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Decapod Crustacean Records from A Collection of Marine Soft-Bottom Macrofauna of the Italian Waters Supporting the Update of Checklists and Registers of the Mediterranean Basin

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Abstract: Decapod crustaceans are important components of the fauna of soft-bottom habitats. In this work, the records of decapod crustaceans are provided through the analysis of a large soft-bottom benthic macroinvertebrates dataset of the Central Mediterranean Sea. Decapod crustacean assemblages were collected in the last twenty years by a Van Veen grab in 42 study sites located along the Italian coasts at depths ranging from 1 up to 120 m. The spatial distribution of the crustaceans examined, which include 120 species belonging to 40 families, was investigated according to the biogeographical zones identified in the Italian seas. The spatial distribution of 36 species was updated, comparing the ISPRA decapod crustacean dataset with the most recent Italian checklists. For the species updated, the number of specimens, the year and season of sampling, and environmental data, such as the bathymetric range and habitat details, are provided for each site investigated. Data are discussed and compared with the existing literature, also referring to what is reported in the World Register of Marine Species (WoRMS), with the aim of contributing to the knowledge of the biodiversity of the marine species and supporting the updating of checklists and registers in the Mediterranean Basin.

Keywords: decapod; crustacean; macrozoobenthos; biogeography; checklist; environmental monitoring; Mediterranean Sea

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1. Introduction

Sedimentary habitats cover most of the ocean and sea bottom and constitute the largest single ecosystem on Earth in terms of spatial coverage [1]. Benthic infauna provides fundamental data that are relevant to the general objectives of most marine monitoring programs: ensuring that human health is not threatened, ensuring that unacceptable harm is not done to the marine ecosystem or marine resources, and supplying managers with information that allows them to make informed decisions concerning continued, reduced, or expanded use of the ocean for waste disposal and other activities [2]. In this regard, environmental monitoring programs related to anthropogenic impact studies on the marine environment often use macrozoobenthos as indicators [3–8], since their dynamics permit an integrated valuation of the spatiotemporal alteration of the ecosystem [9]. At the same time, environmental monitoring programs can also be a source of valuable scientific data to increase the knowledge of benthic communities and species [10].

Crustacean decapods comprise more than 14,000 extant species worldwide [11], where they occur from the upper intertidal zone to the hadal depths of the seafloor [12], including the entire water column and the benthic ecosystems over both hard and soft bottoms, coral reefs, kelp forests, seagrass meadows, macroalgal beds, and hydrothermal vents, wherein they have important regulatory functions [13]. Crustacean decapods are one of

the most important groups in terms of both species richness and ecological roles in the marine environment [14]. The feeding habits of decapods include herbivores, detritivores, carnivores, and omnivores. They are consumed by a vast array of other higher-order consumers, thus constituting a key taxon linking lower and higher trophic levels, so much so that many marine decapods sustain important fisheries [15,16]. In the Italian seas, most of the species typical of the Mediterranean Basin are present [17], and 293 species are reported in the most recent Italian checklist [18]. Among the species present in the Mediterranean Sea, the importance of alien species is emphasized. In fact, among the many alien crustacean species so far recorded in the Mediterranean Basin, numerous are decapods, such as crayfish, crabs, and prawns, which have in common the reputation of being both opportunistic and invasive to various environments [19]. Their entrance to the Mediterranean Basin has often been fostered by human actions, such as the transfer of new species for commercial purposes, or accidentally, whether as bycatch or because they were present in discarded ships' ballast water. The increasing number and growing size of their populations require the attention of the scientific community to evaluate and predict their influence on the marine environment and/or on local fish and bivalve mollusk production [19]. A clear and current example is that of the very competitive blue crab, *Callinectes sapidus*, Rathbun, 1896 [20,21].

Although the community assemblages, distribution, and abundance of decapod crustacean fauna were described from many authors in the Western, Central, and Eastern Mediterranean Basin [22–34], there are still significant gaps in the understanding of their distribution and ecology. In this regard, the resulting faunal picture of decapod crustaceans in the Italian seas is affected by the intensity of the research activity carried out in the various geographical zones considered, and the knowledge on the real distribution of some species is lacking, especially for those difficult to catch [18].

This paper summarizes data collected by the ISPRA (the Italian National Institute for Environmental Protection and Research), formerly the ICRAM (the Institute for Research Applied to the Sea), in the last twenty years and more from numerous environmental monitoring programs along the Italian continental shelf. Specifically, a large soft-bottom benthic macroinvertebrates dataset available in the ISPRA was analyzed, with the aim of providing useful information about decapod crustaceans. In this regard, the spatial distribution of more than one hundred species was examined according to the records available in the biogeographical zones in the Italian seas [18]. Data are discussed and compared with the existing literature, also referring to what is reported in the World Register of Marine Species (WoRMS) [35], with the aim of contributing to the knowledge of the biodiversity of the marine species and to support the updating of checklists and registers of the Mediterranean Basin.

