

## Some deep-sea decapod crustaceans from the international waters of Mersin Bay (North Levant Basin, Turkey)

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### ABSTRACT

The deep-sea decapod crustacean species sampled from trawling operations carried out in the open waters of Mersin Bay (Coordinates: 36.24853N-34.36491E, 36.18839N-43.38847E, 36.17065N-34.40686E, and 36.07227N-34.53326E) in May 2018 were identified. Samples were preserved in ethyl alcohol and were deposited in the Museum of the Systematic, Faculty of Fisheries, Mersin University, (catalogue number: MEUDC-17-11-001, MEUDC-18-12-010-014). In total 13 trawling operations, 6 deep-sea decapod crustacean species were caught. *Plesionika edwardsii* belonging to family of Pandalidae, *Polycheles typhlops* belonging to Polychelidae family, *Geryon longipes* from Geryonidae family, *Medorippe lanata* from Dorippidae family, *Pasiphaea sivado* from Pasiphaeidae family and *Parapenaeus longirostris* from Penaeidae family were caught from a depth of 274 m to 641 m. *P. typhlops* have a wide distribution in the Atlantic, Pacific and Indian Ocean waters, while other species are of the Atlanto-Mediterranean origin. While *P. longirostris* and *P. edwardsii* are the target species for deep-sea trawl operations in Mersin Bay, *P. typhlops*, *P. sivado* and brachyuran crabs are by-catch species.

**KEYWORDS:** Decapod Crustaceans, International Waters, Mersin Bay, North Levant Basin, Turkey

How to cite this article: Ayas, D., Ciftci, N., Shaiek, M., Bakan, M. (2019).

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*MedFAR.*, 2(1):1-11.

## 1. Introduction

While the Mediterranean Sea is separated from the deep waters of the Atlantic by the Gibraltar Strait, Levant basin, one of the seven basins of the Mediterranean Sea, is separated by topographical and hydrographic barriers formed in Tunisia-Sicily Channel. The Levant Basin, the easternmost basin of the Mediterranean Sea, is distinguished from other basins by its oligotrophic structure, high salinity and temperature levels (Galil & Goren, 1994). Mersin Bay is a region with special hydrographic and morphological features located in the north of the Levant Basin. The Bay with a wide continental shelf has often muddy-sandy bottom, sometimes rocky bottom. Because of these properties, the Mersin Bay reflects a significant portion of the fauna of the Levant Basin.

Deep-sea ecosystems include waters below about 200 m deep. Deep-sea ecosystems consist of benthic and pelagic living communities in which interspecific relationships are strong and stable (Martin et al., 1991). The check-list of the deep-sea species of the Levant basin has been reported by Galil & Goren (1994).

Decapoda is an order belonging to the Malacostraca class of Crustaceae subphylum of Arthropoda phylum. The decapods have 8 double thoracic appendages. They are called as decapoda because of 5 pairs of pereopods. The front three appendages of decapods called maxillipeds are responsible for catching and shredding the food. A pair legs (chelipeds) of decapods expands to form claws called chaelae. Last pleopods with the telson form uropods. Gill structure, leg development and larval structure are important in the identification of decapods. Decapods with 8000 species are generally found in shallow and warm waters in the world. There are four basic larval species, nauplius, protozoa, zoea and postlarvae in the developmental stages of decapods (IMAS, 2013). The food abundance and water temperature for crustaceans plays an important role in their growth dynamic. They tend to have higher growth rates in the habitat where there is high temperature with plenty of food (Hartnoll, 1983).

