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A Knowledge Update of 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 among the rarely reported crustacean species in the Central Mediterranean Sea. In December 2020, during a trawl survey off Mazara del Vallo harbour (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. This current note, therefore, updates the existing knowledge of *R. pallidus* in the Strait of Sicily. 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

1. Introduction

The Strait of Sicily is considered a very important biogeographical area [1,2] and remains representative as a barrier to some species [3,4], whereas some others an "ecological corridor" [5–7]. These features make it a biodiversity and productivity hotspot of marine edible resources, which are exploited by national and international fleets [8–11]. Despite that stomatopod crustaceans occupy some space within the Mediterranean waters, there belong to the fauna that has been studied less [12]. Not only is the commercial interest for Stomatopods amply minimal, information regarding the majority of its species are not always available. For instance, the stomatopod genus *Rissoides* comprise 5 species [13] mainly distributed in the shallow waters along the burrows or crevices on different types of substrate [14]. Among these, only the *Rissoides desmaresti* (Risso, 1816) and *Rissoides pallidus* (Giesbrecht, 1910) appear recorded in the Mediterranean Sea [15]. These stomatopod species show a patchy distribution with low densities. In particular, *R. pallidus* is rarely recorded, though believed to be widespread in the Mediterranean, noting the records shown from the Levant [16] to the western Alboran Sea [17], as well as north-western Africa, Canary Islands, and Madeira [18–20]. To supplement existing information, this current note updates the existing knowledge of *R. pallidus* in the Strait of Sicily. Additional information specific to biometrics, bottom types, depth preference, habitats, and geographical distribution of this crustacean species is provided.

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 of a selectivity trawl survey (see

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[21,22] for technical details) carried out off Mazara del Vallo harbour (Northern sector of the Strait of Sicily). The depth of the sampling site ranged between 132 and 152 m. Figure 1 shows the map of how the *R. pallidus* has been distributed based on previous and current studies within the Mediterranean Basin.

