



An Updated Checklist of Copepod Species (Arthropoda: Crustacea) from the Gulf of Cariaco, Venezuela

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Abstract. Copepods from the Gulf of Cariaco have been studied for decades, but the number of species in the gulf is still unknown. This paper presents a list of marine copepod species recorded in scientific journals, research papers and project reports, as well as a description of the sampled areas. The total number of species (136) represents mainly the specific richness of different zones of the water column, Calanoida being the most diverse group, followed by Cyclopoida. Scant information on Harpacticoida and Siphonostomatoida suggests further research on these groups. Ecological and biogeographic affinities and bathymetric distribution are described for each species.

Key words: Calanoida, copepods, Cyclopoida, Gulf of Cariaco, species checklist.

Resumen: Listado actualizado de las especies de Copépodos (Arthropoda: Crustacea) del golfo de Cariaco, Venezuela. Los copépodos del Golfo de Cariaco se han estudiado por décadas; Sin embargo, no se ha establecido el número de especies presentes en el golfo. Este trabajo presenta una lista de las especies de copépodos marinos registrados en revistas científicas, trabajos de tesis e informes de proyectos, e incluye una descripción de las zonas estudiadas. El número total de especies (136) representa principalmente la riqueza específica de distintos ambientes de la columna de agua, con los Calanoida como el grupo más diverso, seguido de los Cyclopoida. Los Harpacticoida y Siphonostomatoida continúan siendo muy poco conocidos, por lo que serían convenientes más estudios. Para cada especie se indica su afinidad ecológica, biogeográfica y su distribución batimétrica.

Palabras clave: Calanoida, copépodos, Cyclopoida, golfo de Cariaco, lista de especies.

Introduction

The Gulf of Cariaco is a geographically semi-enclosed coastal ecosystem in northeastern Venezuela. Located east of the Cariaco Basin from 10°25'–10°35' N to 63°38'–64°13' W (Fig. 1), the gulf is about 62 km long in the east-west direction and 15 km maximum wide in the north-south sense, with an area of 642 km² and an estimated volume of 31.5 x 10⁶ km³ (Okuda 1981). The gulf is one of the main 5 sectors that delimit the total fishing area of northeastern Venezuela, with sardine (*Sardinella*

aurita) as the principal fishing resource (Quintero *et al.* 2002).

The littoral waters of the Gulf of Cariaco are affected by meteorological, hydrodynamic, biological, geochemical, geomorphological, and ecological conditions and by anthropogenic exogenous influx, since the gulf is the final recipient of continental surface run-off, and their hydrological, geochemical and ecological balance becomes modified in diverse ways (Bonilla 1982, Márquez *et al.* 2005, 2011).

Convection and resurgence processes in the Gulf of Cariaco recycle and renovate the warmer superficial waters with deeper lower-temperature and nutrient-rich ones which stimulate plankton growth and supply various-sized sediment particles that are deposited and accumulate over the continental platform and become part of the sea floor richness (Bonilla *et al.* 1985). Due to the favorable characteristics of this water body, the Gulf has become in time the natural reservoir for many marine species.

Marine planktonic copepods of the gulf of Cariaco have been studied a few decades beginning with pioneers Legaré (1961) and Zoppi (1961), and in the 70's and 80's, Bastardo (1975), Bagdó (1977), Espinoza (1977), and Infante & Urosa (1986). After these publications, no new information on copepods from the Gulf of Cariaco was published until the new century, when new research on marine zooplankton was conducted at the Instituto Oceanográfico de Venezuela (IOV), such as Marcano (2007), Morales (2008, 2014), Márquez-Rojas (2008, 2010, 2016), and Márquez-Rojas *et al.* (2006, 2011, 2014a,b). However, studies continue to be scant and records are widely dispersed.

Copepod systematics have had numerous revisions during the last decade, and as we learn more, more changes in the classification are likely. Currently, two classes and ten orders are recognized (Walter & Boxshall 2019). The old order Poecilostomatoida was transferred recently to Cyclopoida (Boxshall & Halsey 2004, Dussart & Defaye 2006, Walter & Boxshall 2019). Worldwide nearly 16,000 copepod species are recognized in 10 orders, 250 families, and 2,600 genera. The subclass Copepoda is represented by free-living marine plankton belonging to 9 of 10 orders: Platycopepoida, Calanoida, Mormonilloida, Misophrioida, Harpacticoida, Cyclopoida, Siphonostomatoida, Monstrilloida, and Gelyelloida (Walter & Boxshall 2019). The database prepared by Razouls *et al.* (2005-2019) lists 723 copepod species for Venezuelan coasts, the Caribbean Sea, the Gulf of Mexico, Florida, and the Sargasso Sea, of which 557 species belong to the order Calanoida, and 156 to other orders.

Despite being the marine zooplankton of great ecological and economic importance, with high species richness, information on eastern coast of Venezuela is scant possibly due to the great number of species present, difficulties in identification, lack of specialists, and very small financial support for projects or research. Nonetheless, the existing

information is mostly from the gray literature (research papers, project reports) and quite dispersed.

The reasons for creating this Gulf of Cariaco checklist based on previous research beginning in 1961 is for amplifying the national inventory of marine planktonic diversity of Venezuela, and since this recompilation will also show information gaps, it might guide objectives for future research.

Materials and Methods

Data compilation started by arranging all sampling stations from the various scientific studies and research theses done on copepods in the study area (Fig. 1). Likewise, a taxonomic listing of all known copepod species for the Gulf of Cariaco was prepared based on all publications.