*G. longipes* is a brachyuran crab living in the muddy bathyal zone of the Mediterranean Sea (Mori

& Belloni, 1985). While no epibionts were found in their exoskeletons (Camillo et al., 2008), *Ophryotrocha spp.* has been reported to infest their gills (Mori & Belloni, 1985; Martin et al., 1991). *G. longipes* is morphologically distinctive from the other brachyuran crabs, the length of the legs is long, and there are 3 spines in the anterolateral part of the carapace. And also the last spine is the longest. Carapace length of the *G. longipes* is 65 x 73-80 mm for adult male and 65 x 50 mm for adult female. There is sexual dimorphism in this species. In reproduction period, the color of the carapace and pereopods become redder and brighter. Reproduction period is between January and May. It has been reported that they feed on polychaeta, decapods, and shellfish. They have been reported to be between 450 m and 1895 m in the Biscay Bay of Morocco between 250 m and 1370 m depth in the Mediterranean Sea (Manning et al., 1989; Danovaro et al., 2010; Ng & Davie, 2015; EOL, 2018). The first record of this crab was given from the Mediterranean Sea (Desportes et al., 1977, Mori & Belloni, 1985). *G. longipes* is seldom caught by the deep-sea trawling operation in the North Levant Basin. Data on the biology of deep-sea species are very limited. *G. longipes* is not commercially caught. It is not known whether *G. longipes* is under threat in the Mediterranean Sea and this crab has not been categorized by IUCN.

Another brachyuran crab of the East Atlantic and the Mediterranean Sea is *M. lanata* (Linnaeus 1767), known as Hairy crab (Manning & Holthuis, 1981). It has been reported that it is distributed at a depth of 9-952 m in sandy-muddy bottom (d'Udekem d'Acoz, 1999) and at most 20-100 m (Zariquiey Alvarez, 1968; Abello et al., 1988). For this reason, those living in the Mediterranean Sea are affected by commercial trawling operations in the continental shelf (Biagi et al., 2002). Despite their high abundance in the continental shelf, data on their reproduction biology and population size is limited. The length of the carapace is 10 to 29 mm for females and 9 to 29 mm for males. Although spawning periods are between March and November, the most abundant period for female individuals' carrying eggs is August and September (Rosetti et al., 2006). In 50 % of mature females, the estimated carapace length is 21 mm. While mature

individuals in males are identified by dimorphism due to their chelae length, their carapace lengths are between 18-29 mm (Rosetti et al., 2006).

*P. typhlops*, which is found in the Pacific, Atlantic and Indian Ocean, and the also Caribbean, and the Mediterranean Sea, is a polychelid decapod species (Galil, 2000, Poore & Ahyong, 2004, Kotthaus, 1966). *P. typhlops* has been widely described and frequently sampled in trawling operations for scientific research purposes (Abello et al., 2002b, Mastrototaro et al., 2010). In the trawling operations in the Mediterranean Sea, they have been reported to be caught at depths of 600-800 m (Abello & Cartes, 1992). *P. typhlops* has been reported to live on soft muddy surfaces and near coral reefs (Mastrototaro et al., 2010). It is not known whether *P. typhlops* is under any threat in marine ecosystem, and it is known that *P. typhlops* is not commercially caught (Paulmier, 1996). This species has been reported by IUCN as least concern (LC).

Pasiphaea is a large group with about 60 species. *P. sivado* has been reported both in the Atlantic Ocean and Indo-Pacific region. This bathyal decapod species was recorded by Abello & Valladares (1988) in the Catalan Sea. Researchers sampled *P. sivado* individuals in surveys conducted at depths of 1000-2000 m. In another study, *P. sivado*, a mesopelagic species, was sampled at 552-2261 m depth from the Catalan sea (Cartes & Sardà, 1992). *P. sivado* individuals were caught in the depths of 138-735 m in the Iberian Peninsula (Abello et al., 2002b). Bayhan et al. (2018) reported the last record for *P. sivado* in the Mediterranean Sea. The researchers sampled the individuals of *P. sivado* at 300 and 601 m depths from the Levant Basin in 2014. The threats that this shrimp faces in the Mediterranean Sea are unknown.

