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Communication

A Rarely Reported Crustacean Species, *Rissoides pallidus* (Giesbrecht, 1910) (Stomatopoda, Squillidae), Caught in the Strait of Sicily Waters (Central Mediterranean Sea)

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Abstract: The mantis shrimp *Rissoides pallidus* (Giesbrecht, 1910) is a rarely reported crustacean species in the central Mediterranean Sea. In December 2020, during a trawl survey off Mazara del Vallo harbor (Strait of Sicily), two specimens of *R. pallidus* were captured on coastal detritus and coastal terrigenous mud bottoms at about 132 and 152 m depths. Additional information specific to biometrics, bottom types, depth preference, habitats, and geographic distribution of this crustacean species are provided.

Keywords: crustacean; stomatopod; mantis shrimp; muddy bottom; trawl fisheries; uncommon species; spatial distribution

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1. Introduction

The Strait of Sicily is considered a very important biogeographical area [1,2], acting as a barrier to some species (i.e., between the western and eastern Mediterranean sub-basins) [3,4] and an ecological corridor for others [5–7]. This area is characterized by a complex topography with a strong hydrographic circulation that establishes a stable upwelling system along the shelf edge of its banks. These features result in a hotspot for both biodiversity [1–3] and productivity of food resources exploited by national and international fleets [8–11]. There is a substantial amount of information from bottom trawl surveys conducted on the demersal fauna of Geographical Sub-Area 16 (GSA 16) [GFCM classification], which lies just south of Sicily. Indeed, Mediterranean International Trawl Surveys (MEDITS) have been performed routinely since the mid-1990s. These studies assess the status of fishery resources in the Mediterranean region [9–11]. However, data on the distribution of mega-benthic fauna within this region are poor. Specifically, there is a lack of information on stomatopods in the Strait of Sicily, perhaps due to the lack of commercial interest in those taxa and/or because some species are restricted to specific biotopes. For example, the genus *Rissoides* comprises five species [12] that are mainly distributed in shallow waters either in burrows or crevices on various substrate types [13]. Among these, only *R. desmaresti* (Risso, 1816) and *R. pallidus* (Giesbrecht, 1910) have been recorded within the Mediterranean Sea [14]; both are known to possess a patchy distribution with low densities. Nonetheless, although *R. pallidus* is believed to be widespread in the Mediterranean [15–17], it has been rarely recorded. Examples of *R. pallidus* include those reported at Levant [18], in the western Alboran Sea [16], as well as in north-western Africa, Canary Islands, and Madeira [19–21]. To augment the fragmented knowledge on

R. pallidus and its distribution in the Mediterranean Sea, we provide a map of its geographical distribution and include some biometrics such as length, weight, and sex, as well as information on bottom type, depth preference, and habitat of this crustacean. These data represent a baseline to evaluate temporal and spatial trends of *R. pallidus* for future studies of this species.

2. Materials and Methods

On December 2020, two specimens of *R. pallidus* (trawl haul points: 37.515° N, 12.4025° E and 37.493° N, 12.4433° E) were captured as part of the discarded fraction during a trawl survey carried out off the Mazara del Vallo harbor (northern sector of the Strait of Sicily). The purpose of the trawl survey was to collect information about gear selectivity in the deep-water rose shrimp (*Parapenaeus longirostris* Lucas, 1846) fishery, which employed the typical Italian commercial trawl net with a codend of 40 mm square mesh [22,23]. Thereafter, we identified the species and collected biometric data of *R. pallidus* specimens at the laboratory of CNR-IRBIM of Mazara del Vallo. Further, we photographed the individuals, weighed them (accuracy 0.1 g), measured their carapace length (CL—distance between the center of the anterior interorbital margin and the center of the posterior margin, excluding the rostral plate), and width (CW—carapace at widest point), as well as total length (TL—distance between the anterior edge of the rostral plate and posterior extremity of the telson). Measurements were recorded to the nearest mm. The sex of *R. pallidus* specimens was determined by either the absence or presence of the penes at the base of the pereopods on the eighth thoracic somite. The specimens reported herein have been deposited in the invertebrate collection of the CNR-IRBIM of Mazara del Vallo, Italy. Hence, the relationship between depth and TL per sex in the Mediterranean basin was calculated. In addition, a least-squares linear model was used to investigate the relation between TL and CL (combined sexes) in *R. pallidus*. The linear model structure is as follows:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

where Y is the TL in mm, X is the CL in mm, β is the model intercept, and ε is the error term. Furthermore, a summary of published records, showing biometrics, bottom types, habitat, and depth of *R. pallidus* previously found within the Mediterranean basin was carried out to enable robust comparisons of emergent data. Lastly, we mapped the geographical distribution of this uncommon species via Quantum GIS software [24].

