mexican Caribbean and southern Gulf of Mexico. MP (Mexican Pacific), MC (Mexican Caribbean), SGoM (southern Gulf of Mexico), NGoM (Northern Gulf of Mexico)

Species	MP	MC	SGoM	NGoM	Source
<i>Lernanthropus belones</i> Krøyer, 1863	<i>Strongylura</i> sp.				Cressey and Collette (1970)
<i>L. chachi</i> Suárez-Morales et al. 2010		<i>Hae- mulon plumieri</i> (Demar- est, 1823)			Suárez-Morales et al. (2010)
<i>L. cornutus</i> Kirtisinghe, 1937	<i>Strongylura</i> sp., <i>Ablennes hians</i> (Valenciennes, 1846)				Cressey and Collette 1970
<i>L. corteziensis</i> Deets and Kabata 1991	<i>Diapterus peruvianus</i> (Cuvier, 1830)				Deets and Kabata (1991)
<i>L. ilishae</i> Chin, 1948	<i>Selar crumenophtalmus</i> (Bloch, 1793), <i>Decapterus muroadsi</i> (Temminck & Schlegel, 1844), <i>Lutjanus inermis</i> (Peters, 1869), <i>Lutjanus peru</i> (Nichols & Murphy, 1922)				Gallegos-Navarro et al. (2018), Violante-Gonzalez et al. (2023)
<i>L. giganteus</i> Krøyer, 1863	<i>Lutjanus peru</i> (Nichols & Murphy, 1922), <i>Caranx caballus</i> Günther, 1868				Villalba-Vazquez et al. (2022), Violante-Gonzalez et al. (2016)
<i>L. gisleri</i> Beneden, 1852	<i>Lutjanus</i> sp., <i>Trachurus trachurus</i> (Linnaeus, 1758)		<i>Centropomus undecimalis</i> (Bloch, 1792)		Causey (1960)
<i>L. pomatomi</i> Rathbun 1887	<i>Lutjanus</i> sp., <i>Trachurus trachurus</i> (Linnaeus, 1758)		<i>Pomatomus saltatrix</i> (Linnaeus, 1766)	<i>Pomatomus saltatrix</i> (Linnaeus, 1766)	Causey (1960), This study, Anderson (1970)
<i>Lernanthropus</i> sp.			<i>Myceroperca bonaci</i> (Poey, 1860)		Espínola-Novelo et al. (2013, 2015)
<i>Lernanthropus</i> sp.		<i>Lutjanus apodus</i> (Walbaum, 1792)			Hernández-Olascoaga et al. (2022)
<i>Caligus bennetti</i> Causey, 1953	<i>Kyphosus saltatrix</i> (Linnaeus, 1758), <i>Paralabrax maculatofasciatus</i> (Steindachner, 1868)				Causey (1960)
<i>C. bonito</i> Wilson C.B., 1905	<i>Cratinus agassizii</i> Steindachner, 1878				Causey (1960)
<i>C. chamelensis</i> Morales-Serna, Pinacho-Pinacho, Gómez & Pérez-Ponce de León, 2014	<i>Kyphosus elegans</i> (Peters, 1869)				Morales-Serna et al. (2014)
<i>C. chelififer</i> Wilson C.B., 1905	<i>Trichiurus lepturus</i> . <i>Xiphias gladius</i>				Ocaña-Luna and Alvarez-Silva (2001)
<i>C. constrictus</i> Heller, 1865	<i>Caranx hippos</i> (Linnaeus, 1766)				Causey (1960)
<i>C. dasyaticus</i> Rangnekar, 1957			<i>Aetobatus narinari</i> (Euphrasen, 1790)		Rodríguez-Santiago et al. (2015)
<i>C. elongatus</i> Heegaard, 1943	<i>Sphoeroides annulatus</i> (Jenyns, 1842)				Causey (1960)
<i>C. fajerae</i> Morales-Serna et al. 2017	<i>Scomberomorus sierra</i> Jordan & Starks, 1895				Morales-Serna et al. (2017)

**Table 1** (continued)

Species	MP	MC	SGoM	NGoM	Source
<i>C. haemulonis</i> Krøyer, 1863		<i>Hae- mulon plumieri</i> (Demar- est, 1823)	<i>Bagre marinus</i> (Mitchill, 1815)		Suarez-Morales et al. (2010), Causey (1960)
<i>C. lalandeu</i> Barnard, 1948	<i>Seriola lalandi</i> Valenciennes, 1833				Ho et al. (2001)
<i>C. longipedis</i> Bassett-Smith, 1898	<i>Caranx lugubris</i> Poey, 1860				Shiino (1959)
<i>C. macarovi</i> Gusev, 1951	<i>Cololabis saira</i> (Brevoort, 1856)				Cressey and Cressey (1980)
<i>C. mutabilis</i> Wilson C.B., 1905	more than 15 species		<i>Scomber japonicus</i> Houttuyn, 1782		Causey (1960), Cressey and Cressey (1980)
<i>C. omissus</i> Cressey and Cressey 1980	<i>Scomberomorus sierra</i> Jordan & Starks, 1895, <i>Scomberomorus concolor</i> (Lockington, 1879)				Cressey and Cressey (1980)
<i>C. pelamydis</i> Krøyer, 1863			<i>Somberomorus cavalla</i> (Cuvier, 1832)		Causey (1960)
<i>C. productus</i> Dana, 1852–1853	more than 15 species				Causey (1960)
<i>C. serratus</i> Shiino, 1965	<i>Sphoeroides annulatus</i> (Jenyns, 1842)				Morales-Serna et al. (2012)
<i>C. tenuifurcatus</i> Wilson C.B., 1937	<i>Nematistius pectoralis</i> Gill, 1862, <i>Centropomus robalito</i> Jordan & Gilbert, 1882				Deets and Benz (1988), Suárez-Morales et al. (2008)
<i>C. trachynoti</i> Heller, 1865			<i>Trachinotus carolinus</i> (Linnaeus, 1766)		Sánchez-Ramírez and Vidal-Martínez (2002)
<i>C. tylosuri</i> (Rangnekar, 1956)	<i>Tylosurus pacificus</i> (Steindachner, 1876)				Cressey and Collette (1970)
<i>C. schistonyx</i> Wilson C.B., 1905			<i>Pomatomus saltatrix</i> (Linnaeus, 1766)	<i>Poma- tomus sal- tatrix</i> (Lin- naeus, 1766)	This study, Anderson (1970)

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**Data Availability** No datasets were generated or analysed during the current study.

## Declarations

**Ethical Approval** Not applicable

**Competing Interests** The authors declare no competing interests.

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