*P. edwardsii* is member of the Pandalidae family of Decapods. Pandalid shrimps are reported to be discarded in the Mediterranean Sea (Company & Sarda, 2000; Demirci, 2007). This shrimp is the target species for the deep-see trawling operations carried out in the Levant Basin for the present. Generally, this red shrimp species is exported to European Union countries from Turkey. This species, known as deep-sea red shrimp, is distributed on the continental shelf and slopes of

tropical and subtropical oceans and seas. (Cartes et al., 1993, Carbonell & Abelló, 1998, Vafidis et al., 2005, Sousa et al., 2014). Due to their being nectobenthonic, they are fed with both pelagic and benthic species, at the same time they are to be food for demersal fishes and cephalopods (Cartes et al., 1993, Cartes, 1998, Cartes et al., 2002, Fanelli & Cartes, 2004, Vafidis et al., 2005, Fanelli et al., 2007). IUCN does not have any information on the threats facing pandalid shrimps.

*P. longirostris* (Lukas, 1846), known as deep-water pink shrimp, is found up to the southern waters of Angola (Crosnier et al., 1968) from the Eastern Atlantic (Olaso, 1990), and this demersal shrimp species has a wide geographical distribution in the Mediterranean Sea to all the basins of the Mediterranean Sea and its adjacent seas (Tyrrhenian, Adriatic, Aegean and Marmara Sea) (Holthuis, 1980; Sobrino et al., 2005). This epibentic shrimp species, short-lived, is the main target species for trawling operations in the East Atlantic Ocean (Holthuis, 1980). *P. longirostris* was spread over a wide area between 20 m and 750 m in the Mediterranean Sea and Atlantic Ocean (Tom et al., 1988) and its maximum abundance was observed in mud or muddy-sandy bottom at depths of 100 to 400 m (Lembo et al., 1999). It has been suggested by researchers that adult individuals move toward shallow waters during the laying period (Dos Santos, 1998). It has been determined that this shrimp is more abundant in the Eastern Mediterranean Sea than in the Central and Western Mediterranean Sea (Abello et al., 2002a). Its maximum total length is 160 mm for males and 186 mm for females and is generally found to be 140 mm for males and 160 mm for females. In a survey carried out in the Marmara Sea, the length of *P. longirostris* individuals varied between 50 and 165 mm and the mean length of the individual was determined to be 109 mm. It was also reported that the average length of the individual changes depending on the season and depth. It has been reported that the individuals which are shallower than 100 meters are larger than those which distribute in more than 100 meters (Zengin, 2004). It has been reported that in 50% of mature females, the estimated total length is 106.1 mm by researchers. Individuals carrying eggs were observed in spring,