3. Results and Discussion

Figure 1 shows the distribution map of *R. pallidus* based on previous and current studies within the Mediterranean basin. Figure 2 shows images of specimens caught in the Strait of Sicily.

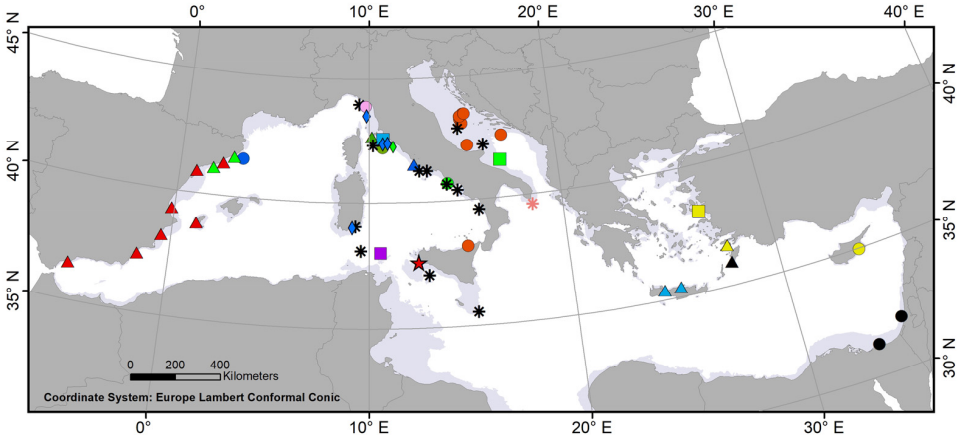

Figure 1. Map of the known distribution of *Rissoides pallidus* in the Mediterranean basin. Specific records include: circle in green, Giesbrecht [25]; yellow, Demetropoulos and Neocleous [26]; pink,

Massi et al. [27]; orange, Manning and Froglia [28]; black, Lewinsohn and Manning [18]; blue, Valladares [29]; dark green, De Ranieri and Mori [30]; asterisk in black, Froglia [31]; square in purple, Pipitone and Tumbiolo [32]; triangles in green, Abello et al. [33]; sky blue, Dounas and Steude [17]; yellow, Kocatas and Katagan [34]; red, Abello et al. [16]; rhombus in green, Biagi et al. [35]; asterisk in salmon, D'onghia et al. [36], triangles in black, Kevredikis and Galil [37]; dark green, Sartor et al. [38]; blue, Colloca et al. [39]; square in green, Ungaro et al. [40]; sky blue, Mori et al. [41]; yellow, Kocak [42], rhombus in dark blue, Innocenti [43]. Red star indicate the records of current study.

Specifically, the two *R. pallidus* specimens caught in the Strait of Sicily were females with 10 and 8 mm CL, 8 and 4 mm CW, and 48 and 33 mm TL, respectively (Figure 2).

Figure 2. Images of *R. pallidus* specimens caught in the Strait of Sicily: (**A**,**B**) whole specimens; (**C**) detail of the uropod; (**D**) detail of the thoracic somites.

The weights of the two specimens were 1.26 and 0.26 g, respectively. In particular, the biometrics were similar to those reported by previous authors [18,28,31,33,42]. For instance, Lewinsohn and Manning [18] reported the TL of females at 47 mm and 45 mm for males. Also, Kocataş and Katağan [34] reported *R. pallidus* obtained from the Aegean Sea with a TL of 56 mm. Figure 3 shows the relationship between depth and TL per sex in the Mediterranean basin. Although the data are limited, mantis shrimp recorded in the Mediterranean show a positive relationship between depth and size (i.e., larger specimens live deeper than smaller ones), even if this hypothesis would be corroborated in the future when more data are available.