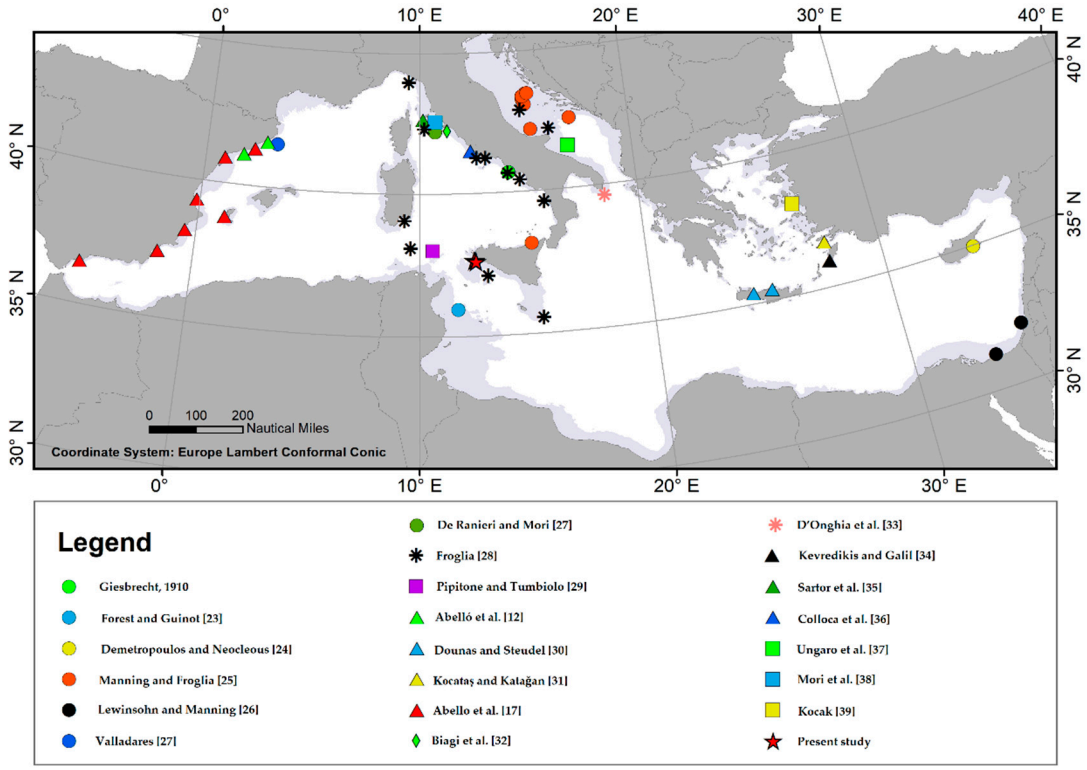

Figure 1. Map showing how the *Rissoides pallidus* has been distributed based on previous and current study within the Mediterranean Basin.

Thereafter, biological samples were transported to the laboratory of CNR-IRBIM of Mazara del Vallo where the *R. pallidus* specimens were identified and biometric data were collected. Specifically, mantis shrimp individuals were photographed, weighted (accuracy 0.1 g) and measured as carapace length (CL – distance between the centre of the anterior interorbital margin and the centre of the posterior margin, excluding the rostral plate), carapace 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) with the help of a calliper to the lowest millimetre. The sex of *R. pallidus* specimens was determined by the presence or absence of penes at the base of the pereopods on the eighth thoracic somite following the method of KUBO et al. [40]. Furthermore, a summary of published records, showing biometrics, bottom types, habitat, and depth of *R. palllidus* previously found within the Mediterranean Basin was carried out to enable robust comparisons of emergent data. Lastly, the geographical distribution of this uncommon species in the Mediterranean basin was mapped using Quantum GIS software (QGIS, 2020).

3. Results and Discussion

The *R. pallidus* specimens from the Strait of Sicily were female with 10 and 8 mm CL, 8 and 4 mm CW, and 48 and 33 mm TL, respectively (Figure 2).

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Figure 2. *Rissoides pallidus* (Risso, 1816) individual caught in the Strait of Sicily: dorsal view (female specimen).

As for weight, these specimens were 1.26 and 0.26 g, respectively. The biometrics of the specimens in the present note resembled those reported by previous authors [12,16,25,28,39]. For instance, Lewinsohn and Manning [16] reported TL of females 47 mm, and males 45 mm. Kocataş and Katağan [31] reported *R. pallidus* obtained from the Aegean Sea with TL of 56 mm. Indeed, the female specimens recorded in the Mediterranean showed a TL from 32 to 67 mm. From our conducted literature summary in Table 1, we can see that the *R. pallidus* specimens found within the Mediterranean can have a reasonable TL range of between 32 and 67 mm.

Table 1. Summary of published records, showing the biometrics, bottom types, habitat, and depth of *Rissoides palllidus* within the Mediterranean Basin.

Reference	Locality	Coordinates	Date	Bottom	Depth (m)	N	CL (mm)	TL (mm)
Giesbrecht (1910)	Gulf of Naples	-	-	-	-	-	-	-
Forest and Guinot [23]	Off Tunisia coasts	-	-	-	170-200	-	-	-
Manning and Froglia [25]	Gulf of Patti	-	17.06.1970	-	500	1♂ 1♀	-	57 - 67
	NW of Pomo	43°15'N 15°00'E	24.04.1969	-	115-132	1♀	-	56
		43°22'N 15°00'E	24.04.1969	-	115-125	1♀	-	66
		43°28'N 15°10'E	28.10.1975	-	200	3♂ 1♀	-	60 – 63
	West of Pomo	43°05'N 15°05'E	22.07.1970	epibathial muds	220	1♂	-	47
		43°05'N 15°05'E	20.07.1977	-	-	2♀	-	62 - 64
	Incoronata Island	43°22'N 15°00'E	25.05.1969	-	125	1♂	-	66
	SW of Lucietta	43°28'N 15°14'E	12.04.1973	coarse sands	133	3♀	-	52 - 68
	NW of Isole Tremiti	42°11′N 15°18'E	24.02.1973	muddy sands	104	1♀	-	65