Due to the scant available papers information for the study area, data from studies included master and undergraduate theses, final reports from research projects, and environmental baseline studies; however, many identified species may have to be corroborated in future research. This list is also complemented with data of bathymetric distribution, zoogeographic and ecological affinities for all identified species.

The taxonomy of this list is based on Huys & Boxshall (1991), Campos-Hernández & Suárez-Morales (1994), Bradford-Grieve *et al.* (1999), Boxshall & Hasley (2004) and Walter & Boxshall (2019).

Results

The table in ANNEX I presents the taxonomic list of species of the subclass Copepoda recorded in studies based principally in the microzooplankton (20-200 µm) and mesozooplankton (0.2-20 mm) of the Gulf of Cariaco waters. Included are 136 species from 104 published records and 32 from gray literature. From this subclass, 71 species (52.2%) belong to order Calanoida, 48 (35.3 %) to Cyclopoida, 10 (7.3 %) to Harpacticoida, and 7 (5.1 %) to Siphonostomatoida. From these species, excluding those of order Siphonostomatoida, 120 have been confirmed for Venezuela, Caribbean Sea, Gulf of Mexico, Florida, and Sargasso Sea based on data from Razouls *et al.* (2005-2019).

On the family and genera level, order Calanoida is the most diverse group with 18 families and 38 genera present in the Gulf of Cariaco, followed by Cyclopoida (6 and 14, respectively), and Harpacticoida (9 and 11, respectively). In the Calanoida, the Paracalanidae family contains more

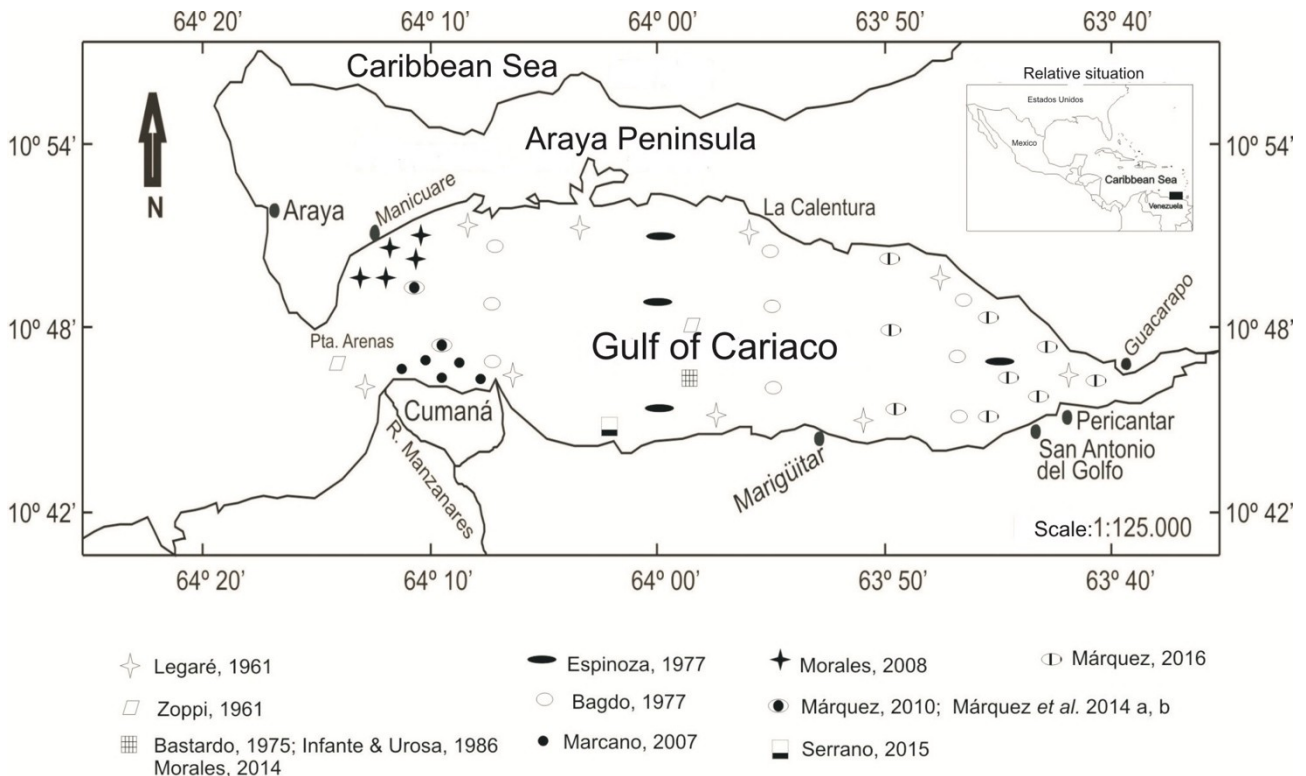


Figure 1. Map of the Gulf of Cariaco showing all sampling stations from previous copepod studies performed in the gulf.

species (11 spp.), followed by Pontellidae (9 spp.), and Acartidae and Eucalanidae (6 spp. each). Most representative calanoids are *Paracalanus aculeatus*, *P. quasimodo*, *Labidocera acutifrons*, *L. scotti*, *Acartia tonsa*, *A. lilljeborgi*, *Subeucalanus subtenuis* and *S. subcrassus*. The main Calonoidan genera by their abundance in the Gulf of Cariaco are *Temora*, *Acartia*, *Paracalanus* and *Subeucalanus* (Legaré 1961, Zoppi 1961, Márquez-Rojas *et al.* 2006, Márquez-Rojas 2010). The dominant species from these genera are *T. turbinata*, *A. tonsa* and *P. quasimodo* and are referred as the dominant copepods in NE Venezuela, the Cariaco basin and Gulf of Cariaco, and Margarita Island (Nueva Esparta state) waters (Legaré 1961, 1964, Zoppi 1961, Infante & Urosa 1986), as well as the Caribbean Sea and the southeastern Caribbean (Michel & Foyo 1976) and south of the Gulf of Mexico (Suárez-Morales & Gasca 1997, 1998, Ruiz-Pineda *et al.* 2016).