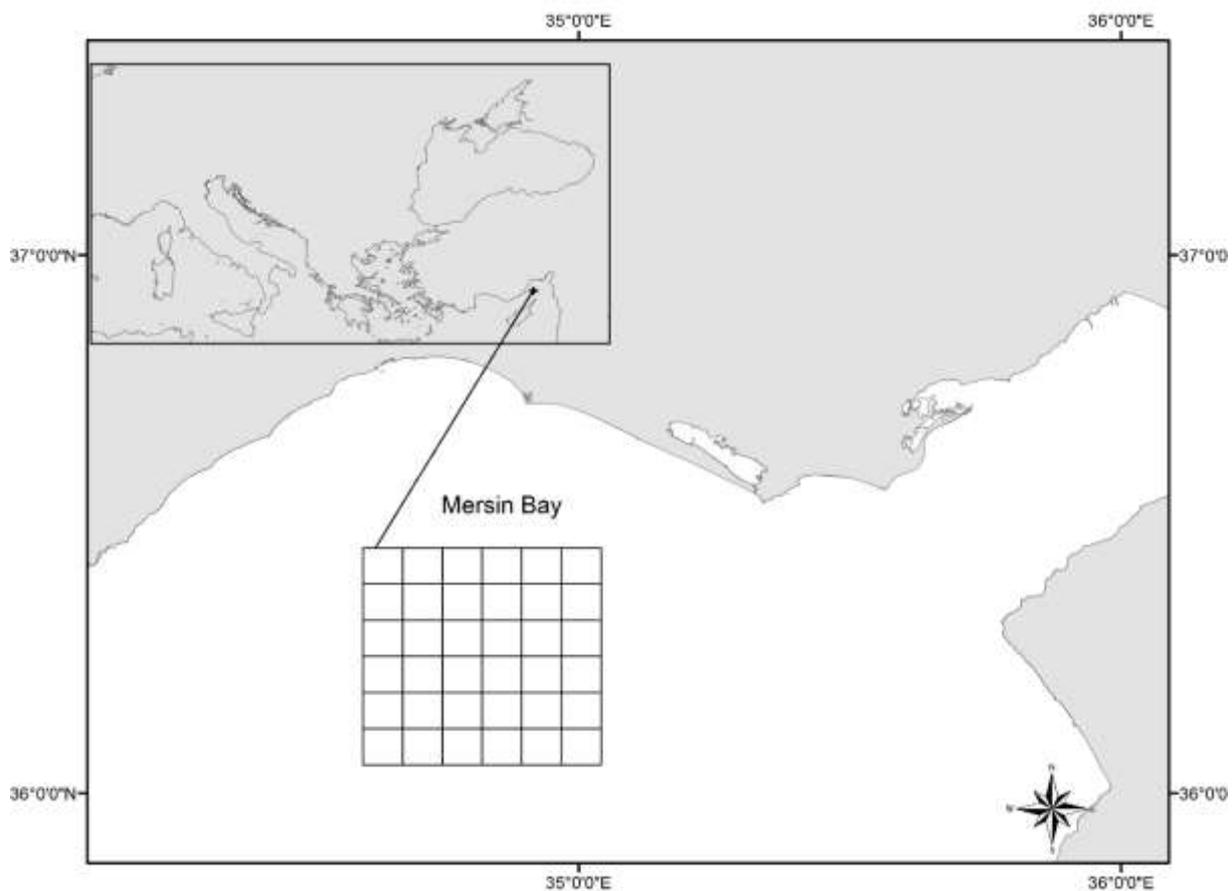
June, October and November. It has been determined that the shrimp tended to breed at the age of 1; the average reproductive age was reported to be 2 years (Zengin, 2004). This shrimp is caught in considerable quantities because of its economic importance. There is no risk assessment in IUCN for this shrimp species.

In this study, it was aimed to determine the deep-sea decapod crustaceans caught in the bottom trawl operations from the open waters of the Mersin Bay.

## 2. Material and Methods

Deep-sea sampling was carried out in the international waters of the Mersin bay between 14

and 17 May 2018 by a commercial trawl. The depth of sampling area is between 274 and 641 m. Coordinates of the sampled area: 36.24853N-34.36491E, 36.18839N-43.38847E, 36.17065N-34.40686E, 36.07227N-34.53326E (Fig. 1). A total of 13 trawling operations were carried out. Each trawl operation lasted approximately 4 hours. During the sampling, six species of the deep-sea decapod crustaceans were caught. All species were preserved in ethyl alcohol and was deposited in the Museum of the Systematic, Faculty of Fisheries, Mersin University, (MEUDC-17-11-001, MEUDC-18-12-010-014) (Fig. 2).



**Figure 1.** The shaded area indicates the locations where the species was caught



**Figure 2. Species of deep-sea decapod crustaceans from Northeastern Mediterranean Sea**  
*G.longipes*<sup>1</sup>, *P. typhlops*<sup>2</sup>, *M. lanata*<sup>3</sup>, *P. sivado*<sup>4</sup>, *P. edwardsii*<sup>5</sup>, *P. longirostris*<sup>6</sup>

### 3.Results

Six species of decapod crustacean were caught in 13 trawl operations at 274-641 m depths in the open waters of the Mersin Bay. The photographs of the species are shown in Figure 2.