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	SE of Lagosta	42°29'N 17°11′E	4.07.1973	muddy sands	285	1♂ 1♀	-	52
Lewinsohn and Manning [16]	Palmahim	31°56'N 34°34'E	03.05.1977	mud	80	1♂	-	45
	Bardawil lagoon	-	04.02.1969	-	91.5	1♀	-	47
Valladares [26]	Cabo de Creus Cabo de La Nao	41°33′N 03°17′E	2.03.1977	-	290-300	3♂	13 - 15	-
De Ranieri and Mori [27]	Off Elba Island	-	1985-1986	bathyal mud detritic biocoenoses	190-335	6♂ 7♀	-	-
Froglia [28]	Off Punta Mesco	-	07.06.1975	-	435-500	1♂ 1♀	-	50 52
	Gulf of Cagliari	38°53'N 9°20'E	23.12.1985	-	650-720	1♀	-	66
		39°01'N 9°17'E	02.05.1986	-	580-610	1♀	-	58
	North of Sentinelle Bank	38°05'N 9°35'E	25.07.1985	-	450-600	1♂	-	65
	Off Isola del Giglio	-	3.04.1985	-	307	1♂ 1♀	-	62 - 68
	South of Isola d'Elba	-	3.04.1985	-	245	1♀	-	61
	Off Anzio	41°11'N 12°39'E	04.1987	-	275	1♀	-	68
		41°08'N 12°45'E	9.04.1987	-	340	1♀	-	70
	SW of Gaeta	41°02'N 13°22'E	11.05.1987	-	325	3♂	-	70 - 76
	Gulf of Napoli	40°46'N 14°12'E	19.04.1986	-	218	3♂	-	70 - 73
	Gulf of Salerno	40°28'N 14°42'E	4.09.1986	-	264-277	1♀	-	61
	Off Capo Bonifanti	39°36'N 15°40'E	15.04.1986	-	370-403	4♀	-	57 - 68
	Strait of Sicily	37°05'N 13°00'E	06.09.1990	-	302-337	1♂	-	54
	Off Malta	35°32'N 15°17'E	02.1986	-	263	3♂	-	55 - 65
	Off Gargano	42°09'N 16°10'E	21.07.1985	-	114-120	1♀	-	46
	Western Pomo pit	42°50'N 14°50'E	15.05.1978	-	220	1♀	-	61
		42°59'N 14°29'E	16.05.1978	-	120	3♂ 5♀	-	64 - 70 65 - 75
Abello et al. [12]	Vilanova, Catalonia	41°5'N 1°45'E	6.03.1991	terrigenous mud	110-247	1♂	7	35

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	Blanes, Catalonia	41°35'N 2°48'E	20.10.1991	terrigenous mud	110-113	1♂	14	65
Dounas and Steudel [30]	Iraklion Bay	-	-	silty clay	190	1♀	-	32
	Georgioupolis	-	04.08.1991	-	105	1♂	-	38
Kocatas and Katagan [31]	Datca Peninsula	-	05.05.1992	mud	280	1♀	-	56
Abello et al. [12]	W. Alboran Sea Vera Gulf Alacant Eivissa Island Valencia Ebro delta N. Catalonia	-	1994-1999	-	117-523	21	-	-
Biagi et al. [32]	Off Tuscany and Latium coasts	-	1994-1997	-	-	-	-	-
Kevredikis and Galil [34]	Prassonisi	-	29.10.1997	-	63-85	-	-	-
Sartor et al. [35]	Island of Giglio, Montecristo, Pianosa	-	1995-1999	-	300-650	-	-	-
Colloca et al. [36]	Western coasts of Italy	-	1997-2001	detritic organogenic sediments	10-700	-	-	-
Ungaro et al. [37]	Southern Adriatic Sea	-	1996-2000	-	16-588	-	-	-
Mori et al. [38]	Tuscany Archipelago	-	1994-1996	-	250-550	75♂ 84♀	8 - 16 8 - 15	36 - 68 35 - 66
Kocak [39]	Sıgacık Bay	-	19.06.2008	mud	550	3♀	11 - 12	48 - 52
Present Study	Strait of Sicily (Gigibau)	37°51′N 12°40′E	18.12.2020	coastal detritus	152	1♀	10	48
		37°49′N 12°44′E	17.12.2020	coastal terrigenous	132	1♀	8	33

(N: number of individuals; CL: carapace length; TL: total length; ♂: males; ♀: females, -: not available).