The TL of females ranged from 32 mm to 70 mm (mean = 56.4 ± 10.0 mm ± 1 SD), while the TL of males ranged from 35 mm to 73 mm (mean = 57.2 ± 10.4 mm). The CL of females ranged from 8 mm to 12 mm (mean = 10.5 ± 1.8 mm), while the CL of males ranged from 7 mm to 14 mm (mean = 11.8 ± 2.6 mm). (See Table S1.)

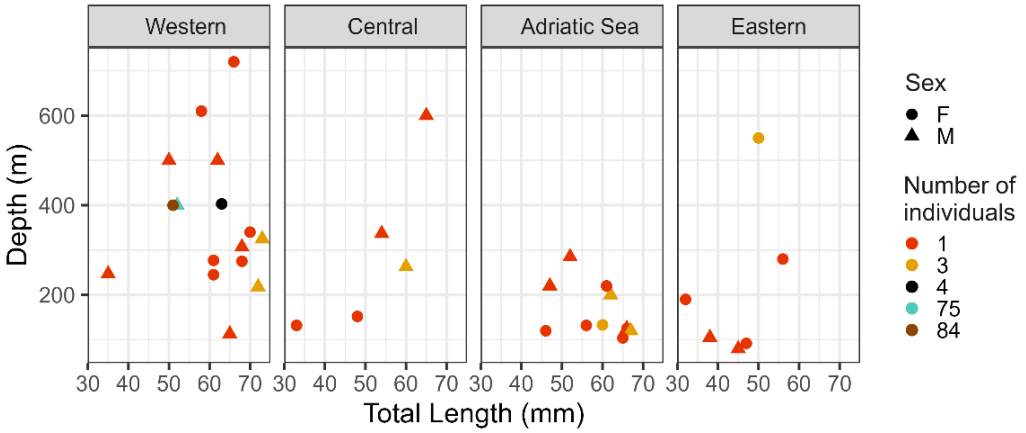

Figure 3. Relationship between depth and TL per sex in the Mediterranean basin. Dots and triangles represent the records of *Rissoides pallidus*, respectively, females (F) and males (M).

The relation between TL and CL per combined sex of *R. pallidus* is shown in Figure 4. Visual inspection of the scatter plot indicates that the linear regression fits well, suggesting that the relationship between the two measurements (combined sexes) is linear for the range of size reported in the literature.

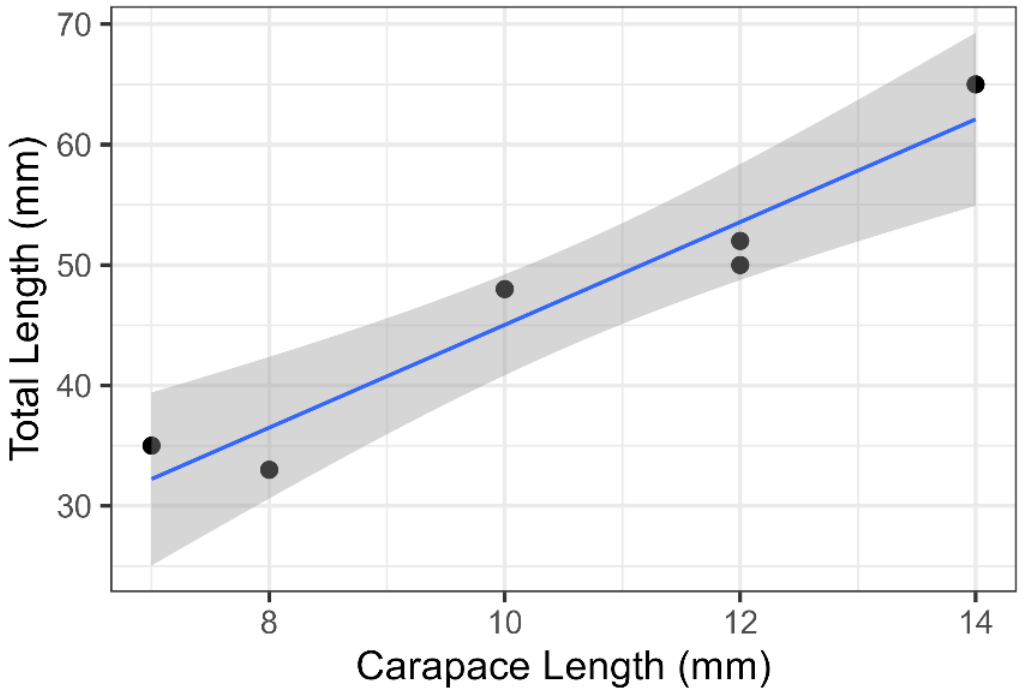

Figure 4. Relationship between total length (mm) and carapace length (mm) per combined sex in the Mediterranean basin. Black dots are the observed data; the blue line represents the model prediction, while the grey band indicates the standard error.