In the Cyclopoida, only the Oithonidae family and genus *Oithona* are recorded with seven species, *Oithona plumifera* and *O. setigera* being the most abundant and frequently occurring in samples above 100 m depth in coastal and estuarine areas of the Gulf of Mexico and the Caribbean Sea (Owre & Foyo 1967, Campos-Hernández & Suárez-Morales 1994, Suárez-Morales & Gasca 1997). All *Oithona*

species recorded and compiled for this paper are quoted for the Mexican Caribbean (Suárez-Morales & Gasca 1998), Caribbean Sea (Owre & Foyo 1967) and from the database of Razouls *et al.* (2005-2019) for the coastal zone of Venezuela, the Caribbean Sea and Florida.

In the suborder Poecilostomatoida, the most abundant Corycaeidae family was represented by five genera and 22 species. For the Venezuelan Caribbean zone only 23 species of *Corycaeus* and 3 species of *Farranula* had been recorded (Legaré 1961, 1964, Zoppi 1961, Cervigón 1963, 1964, Cervigón & Marciano 1965, Razoul *et al.* 2005-2019). From these, 19 have been recorded for the Gulf of Cariaco. The most common and abundant for the Southeastern Caribbean, both Cariaco basin and gulf, are *Corycaeus speciosus*, *Urocorycaeus lautus* y *Ditrichocorycaeus amazonicus* (Legaré 1961, 1964, Zoppi 1961, Cervigón, 1963, 1964, Cervigón & Marciano 1965, Márquez-Rojas *et al.* 2006, 2011, 2014a, b). The Oncaeidae y Sapphirinidae families were also represented with 7 and 10 species, respectively. In the first family, *Oncaea mediterranea* is the most abundant and frequently collected, followed by *O. media*, *O. venusta*. In the Sapphirinidae the most common and abundant species are *Copilia mirabilis*, *Sapphirina angusta*, *S. intestinata*, *S. opalina*, and *S.*

nigromaculata. For the Gulf of Mexico and Caribbean Sea two genera and fourteen species have been reported in the Sapphirinidae family (Campos-Hernández & Suarez-Morales 1994).

Harpacticoids, generally benthic copepods, have a few planktonic species. The most common harpacticoid in planktonic shallow waters of the Gulf of Cariaco is *Euterpina acutifrons*, as is the case for the Gulf of Mexico, Caribbean Sea and adjacent waters (Legaré 1961, Zoppi 1961, Hernández-Trujillo *et al.* 2004, Márquez-Rojas *et al.* 2006). Other harpacticoids identified in the Gulf of Cariaco are *Microsetella rosea*, *Macrosetella gracilis*, and *Miracia efferata*.

The group of Siphostomatoides copepods of the *Caligus* genus is one of the most diverse representatives of parasitic or ectoparasitic crustaceans of teleost fish. These parasites in their first life stage are free-swimming and zooplanktonic. *Lepeophtheirus nordmanni* and *Cecrops latreillii* were reported for the first time as ectoparasites of the sunfish *Mola mola* in the Gulf of Cariaco (Díaz-Díaz 2000). Also, Kim *et al.* (2019) report for the first time *Caligus littoralis*, *C. evelynae*, *C. praetextus*, and *C. rufimaculatus* for the Gulf of Cariaco, observing that *C. evelynae* and *C. rufimaculatus* have been found only in the plankton, and their hosts remain unknown (ANNEX I).

The zoogeographic analysis of the faunal composition of Gulf of Cariaco copepods, achieved by combining data compiled for this study and previous faunal records, show that 77.34% of species found are of tropical-subtropical affinity, 15.62% are related to temperate waters, and 7% are of cosmopolitan distribution (ANNEX I).

Forty percent of recorded copepods are from oceanic platform waters, while 23.7% presented affinity for upper platform waters, and 19.73% show oceanic affinity. Only 16.57% of species are common residents of the coastal-neritic zones (ANNEX I).

Regarding bathymetric distribution patterns of the collected copepods, 71.65% are found associated to surface strata, 9.45% are from subsurface strata, and 18.89% are from mesopelagic waters, with water-column migrations reaching at some time epipelagic waters (ANNEX I).

Discussion

This database assessment provides only a small number of species compared with the database for Mexico and Colombia (Campos-Hernández & Suarez-Morales 1994, Suarez-Morales & Gasca

1997, 1998, Medellín-Mora & Navas 2010) or that of Razoul *et al.* (2005-2019) for the area of Venezuela, Caribbean Sea, Gulf of Mexico, and Florida. While our study is done for a particular geographical area, the other studies mentioned are inventories or compilations of several areas, including bays, coastal zones, various lakes, etc. Also, many of those records refer to epipelagic samples (> 100 m), while the maximum depth in the gulf samples is 90 m (Caraballo 1982). So, the known list is expected to increase considerably as more plankton samples are taken from greater depths, the copepod fauna below 100 m in the northeastern zone of Venezuela is largely unknown.