One individual of *G. longipes* was caught in the deep-sea trawling operations. One individual of *M. lanata*, the other brachyuran crab, was caught. In this survey conducted in the North Levant, it was determined that both

brachyuran crab species were fewer than other deep-sea decapod crustacean species. In this study, 155 individuals of *P. typhlops* were caught in trawling operations. The most caught decapod crustaceans were shrimp species and *P. longirostris* was in the first rank in terms of abundance. Pandalid shrimp species, *P. edwardsii*, was in second rank in terms of abundance. There were eggs in the *P. edwardsii* individuals.

### 4.Discussion

The previous records of the sampled species are presented in Table 1.

**Table 1.** Some records of the deep-sea decapod crustaceans from Mediterranean Sea

Species		Previous Records		
Infraorder Brachyura Family Geryonidae <i>Geryon longipes</i>	Abello & Valladers, 1988 (Catalan Sea- Northwestern Mediterranean Sea)	Martin et al., 1991 (Balearic Sea-Western Mediterranean Sea)	Galil & Goren, 1994 (Israel Coast-Levant Basin)	Bayhan et al., 2018 (Mersin Bay, Turkey)
Family Dorippidae <i>Medorippe lanata</i>	Vignoli et al., 2004 (Central Tyrrhenian- Northwestern Mediterranean Sea)	Özcan et al., 2005 (Iskenderun Bay, Levant Basin)	Moussa et al., 2016 (Mediterran ean Sea, Egypt)	Bayhan et al., 2018 (Mersin Bay, Turkey)
Infraorder Polychelida Family Polychelidae <i>Polycheles typhlops</i>	Holthuis & Gottlieb, 1958 (Israel Coast- Levant Basin)	Abello & Valladers, 1988 (Catalan Sea- Northwestern Mediterranean)	Galil & Goren, 1994 (Israel Coast-Levant Basin)	Bayhan et al., 2018 (Mersin Bay, Turkey)
Suborder Pleocyemata Family Pasiphaeidae <i>Pasiphaea sivado</i>	Abello & Valladares 1988 (Catalan Sea)	Cartes & Sardà 1992 (Catalan Sea)	Abello' et al. 2002b (Iberian Peninsula)	Bayhan et al., 2018 (Mersin Bay, Turkey)
Suborder Pleocyemata Infraorder Caridea Family Pandalidae <i>Plesionika edwardsii</i>	Garcia-Rodrigues et al., 2000 (Spanish Western Mediterranean)	Politou et al., 2005 (Ionian Sea)	Christodoul ou et al. 2009 (Cyprus- Levant Basin)	Bayhan et al., 2018 (Mersin Bay, Turkey)
Suborder Dendrobranchia ta Infraorder Penaeidea Family Penaeidae <i>Parapenaeus longirostris</i>	Levi et al., 1995 (Sicilian Channel- Central Mediterranean)	Kocataş & Katağan, 2003 (Turkish Coast-Levant Basin)	Politou et al., 2005 (Ionian Sea)	Bayhan et al., 2018 (Mersin Bay, Turkey)

*G. longipes* is not caught in commercial trawling operations conducted on shallow waters.

While this crab is not caught in the commercial trawling

operations carried out in the Mersin Bay, there is a possibility of catching in the deep-sea trawling operations. Only one individual was caught in a total of 13 deep-sea trawling operations carried out on the Mersin Bay. This species of crab, living in the bathyal zone at depth 250-1895 m (Manning et al., 1989; Danovaro et al., 2010; Ng & Davie, 2015; EOL, 2018), cannot be caught by commercial trawls for the reason that the continental shelf is wide in the Mersin Bay. This species of crab has been reported both in the Western Mediterranean Sea (Abello & Valladers, 1988; Martin et al., 1991) and in the Eastern Mediterranean Sea (Galil & Goren, 1994; Bayhan et al., 2018). With this study, the last record of the *G. longipes* has been reported from the open waters of the Mersin Bay.