Compared to other species that belong to *Squilidae*, the male individuals of *R. pallidus* exhibits a sexual dimorphism characterized by an inflated telson carinae and tubercles, whereas the growth of the telson width resembles in both sexes [38].

Morphological characteristics were in agreement with the description provided by Manning [18] and Lewinsohn and Manning [16]. It is worth noting that, *R. pallidus* can sometimes be confused with *R. desmaresti* [12]. Nevertheless, such features that allow its recognition may occur in the colour and morphology of the body. Specifically, *R. pallidus* is characterized by the long antennular peduncle, lateral process of the fifth thoracic somite (that is considered laterally sharp), lateral carinae of the fourth abdominal somite (that is considered armed posteriorly) and a series of spinules on the inner margin of the basal prolongation of the uropod [16,25]. Although the colour pattern of both species closely resembled, the *R. Pallidus* shows a pigment that appears much less well marked, with a

noticeably less pigment that is laterally placed on the abdomen, between the intermediate and lateral carina [18].

The specimens of the current study were caught in a fishing ground locally known as 'Gigibau'. This is an area of about 500 km^2 with a depth range of between 100 and 170 m and 10 nautical miles (SW) from Mazara del Vallo, which equally characterized by two different biocenoses namely: coastal detritus and coastal terrigenous mud [42,43]. Concerning the habitat and geographic distribution, some previous studies have reported the occurrence of *R. pallidus* at different substrates, notwithstanding that the muddy areas of the deep continental shelf and upper slope seem to be the preferred habitat of this species (Table 1). The *R. pallidus*, similarly to the congeneric species *R. desmaresti* [44], might build burrows. According to Laban and Lindeboom [45], such burrows would have to avoid the catch of animals by trawls that penetrate into the sediment, and much less the depth. However, in the present study, *R. pallidus* specimens were caught using a trawl net in a deep water rose shrimp (*Parapenaeus longirostris* Lucas, 1846) fishing ground [46–50]. In particular, the present study asserts the occurrence of *R. pallidus* in the Strait of Sicily. The last record to our best knowledge about the *R. pallidus* specific to the Strait of Sicily appears after twenty-eight years [29].

Relevant information concerning the biology of *R. pallidus* appears scanty. For instance, the information about the size at maturity, and growth appears not available in the scientific literature, to our best knowledge. In particular, the females of *R. pallidus* might depict a similar resembling reproductive period to *Squilla mantis* especially during the fall and winter seasons [51]. Besides, peak abundance of *R. pallidus* has been reported during the autumn and winter months in the Adriatic Sea [52]. Given that, the *R. pallidus* specimens of this study were caught in the December month, such a catch might be linked to the feeding activity beyond the burrows prior to egg incubation [51,52].

Overall, the current note has provided an update regarding the spatial distribution of *R. pallidus* in the Mediterranean Sea. Furthermore, in order to provide a complete picture for anyone aiming to study the *R. pallidus*, as much relevant biological information that is available in the scientific literature has to be collected, and that is what we have attempted to do here. Despite this, much more is yet to be learned about the distribution and biology of *R. pallidus*. Not only that there is no commercial interest for this *R. pallidus*, some stomatopods to live in specific biotopes [53] - both reasons may be why the records of this species are scanty. However, as suggested by Falsone et al. [53] and Sardo et al. [55], there is need for an adequate sampling methodology, which might help overcome such a challenge. Lastly, to improve the knowledge about the spatial distribution and biological features of uncommon or threatened species, an *ad-hoc* research project [56,57] and a closer collaboration with fishers [58–60] should be encouraged.

Supplementary Materials: All emergent data are included in the main text.

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to the fact that individuals arrived on deck already dead.

Informed Consent Statement: Not applicable.

Data Availability Statement: All emergent data are included in the main text.

Conflicts of Interest: The authors declare no conflict of interest.

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