The hydrologic dynamics of the tropical waters of the Gulf of Cariaco influences the copepod fauna and high proportions are species typical of these geographic latitudes. The local copepod fauna is principally comprised of species derived from surface waters of the Caribbean Sea (Michel & Foyo 1976, Campos-Hernández & Suárez-Morales 1994), while oceanic species that enter the gulf, do so through upwelling processes, especially during the first six months of the year (Okuda *et al.* 1978).

The dominance in numbers of littoral and shelf species (70%) might be related to the study site and sampling locations, since 80% of sampling stations are located near the coast, the rest are at the center of the gulf. Noteworthy is the coincidence between the ecological affinity characteristics described for the referenced species and observations in the study area. For example, *A. tonsa*, *T. turbinata*, and *P. quasimodo*, which are coastal species, also happened to be the most abundant and dominant of the copepod fauna of the Gulf of Cariaco.

The bathymetric distribution of collected copepods from the gulf highlights the dominant presence of epiplankton or subsurface species, and that is related to the depth and sampling methods used, since the horizontal hauls were carried out in superficial waters strata (< 90 m).

The relevant occurrence of mesopelagic (*sensu lato*) species, such as *A. negligens*, *E. rostrata*, *H. setuliger*, *M. tenuicornis*, *S. longifurca*, *T. mayumbaensis*, *C. pacificus*, *D. americanus*, that present wide vertical migrations (0-2000/3000 m), as well as the anomalous presence of some species of meso- or bathypelagic (*sensu stricto*) habits, such as *A. multiserrata*, *S. angusticeps*, *O. notopus*, and *O. curta*, in the superficial strata can be attributed to active emersions that are found in the northeastern region of Venezuela. Thus, coastal upwelling would

have a vertical transport effect on these species, carrying them from mesopelagic depths to the upper levels of the water column, as also has been mentioned by Suárez (1992), and Suárez-Morales & Gasca (1997).

Although the knowledge of marine copepods in Venezuela has increased substantially in the last decade, we cannot determine an approximation of the proportion of local species against the world's data. From the 10 recognized orders for the group, in Venezuela only some representatives have been reported for the four orders listed in this study. This shows, on the one side, a dismal lack of information available about the group, and on the other, the great need for identification of collected Copepod, due to the reduced number of Venezuelan scientists dedicated to taxonomic studies of zooplankton in general, and specifically this crustacean group.

As more is learned of these microcrustaceans in eastern Venezuela, and more specifically in the gulf of Cariaco, this knowledge will help clarify their role in the marine ecosystem and will provide key information on local and regional processes, where some copepod species, such as *T. turbinata* and *A. tonsa*, are consumed by *S. aurita*, the most important fishing resource of the country (Caldera *et al.* 1988).

In this paper, 120 species reported for Venezuela, the Caribbean Sea, Gulf of Mexico, Florida, and the Sargasso Sea in the database of Razouls *et al.* (2005-2019) have been confirmed, and pending are the Calanoids *Eucalanus elongatus*, *Pareucalanus attenuatus*, *Scolecithricella longifurca*, Cyclopoids *Ditrichocorycaeus americanus*, *D. affinis*, *D. andrewsi* and Harpacticoids *Aegisthus aculeatus*, *Tigriopus sp.*, *Heterolaophonte sp.*, and *Porcellidium fimbriatum*. This confirmation is owed because some species were identified in the 60-70 decade as of temperate distribution and others were only mentioned in the gray literature. Besides, in Venezuela the identification of harpacticoid copepods is totally absent.

So, the number of copepod species belonging to the four orders studied in the gulf of Cariaco were increased to 127, including the Siphostomatoids *Caligus littoralis* and *C. praetextus*, which had not been previously reported for Venezuelan waters or the Venezuelan Caribbean, therefore, their finding in the study area complements the zoogeographic information on their regional distribution.

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An Updated Checklist of Copepod Species (Arthropoda: Crustacea) from the Gulf of Cariaco, Venezuela

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ANNEX I: Taxonomic list of copepod species from the Gulf of Cariaco

Bathymetric distribution is characterized *sensu lato* (s.l) or *sensu stricto* (s.s)

Taxon	Published references	Unpublished references	Ecological affinity	Bathymetric distribution	Biogeographic affinity
PHYLUM ARTHROPODA					
SUBPHYLUM CRUSTACEA					
SUBCLASS COPEPODA Milne Edwards, 1840					
INFRACLASS NEOCOPEPODA Huys & Boxshall, 1991					
SUPERORDER GYMNOPLA Giesbrecht, 1882					
ORDER CALANOIDA G.O.Sars, 1903					