One specimen of *M. lanata*, another brachyuran crab species, was also caught in this survey. It was determined that both brachyuran crab species were fewer than other deep-sea decapod species in the survey conducted in the open waters of Mersin Bay. *M. lanata* distributes in shallow water than *G. longipes*; for this reason, it may be more affected by commercial trawling operations in Mersin Bay. The number of studies on abundance and biomass of these crabs is very limited. A small number of individuals of these crabs were caught in this study; the effects of post-fishing deaths on these crabs (Rosetti et al., 2006) should be investigated. The presence of this crab species in the Mediterranean Sea has been reported more in recent years. *M. lanata* has been reported both in the Northwestern Mediterranean Sea (Vignoli et al., 2004) and in the Levant Basin (Özcan et al., 2005; Moussa et al., 2016, Bayhan et al., 2018). In this study, an individual of *M. lanata* was reported from the Northern Levant Basin.

In the trawling operation carried out on the open waters of the Mersin Bay, a total of 155 individuals of *P. typhlops* were caught. The individuals of this decapod species were sampled in each trawl operation during the survey. This situation is parallel to the literature (Abello et al., 2002b, Mastrototaro et al., 2010). This indicates a wide distribution of this species in the bathyal zone of the North Levant Basin. It has been reported that this decapod species was caught at 600-800 m depth in the Mediterranean Sea (Abello & Cartes,

1992). The polychelid decapod species is sampled from the shallower depth (274-641) than the reported depth (600-800) in the literature. *P. typhlops* is distributed in the deep waters of all basins of the Mediterranean Sea (Holthuis & Gottlieb, 1958; Abello & Valladers, 1988; Galil & Goren, 1994; Bayhan et al., 2018). *P. typhlops* has been reported to live on soft muddy surfaces and near coral reefs (Mastrototaro et al., 2010). This species is sampled from the sandy-muddy bottom in parallel to the literature.

*P. sivado* is a mesopelagic shrimp species that is distributed both in the Atlantic Ocean and Indo-Pacific region. Which way this shrimp, which was previously reported from the Mediterranean Sea, used for entering to Mediterranean Sea is controversial. *P. sivado* is reported more frequently than the Western Mediterranean Sea (Abello & Valladares, 1988; Cartes & Sardà, 1992; Abello et al., 2002). Rarely, *P. sivado* was recorded in the Eastern Mediterranean Sea (Bayhan et al., 2018). *P. sivado* has been reported to be distributed in the deeper waters (552-2261 m) in the study (Cartes & Sardà, 1992) conducted in the Catalan Sea. This species is sampled from the shallower depth (274-641) than the reported depth (552-2261 m) in the literature.

This nectobenthonic shrimp is the target species for deep-sea trawling operations in the Levant Basin. *P. edwardsii* is the densest shrimp species after *P. longirostris* in the Levant Basin. There were eggs in the *P. edwardsii* individuals. This economic shrimp species has a dense distribution both in the Western Mediterranean Sea (Garcia-Rodrigues, 2000) and in the Eastern Mediterranean Sea (Christodoulou et al., 2009; Bayhan et al., 2018).

The most abundant species of deep-sea trawling operations carried out at Levant Basin is *P. longirostris*. This situation is parallel to the literature (Bayhan et al., 2018). According to the literature, this shrimp species is more common in the Levant basin than the other basins in the Mediterranean Sea (Abello et al., 2002b). For the Eastern Mediterranean Sea, this species is an important shrimp species which has an economic value (Kocataş & Katağan, 2003; Bayhan et al., 2018).

The deep-sea species, *G. longipes*, *M. lanata*, *P. typhlops*, *P. sivado*, *P. edwardsii*, and *P. longirostris*, sampled in this survey were recorded from the Levant basin before. In this study, last records were given for the bathyal decapod crustaceans from Mersin Bay.

### Conflict of interests

The authors declare no conflict of interests.

### Acknowledgements

This study was supported by the Research Fund of Mersin University in Turkey with Project Number: 2017-2-AP2-2353.

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