2. Materials and Methods

2.1. Sampling Strategy and Field and Laboratory Procedures

Information on decapod crustaceans from the 42 study sites available, located along the Italian continental shelf, were extracted from the ISPRA's dataset (Figure 1a, Table 1), gained through numerous environmental monitoring campaigns carried out in Italy from 1999 to 2022 for different purposes, such as sand dredging, offshore installation developments (i.e., gas platforms, liquefied natural gas regasification structures, cables), aquaculture facilities, and beach nourishments. Soft-bottom benthic macroinvertebrates were collected by a Van Veen grab sampler (with a 0.1 m^2 covering area) at depths ranging from 1 up to 120 m.

For each case study, the context information (sea, biogeographical zone, geographical coordinates), the number of sampling stations, divided into depth ranges (1–10 m; 10.1–20 m; 20.1–30 m; 30.1–50 m; >50 m), the monitoring time frame, and the overall sampling effort (i.e., the total number of samples collected considering the number of stations, the number of replicates sampled at each station, the number of years of monitoring, and the frequency of sampling) were reported (Table 1). Samples were collected from 845 stations with replication in doubles, triples, or quintuples differently placed and monitored in

time in each study site depending on the sampling strategy and project financing, collecting several thousand of samples overall. Sediments sampled were sieved through a 1 mm mesh, and the retained material was preserved in seawater by adding 4% $CaCO_3$-buffered formalin. Macrozoobenthic samples were further sorted into major taxonomical groups, and the collected decapod crustaceans were counted and classified to the lowest possible taxonomic level by professional stereoscopes (Zeiss Discovery.V20; Leica M165C; Leica M216; Zeiss STEMI 2000) with a maximum magnification of 200 times. The guides used in taxonomic identification were from [36–50].

2.2. Data Analyses

The spatial distribution of each species was analyzed according to the division of the Italian seas into nine biogeographical zones, as proposed by [51] (Figure 1b, Table 1). The division of the Italian seas according to [51] was based on information on the geographical distribution of coastal fauna and the attempt to identify barriers (in the biogeographical sense) of three types: (i) physical (thresholds); (ii) hydrological (jet and gyre); (iii) physiological (surface isotherms). Information taken from marine phytogeography was also taken into account, with the belief that the analysis of marine fauna and flora must produce a coherent biogeographical subdivision of the Italian seas [51]. The division of the Italian seas according to [51] has been accepted by the Italian Society of Marine Biology (S.I.B.M.) and has been applied in the Italian checklist of marine flora and fauna [52]. To date, this represents the most detailed and informative classification of the Italian marine waters for the aims of this work. For example, the Adriatic Sea, which is identified as a single geounit in the World Register of Marine Species (WoRMS) [35], or as a single ecoregion in the worldwide biogeographic classification according to [53], has been subdivided in [51] into three different biogeographical zones: the Northern Adriatic Sea, the Central Adriatic Sea, and the Southern Adriatic Sea (Figure 1).

The spatial distribution of species was updated, comparing the ISPRA decapod crustacean dataset with the most recent Italian checklists [52]. In this work, different types of records were classified as follows: type 1 records: records confirming the species distribution in one or more biogeographical zones according to [52]; type 2 records: records implementing species distribution in one or more biogeographical zones not yet covered by the Italian checklist [52]; type 3 records: records highlighting species presence not yet included in the Italian checklist [52].

No data were available for our study from biogeographical zones 4, 5, and 6 (Figure 1, Table 1). For the species updated (type 2 records and type 3 records), the study areas investigated, the number of specimens, and environmental data, such as the bathymetric range and habitat details, are provided in the text at the biogeographical zone level, which represents the geographical spatial level of main interest of our work. In addition, further data (sea depth, number of specimens, habitat, year, season) are provided at the study area level in the Supplementary Materials to increase the usability of the data for future research. In addition, to identify possible mismatches between the Italian checklist [52] and international reference registers, biogeographical data for each species updated (type 2 records and type 3 records) were also analyzed and compared by referring to the geounits and related sources reported in the World Register of Marine Species (WoRMS) [35] and to the Ocean Biodiversity Information System (OBIS) [54] occurrences documented in the WoRMS. If available, distribution information was also compared with other existing literature.