Family Acartiidae Sars 1903

<i>Acartia (Acanthacartia) tonsa</i> Dana, 1849	Infante & Urosa, 1986, Márquez <i>et al.</i> 2006	Espinoza 1977, Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Coastal	Surface	Cosmopolitan
<i>A. (A.) spinata</i> Esterly, 1911		Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2010	Coastal	Surface	Tropical-subtropical
<i>A. (Acartiura) clause</i> Giesbrecht, 1889	Márquez-Rojas <i>et al.</i> 2006	Legaré 1961, Marcano 2007, Morales 2008, Márquez-Rojas 2010	Neritic-Coastal	Surface	Tropical-subtropical
<i>A. (A.) bermudensis</i> Esterly, 1911		Márquez-Rojas, 2010	Neritic-Coastal	Surface	Tropical-subtropical
<i>A. (Acartia) danae</i> Giesbrecht, 1889	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Morales 2008, Serrano 2015, Márquez-Rojas 2010, 2016	Oceanic	Surface	Tropical-subtropical
<i>A. (A.) negligens</i> Dana, 1849		Marcano 2007, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Mesopel.(s.l.)	Tropical-temperate
<i>A. (Odontacartia) lilljeborgii</i> Giesbrecht, 1889	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006	Morales 2008, Márquez-Rojas 2010, 2016	Neritic-Coastal	Surface	Tropical-temperate
Family Aetideidae Giesbrecht, 1893					
<i>Aetideus armatus</i> (Boeck, 1872)	Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Surface	Subtropical- Temperate
<i>A. giesbrechti</i> Cleve, 1904	Legaré 1961, Zoppi 1961		Shelf	Subsurface	Cosmopolitan
<i>Aetideopsis multiserrata</i> (Wolfenden, 1904)	Márquez-Rojas <i>et al.</i> 2006		Oceanic	Mesopel(s.e.)	Subtropical- Temperate
<i>Euchirella rostrata</i> (Claus, 1866)		Morales 2014, Márquez-Rojas 2016	Oceanic	Mesopel.(s.l.)	Tropical-subtropical
Family Augaptilidae Sars G.O., 1905					
<i>Haloptilus longicornis</i> (Claus, 1863)	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006		Oceanic	Surface	Subtropical- Temperate
<i>H. acutifrons</i> (Giesbrecht, 1893)	Legaré 1961, Zoppi 1961 Márquez-Rojas <i>et al.</i> 2006		Oceanic	Surface	Tropical-subtropical
<i>H. setuliger</i> Tanaka, 1964	Márquez-Rojas <i>et al.</i> 2006		Coastal	Mesopel.(s.l.)	Tropical-subtropical
<i>Euaugaptilus fosaii</i> Pineda-Polo, 1979	Márquez-Rojas <i>et al.</i> 2006			Surface	

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Family Calanidae Dana, 1849

<i>Mesocalanus tenuicornis</i> (Dana,1849)	Márquez-Rojas <i>et al.</i> 2006		Shelf	Mesopel.(s.l.)	Tropical-subtropical
<i>Nannocalanus minor</i> (Claus,1863)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Bagdó 1977, Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2010	Shelf-Oceanic	Subsurface	Tropical-subtropical
<i>Neocalanus gracilis</i> (Dana,1852)	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006	Márquez-Rojas 2010	Shelf-Oceanic	Surface	Tropical-subtropical
<i>N. robustior</i> (Giesbrecht,1888)		Morales 2014	Oceanic	Surface	Tropical-subtropical
<i>Undinula vulgaris</i> (Dana,1849)		Morales 2008, Márquez-Rojas 2010	Shelf-Oceanic	Surface	Tropical

Family Candaciidae Giesbrecht, 1893

<i>Candacia curta</i> (Dana,1849)	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006	Bastardo,1975	Oceanic	Surface	Tropical-subtropical
<i>C. pachydactyla</i> (Dana,1849)	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006	Morales 2008, 2014, Márquez-Rojas 2010	Shelf-Oceanic	Surface	Tropical-subtropical
<i>C. bipinnata</i> (Giesbrecht, 1889)	Márquez-Rojas <i>et al.</i> 2006		Neritic	Surface	Temperate
<i>C. varicans</i> (Giesbrecht, 1893)	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006	Márquez-Rojas 2010	Oceanic	Surface	Tropical-subtropical

Family Centropagidae Giesbrecht, 1893

<i>Centropages velificatus</i> (Oliveira, 1947)		Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2016	Shelf	Surface	Tropical-subtropical
<i>C. violaceus</i> (Claus,1863)	Márquez-Rojas <i>et al.</i> 2006	Márquez-Rojas 2010	Shelf	Subsurface	Tropical-subtropical
<i>C. furcatus</i> (Dana,1849)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Espinoza 1977, Marcano 2007, Morales 2014	Neritic	Surface	Tropical

Family Clausocalanidae Giesbrecht, 1893

<i>Clausocalanus furcatus</i> (Brady,1883)	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>C. arcuicornis</i> (Dana,1849)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2010, 2016	Shelf	Surface	Tropical-subtropical