The following relationship between TL and CL was obtained:

$$TL = 2.36 + 4.27CL,$$

with the R^2 being quite high (Table 1).

Table 1. Relation and summary of the output of the linear model between Total length (Y) and Carapace length (X) of *R. pallidus* in the Mediterranean Sea.

Coefficients:	Estimate	Std. Error	t Value	*p*-Value	R^2
Intercept	2.36	6.54	0.36	0.74	0.91
TL	4.27	0.61	7.03	0.00	

TL: total length; Std. Error: standard error.

The morphological characteristics of the *R. pallidus* specimens of our current study agreed with the description provided by Manning [19] and Lewinsohn and Manning [18]. *R. pallidus* can sometimes be confused with *R. desmaresti* [33]. Specifically, *R. pallidus* is characterized by the long antennular peduncle, lateral process of the fifth thoracic somite (which is considered laterally sharp), lateral carinae of the fourth abdominal somite (which is considered armed posteriorly), and a series of spinules on the inner margin of the basal prolongation of the uropod [18,28]. Although the color pattern of *R. pallidus* and *R. desmaresti* closely resemble one another, the pigment pattern in *R. pallidus* appears less well marked. That is, there is noticeably less pigment on the lateral edge of the abdomen, i.e., between the intermediate and lateral carina [19].

The *Rissoides pallidus* specimens of our study were caught at a depth range between 132 and 152 m at a fishing ground locally known as 'Gigibau'. Specifically, the Gigibau fishing ground is 10 nautical miles (SW) from Mazara del Vallo and occupies an area of about 500 km^2, with a depth range of between 100 and 170 m. This fishing ground is equally characterized by two different biocenoses, namely, coastal detritus and coastal terrigenous mud [44,45]. The previous record of *R. pallidus* in the Strait of Sicily occurred close to the Graham Bank on a biocenosis of soft muds with a fluid surface film [31,44]. Concerning the habitat and geographic distribution, previous studies have reported the occurrence of *R. pallidus* on different substrates [46], but muddy areas of the deep continental shelf and upper slope seem to be the preferred habitat of this species (Table S1). We believe that *R. pallidus*, similarly to its congener *R. desmaresti* [47], might build burrows. According to Laban and Lindeboom [48], such burrows would have the effect of the animals avoiding capture even by trawls that penetrate into the sediment.

The Strait of Sicily is recognized as a major biogeographic boundary between the western and eastern Mediterranean. Our study indicates that the distribution of *R. pallidus* follows a gradient that decreases from north-west to south-east. It also suggests that the deeper reaches of GSA 16 might potentially represent a transitional zone for this species, i.e., between western and eastern basins of the Mediterranean Sea. However, we note that some records of this stomatopod species have been reported from the Levantine basin (Figure 1). Moreover, the ecological process that forms the basis of this biogeographic barrier could be found in the cold waters off the southern coast of Sicily [1,46].

Relevant information on the biology of *R. pallidus* still appears rather scanty. For instance, and to our best knowledge, literature specific to the size at maturity and the growth of *R. pallidus* is not available.

4. Conclusions

In this communication, we provide a map of *R. pallidus* in the Mediterranean Sea and an update to the information on its spatial distribution. Despite the fact that there is no commercial interest in this species, much still needs to be learned about the distribution and biology of *R. pallidus*, specific to their biotopes [49]. Indeed, improving the knowledge about biological features as well as the spatial distribution of uncommon/threatened species requires closer collaborative efforts with fishermen [49–56]. Thus, we encourage data sharing between these stakeholders, which could be accomplished by holding special meetings, sharing pictures/descriptions, and retaining specimens that fishermen consider "uncommon". Additionally, specific research about these species which involves national history museum collections may be performed. In conclusion, rare/uncommon species

such as *R. pallidus* offer an opportunity to gain a greater understanding of the community composition of benthic marine crustaceans.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/hydrobiology2040038/s1, Table S1: Summary of published records, bottom biocenosis, habitat, and depth of Rissoides palllidus within the Mediterranean Basin.

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