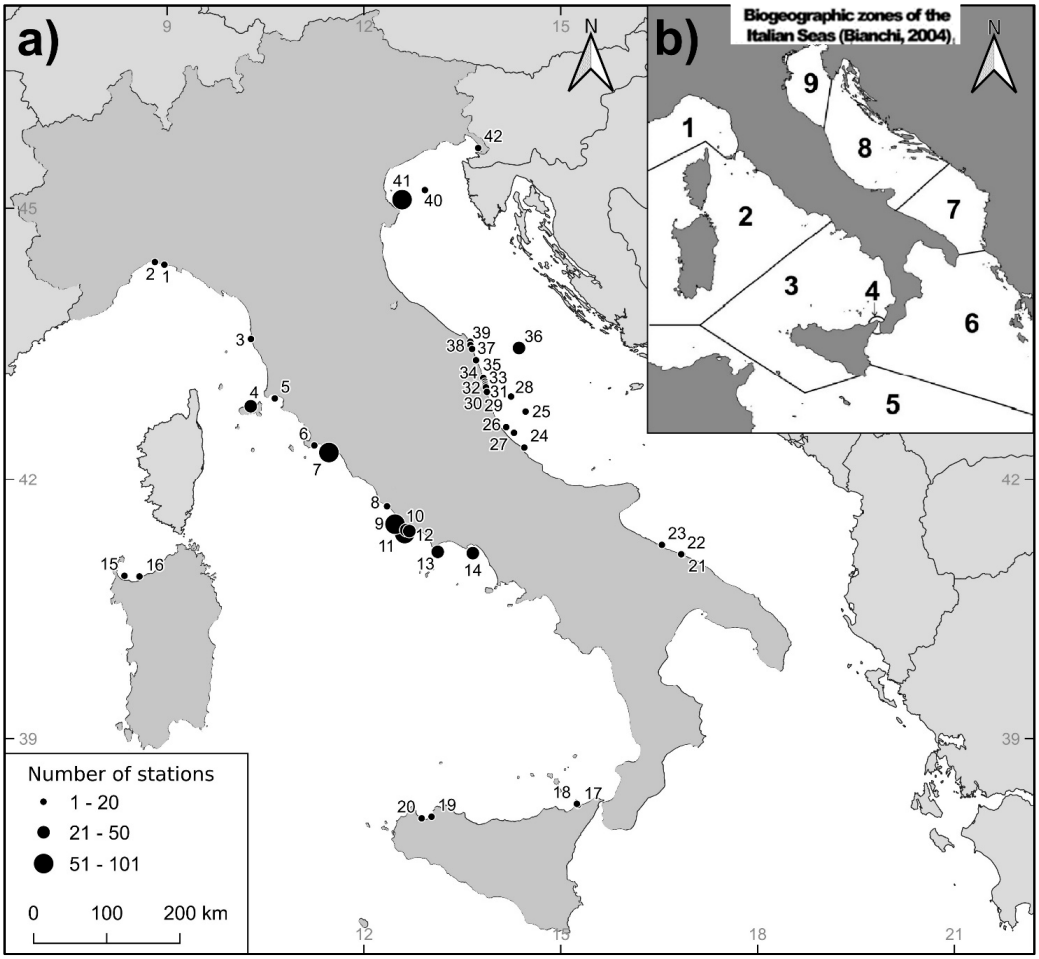

Figure 1. (**a**) Location of the 42 study areas from which the decapod crustacean data are extracted. Study areas are numbered (from 1 to 42) from the Ligurian Sea to the Northern Adriatic Sea. The circles of the study areas 17 and 18, and 21 and 22, respectively, are partially overlapping (for details, see Table 1). The dimension of the circle is proportional to the number of stations investigated in each area. (**b**) The nine biogeographical zones described in the Italian seas are as according to [51] and followed in the Italian checklist of flora and fauna of the Italian seas [52].

Table 1. The 42 study areas located in the biogeographical zones identified in the Italian seas [51] and the related names of the Italian seas (C = Central; S = Southern; N = Northern). The table reports, for each study area, the context information (sea, biogeographical zone, geographical coordinates), the number of stations (in parentheses at the beginning), the monitoring time frame (in the middle), and the overall sampling effort (in parentheses at the end). Depth ranges are also presented.