Family Eucalanidae Giesbrecht, 1893

<i>Eucalanus elongates</i> (Dana,1848) *	Márquez-Rojas <i>et al.</i> 2006		Oceanic	Mesopel.(s.l.)	Temperate
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<i>Pareucalanus attenuates</i> (Dana,1849) *	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Espinoza 1977	Oceanic	Subsurface	Tropical-subtropical
<i>Subeucalanus subtenuis</i> (Giesbrecht, 1888)	Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Márquez-Rojas 2016	Shelf-Oceanic	Mesopel.(s.l.)	Tropical-subtropical
<i>S. crassus</i> (Giesbrecht, 1888)		Morales 2008, Márquez-Rojas 2016	Littoral	Surface	Tropical
<i>S. subcrassus</i> (Giesbrecht, 1888)		Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2010, 2016	Littoral	Surface	Subtropical
<i>S. monachus</i> (Giesbrecht,1888)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Bagdó 1977, Espinoza 1977, Marcano 2007	Shelf-Oceanic	Surface	Tropical-subtropical
Family Euchaetidae Giesbrecht, 1893					
<i>Euchaeta marina</i> (Prestandrea,1833)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Espinoza 1977, Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2010	Shelf-Oceanic	Surface	Cosmopolitan
Family Lucicutiidae Sars G.O.,1902					
<i>Lucicutia flavicornis</i> (Claus,1863)	Legaré 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Morales,2014	Shelf-Oceanic	Surface	Tropical-subtropical
<i>L. clausi</i> (Giesbrecht, 1889)	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006	Márquez-Rojas 2010	Oceanic	Subsurface	Subtropical
Family Metridinidae Sars G.O., 1902					
<i>Pleuromamma gracilis</i> Claus,1863	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006		Shelf	Subsurface	Tropical-subtropical
<i>P. piseki</i> Farran, 1929	Márquez-Rojas <i>et al.</i> 2006		Shelf	Surface	Tropical-subtropical
Family Paracalanidae Giesbrecht, 1893					
<i>Acrocalanus longicornis</i> Giesbrecht, 1888	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006	Morales 2014	Shelf	Surface	Tropical-subtropical
<i>A. andersoni</i> Bowman, 1958	Márquez-Rojas <i>et al.</i> 2006		Oceanic	Surface	Tropical-temperate
<i>Calocalanus pavo</i> (Dana,1852)	Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Surface	Cosmopolitan
<i>C. styliremis</i> Giesbrecht, 1888	Legaré 1961,		Shelf	Surface	Cosmopolitan
<i>C. contractus</i> Farran, 1926	Márquez-Rojas <i>et al.</i> 2006		Shelf	Surface	Tropical-temperate
<i>C. plumulosus</i> (Claus,1863)	Márquez-Rojas <i>et al.</i> 2006		Shelf	Surface	Subtropical
<i>Mecynocera clausi</i> ThompsonI.C., 1888	Infante & Urosa 1986	Morales 2014	Shelf-Oceanic	Surface	Tropical-subtropical

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<i>Paracalanus aculeatus</i> Giesbrecht, 1888	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Bagdó 1977, Espinoza 1977, Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas, 2010,2016	Shelf	Surface	Tropical-subtropical
<i>P. quasimodo</i> Bowman, 1971	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Morales 2008,2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>P. parvus</i> (Claus,1863)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Marcano,2007;Morales,2014;Márquez-Rojas,2010	Coastal-Neritic	Surface	Tropical-temperate
<i>Parvocalanus crassirostris</i> (DahlF., 1894)	Márquez-Rojas <i>etal.</i> ,2006	Marcano,2007	Shelf-Oceanic	Surface	Tropical-subtropical
Family Pontellidae Dana, 1852					
<i>Calanopia americana</i> DahlF.,1894		Marcano 2007, Morales 2008, Márquez-Rojas 2010	Littoral	Surface	Tropical-subtropical
<i>Labidocera aestiva</i> Wheeler,1900		Serrano 2015	Littoral	Surface	Tropical-temperate
<i>L. acutifrons</i> (Dana,1849)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Bastardo 1975, Márquez-Rojas 2010, 2016	Oceanic	Surface	Tropical-subtropical
<i>L. scotti</i> Giesbrecht,1897	Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Márquez-Rojas 2010, 2016	Littoral	Surface	Tropical
<i>L. detruncata</i> (Dana,1849)		Márquez-Rojas 2016	Shelf	Surface	Subtropical
<i>Pontellina plumata</i> (Dana,1849)	Márquez-Rojas <i>et al.</i> 2006		Oceanic	Surface	Tropical-subtropical
<i>Pontellopsis villosa</i> Brady,1883	Márquez-Rojas <i>et al.</i> 2006	Serrano 2015	Oceanic	Surface	Tropical-subtropical
<i>P. perspicax</i> (Dana, 1849)	Márquez-Rojas <i>et al.</i> 2006		Oceanic	Surface	Tropical-subtropical
<i>P. brevis</i> (Giesbrecht,1889)	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006		Coastal	Surface	Tropical-subtropical
Family Pseudodiaptomidae Sars G.O., 1902					
<i>Pseudodiaptomus marshi</i> Wright, 1936		Márquez-Rojas 2016	Neritic-Coastal	Surface	Tropical-
<i>P. pelagicus</i> Herrick,1884		Márquez-Rojas 2010,2016	Shelf	Surface	Tropical-subtropical
<i>P. cokeri</i> Gonzalez & Bowman, 1965		Márquez 2016	Littoral	Surface	Tropical-subtropical
<i>P. acutus</i> (DahlF., 1894)		Morales 2014	Littoral	Surface	Tropical-subtropical
Family Rhincalanidae Geletin, 1976					

<i>Rhincalanus cornutus</i> (Dana,1849)	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Subsurface	Tropical-subtropical
Family Scolecitrichidae Giesbrecht, 1893					
<i>Scolecithrix danae</i> (Lubbock, 1856)	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006		Oceanic	Subsurface	Tropical-subtropical
<i>Scolecithricella longifurca</i> (Giesbrecht, 1888)		Morales 2014	Oceanic	Mesopel.(s.l.)	Subtropical
Family Spinocalanidae Vervoort, 1951					
<i>Spinocalanus angusticeps</i> Sars G.O.,1920	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006		Oceanic	Mesopel(s.s.)	Tropical-subtropical
Family Temoridae Giesbrecht, 1893					
<i>Temora stylifera</i> Dana, 1849	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Bastardo 1975, Bagdó 1977, Marcano 2007, Morales 2008 , 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical
<i>T. turbinata</i> (Dana,1849)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Bastardo 1975, Bagdó 1977, Espinoza 1977, Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf	Surface	Tropical-subtropical
<i>Temoropia mayumbaensis</i> ScottT., 1894	Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Morales 2014	Oceanic	Mesopel.(s.l.)	Subtropical
SUPERORDER PODOPLEA (Giesbrecht, 1882)					
ORDER CYCLOPOIDA Burmeister, 1834					
Family Oithonidae Dana,1853					
<i>Oithona atlantica</i> Farran, 1908	Legaré 1961, Zoppi 1961	Serrano 2015, Márquez-Rojas 2016	Shelf-Oceanic	Epi-mesopel	Tropical-temperate
<i>O. nana</i> Giesbrecht,1892		Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Coastal	Surface	Tropical-temperate
<i>O. plumífera</i> Baird,1843	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>O. setigera</i> (Dana,1849)	Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Morales 2008,	Shelf-Oceanic	Surface	Tropical-subtropical

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<i>O. similis</i> Claus, 1866		Serrano 2015, Márquez-Rojas 2010, 2016	Oceanic	Surface	Tropical-subtropical
<i>O. robusta</i> Giesbrecht, 1891		Marcano 2007, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Epi-mesopel	Tropical-subtropical
<i>O. simplex</i> Farran, 1913		Marcano 2007, Serrano 2015; Serrano 2015	Shelf-Coastal	Surface	Subtropical
SUBORDER POECILOSTOMATOIDA					
Thorell, 1859					
Family Clausidiidae Embleton, 1901					
<i>Saphirella tropica</i> Wolfenden, 1906	Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Serrano 2015, Márquez-Rojas 2016	Littoral	Epi-mesopel	Tropical
Family Corycaeidae Dana, 1852					
<i>Agetus flaccus</i> (Giesbrecht, 1891)	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006	Morales 2014, Serrano, 2015, Márquez-Rojas 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>A. typicus</i> Krøyer, 1849	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>A. limbatus</i> (Brady, 1883)	Márquez-Rojas <i>et al.</i> 2006	Márquez-Rojas, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>Corycaeus agilis</i> Dana, 1849	Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Epi-mesopel	Tropical-temperate
<i>C. clause</i> DahlF., 1894	Márquez-Rojas <i>et al.</i> 2014a,b	Marcano 2007, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>C. catus</i> DahlF., 1894	Márquez-Rojas <i>et al.</i> 2014a,b	Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2010, 2016	Shelf	Surface	Tropical-subtropical
<i>C. giesbrechti</i> DahlF., 1894	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Márquez-Rojas 2010, Morales 2014	Shelf-Oceanic	Epi-mesopel	Tropical-subtropical
<i>C. latus</i> Dana, 1849	Márquez-Rojas <i>et al.</i> 2014a,b	Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Epi-mesopel	Tropical-subtropical
<i>C. pacificus</i> DahlF., 1894	Márquez-Rojas <i>et al.</i> 2006		Oceanic	Mesopel.(s.l.)	Tropical-temperate
<i>C. speciosus</i> Dana, 1849	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>Monocorycaeus robustus</i> Giesbrecht, 1891	Márquez-Rojas <i>et al.</i> 2014a,b	Marcano 2007, Morales 2008,	Shelf-Oceanic	Surface	Tropical-temperate

<i>Ditrichocorycaeus amazonicus</i> (DahlF.,1894)	Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Márquez-Rojas 2010, Serrano 2015 Marcano 2007, Morales 2008, 2014, Márquez-Rojas 2010, 2016, Serrano 2015	Shelf-Oceanic	Surface	Tropical-subtropical
<i>D. americanus</i> (WilsonM.S.,1949) *	Márquez-Rojas <i>et al.</i> 2006		Shelf-Coastal	Mesopel.(s.l.)	Tropical-subtropical
<i>D. anglicus</i> (Lubbock,1857)	Márquez-Rojas <i>et al.</i> 2006		Shelf	Surface	Tropical-temperate
<i>D. affinis</i> McMurrich,1916) *	Márquez-Rojas <i>et al.</i> 2014a,b	Marcano 2007, Márquez-Rojas 2010, Serrano 2015	Shelf-Oceanic	Surface	Tropical-subtropical
<i>D.andrewsi</i> (Farran,1911) *		Morales 2008	Shelf	Surface	Tropical-subtropical
<i>Urocorycaeus furcifer</i> (Claus,1863)	Márquez-Rojas <i>et al.</i> 2006;	Morales 2008, Serrano 2015, Márquez-Rojas 2016	Shelf-Oceanic	Epi-mesopel	Tropical-subtropical
<i>U. longistylis</i> Dana,1849	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Marcano 2007, Márquez-Rojas 2010, 2016	Shelf	Surface	Tropical-temperate
<i>U. lautus</i> (Dana,1849)	Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Marcano 2007, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>Farranula carinata</i> (Giesbrecht,1891)	Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Serrano 2015, Márquez-Rojas 2016	Shelf	Surface	Tropical
<i>Farranula gracilis</i> (Dana,1849)	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical
<i>Farranula rostrata</i> (Claus,1863)	Márquez-Rojas <i>et al.</i> 2006, 2014a,b	Marcano 2007, Márquez-Rojas 2010, Morales 2014, Serrano 2015	Shelf-Oceanic	Subsurface	Tropical-subtropical
Family Lubbockiidae Huys & Böttger-Schnack,1997					
<i>Lubbockia squillimana</i> Claus,1863	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006		Shelf	Subsurface	Tropical-subtropical
Family Oncaeidae Giesbrecht, 1893					
<i>Oncaea media</i> Giesbrecht,1891		Marcano 2007, Morales 2008, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf	Surface	Tropical-subtropical
<i>O. mediterranea</i> (Claus,1863)	Legaré 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Subsurface	Tropical-subtropical

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<i>O. notopus</i> Giesbrecht, 1891		Marcano 2007, Serrano 2015, Márquez-Rojas 2016	Oceanic	Meso-bathypelagic (s.s)	Tropical-subtropical
<i>Oncaea curta</i> Sars G.O., 1916		Morales 2008, Márquez-Rojas 2010	Oceanic	Mesopel. (s.s)	Tropical-subtropical
<i>O. venusta</i> Philippi, 1843		Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Shelf-Oceanic	Surface	Tropical-subtropical
<i>Triconia conifera</i> (Giesbrecht, 1891)	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006;	Marcano 2007, Márquez-Rojas 2010	Shelf-Oceanic	Surface	Subtropical
<i>Monothula subtilis</i> (Giesbrecht, 1892)		Morales 2008	Shelf-Oceanic	Epi-mesopel	Tropical-subtropical
Family Sapphirinidae Thorell, 1859					
<i>Copilia mirabilis</i> Dana, 1852	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Surface	Tropical-subtropical
<i>Copilia vitrea</i> (Haeckel, 1864)	Márquez-Rojas <i>et al.</i> 2006		Shelf	Surface	Tropical-subtropical
<i>Sapphirina angusta</i> Dana, 1849	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006		Shelf	Surface	Tropical-subtropical
<i>S. opalina</i> Dana, 1849	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006		Shelf	Surface	Tropical-temperate
<i>S. intestinata</i> Giesbrecht, 1891	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006		Shelf	Surface	Tropical-subtropical
<i>S. nigromaculata</i> Claus, 1863	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Surface	Tropical-subtropical
<i>S. auronitens</i> Claus, 1863	Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Surface	Tropical-subtropical
<i>S. scarlata</i> Giesbrecht, 1891		Morales 2014	Shelf-Oceanic	Surface	Tropical-subtropical
<i>Sapphirina ovatolanceolata gemma</i> Dana, 1852	Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Surface	Tropical-subtropical
<i>Sapphirina auronitens-sinuicauda</i> Lehnhofer, 1929	Márquez-Rojas <i>et al.</i> 2006		Shelf-Oceanic	Surface	Tropical-subtropical
ORDER HARPACTICOIDA Sars M., 1903					
Family Aegisthidae Giesbrecht, 1893					

<i>Aegisthus aculeatus</i> Giesbrecht,1891		Serrano,2015	Shelf-Oceanic	Meso-bathypelagic	Tropical-subtropical
Family Ectinosomatidae Sars G.O., 1903					
<i>Microsetella rosea</i> (Dana,1847)	Legaré1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Morales,2014;Serrano,2015;	Shelf-Oceanic	Surface	Cosmopolitan
Family Harpacticidae Dana, 1846					
<i>Tigriopus</i> sp.Norman,1869		Serrano 2015			
Family Miraciidae Dana, 1846					
<i>Miracia efferata</i> Dana,1849	Legaré 1961, Márquez-Rojas <i>et al.</i> 2006		Littoral	Surface	Tropical-subtropical
<i>Macrosetella gracilis</i> (Dana,1847)	Legaré 1961, Zoppi 1961, Márquez-Rojas <i>et al.</i> 2006	Serrano 2015;	Oceanic	Subsurface	Cosmopolitan
Family Laophontidae ScottT., 1904					
<i>Heterolaophonte</i> sp. Lang, 1948		Serrano 2015			
Family Peltidiidae Claus,1860					
<i>Goniopsyllus rostratus</i> Brady,1883	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Morales 2014, Serrano,2015	Neritic-Coastal	Surface	Tropical-temperate
<i>Clytemnestra scutellata</i> Dana,1847		Serrano 2015	Shelf	Surface	Tropical-subtropical
Family Porcellidiidae Boeck,1865					
<i>Porcellidium fimbriatum</i> Claus,1863*		Serrano 2015			
Family Tachidiidae Sars G.O.,1909					
<i>Euterpina acutifrons</i> (Dana,1848)	Legaré 1961, Zoppi 1961, Infante & Urosa 1986, Márquez-Rojas <i>et al.</i> 2006	Marcano 2007, Morales 2008, 2014, Serrano 2015, Márquez-Rojas 2010, 2016	Littoral	Surface	Cosmopolitan
ORDER SIPHONOSTOMATOIDA					
Thorell, 1859					
Family Caligidae Burmeister,1835					
<i>Caligus atromaculatus</i> WilsonC.B.,1913	Suárez-Morales <i>et al.</i> 2012	Serrano 2015	Shelf-Oceanic	Parasite	Tropical
<i>C. littoralis</i> Luque and Cezar,2000	Kim <i>et al.</i> 2019		Shelf-Oceanic	Parasite	Tropical
<i>C. evelynae</i> Suárez-Morales,Camisotti & Martín,2012	Suárez-Morales <i>et al.</i> 2012, Kim <i>et al.</i> 2019		Shelf-Oceanic	Parasite	Tropical

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<i>C. praetextus</i> Bere,1936	Kim <i>et al.</i> 2019		Shelf-Oceanic	Parasite	Tropical
<i>C. rufimaculatus</i> Wilson C.B.,1905	Suárez-Morales <i>et al.</i> 2012, Kim <i>et al.</i> 2019		Shelf-Oceanic	Parasite	Tropical
<i>Lepeophtheirus nordmanni</i> (MilneEdwards,1840)	Díaz-Díaz 2000	Serrano 2015	Shelf-Oceanic	Parasite	Cosmopolitan
Family Pandaridae Milne Edwards,1840					
<i>Cecrops latreillii</i> Leach,1816	Díaz-Díaz 2000		Shelf-Oceanic	Mesoparasite	Tropical-subtropical