Study Area	Sea	Biogeographic Zone	Geographical Coordinates		(Number of Stations) Monitoring Time Frame (Overall Sampling Effort)	Depth Ranges (m)				
			Latitude (N)	Longitude (E)		1–10	10.1–20	20.1–30	30.1–50	>50
1. Genova #1	Ligurian Sea	1	44°23′16″	08°57′34″	(3) 2008–2009 (58)	0	3	0	0	0
2. Genova #2	Ligurian Sea	1	44°24′59″	08°48′52″	(3) 2009–2010 (20)	1	2	0	0	0
3. Livorno	Ligurian Sea	1	43°34′25″	10°16′44″	(3) 2022 (6)	2	1	0	0	0
4. Elba	N Tyrrhenian Sea	2	42°49′36″	10°16′31″	(41) 2006 (86)	1	2	3	16	19
5. Follonica	N Tyrrhenian Sea	2	42°54′51″	10°38′32″	(5) 2011–2018 (130)	0	0	3	2	0
6. Porto Ercole	N Tyrrhenian Sea	2	42°23′17″	11°14′39″	(11) 2000–2002 (88)	0	0	11	0	0
7. Montalto	C Tyrrhenian Sea	2	42°18′29″	11°28′01″	(101) 2001–2014 (264)	0	2	8	67	24
8. Castel Porziano	C Tyrrhenian Sea	2	41°41′21″	12°21′10″	(12) 2004–2021 (72)	3	3	3	3	0
9. Torvaianica	C Tyrrhenian Sea	2	41°29′07″	12°28′27″	(82) 2003–2010 (246)	8	4	4	8	58
10. Nettuno	C Tyrrhenian Sea	2	41°25′06″	12°38′42″	(21) 2007–2011 (338)	5	6	7	3	0
11. Anzio	C Tyrrhenian Sea	2	41°22′45″	12°37′17″	(87) 1999–2012 (296)	0	0	0	80	7
12. Sabaudia	C Tyrrhenian Sea	2	41°24′24″	12°41′35″	(40) 2004 (80)	6	3	5	8	18
13. Terracina	C Tyrrhenian Sea	2	41°10′12″	13°07′32″	(50) 2004 (102)	9	3	2	13	23
14.Gaeta	C Tyrrhenian Sea	2	41°09′18″	13°39′37″	(33) 2002–2003 (74)	0	4	2	10	17
15. Porto Torres	Sardinian Sea	2	40°53′42″	08°21′01″	(17) 2007–2011 (272)	0	0	5	12	0
16. Castelsardo	Sardinian Sea	2	40°53′16″	08°34′45″	(9) 2007–2010 (126)	0	0	2	7	0
17. Milazzo #1	S Tyrrhenian Sea	3	38°13′29″	15°14′46″	(5) 2001 (40)	0	0	0	5	0
18. Milazzo #2	S Tyrrhenian Sea	3	38°12′38″	15°15′49″	(8) 2006 (24)	4	2	1	1	0
19. Trappeto	S Tyrrhenian Sea	3	38°04′16″	13°01′54″	(14) 2008 (44)	0	0	14	0	0
20. Castellammare del Golfo	S Tyrrhenian Sea	3	38°03′04″	12°52′51″	(14) 2001–2008 (168)	0	0	0	14	0
21. Bari #1	S Adriatic Sea	7	41°08′28″	16°51′08″	(3) 2014 (36)	1	2	0	0	0
22. Bari #2	S Adriatic Sea	7	41°08′33″	16°50′11″	(7) 2009–2014 (28)	2	4	1	0	0
23. Bisceglie	S Adriatic Sea	7	41°14′59″	16°32′32″	(11) 2003–2007 (68)	0	0	11	0	0
24. Ortona	C Adriatic Sea	8	42°21′49″	14°26′41″	(5) 2007–2008 (20)	0	0	0	5	0
25. Pescara #1	C Adriatic Sea	8	42°46′02″	14°27′50″	(12) 2004 (48)	0	0	0	0	12
26. Pescara #2	C Adriatic Sea	8	42°35′36″	14°10′07″	(12) 2004 (48)	0	12	0	0	0
27. Pescara #3	C Adriatic Sea	8	42°31′46″	14°17′17″	(15) 2006 (30)	0	0	6	5	4
28. S. Benedetto del Tronto	C Adriatic Sea	8	42°56′05″	14°14′36″	(10) 2005–2013 (348)	0	0	0	0	10
29. Grottammare	C Adriatic Sea	8	42°59′11″	13°52′30″	(8) 2008–2010 (32)	8	0	0	0	0
30. Cupramarittima	C Adriatic Sea	8	43°02′16″	13°51′36″	(8) 2008–2010 (32)	8	0	0	0	0
31. Massignano	C Adriatic Sea	8	43°03′29″	13°51′13″	(4) 2008–2010 (16)	4	0	0	0	0
32. Campofilone	C Adriatic Sea	8	43°04′40″	13°50′57″	(4) 2008–2010 (16)	4	0	0	0	0
33. Pedaso	C Adriatic Sea	8	43°06′04″	13°50′40″	(6) 2008–2010 (24)	6	0	0	0	0
34. Fermo	C Adriatic Sea	8	43°08′30″	13°49′15″	(8) 2008–2010 (32)	8	0	0	0	0
35. Civitanova Marche #1	C Adriatic Sea	8	43°20′20″	13°42′33″	(8) 2008–2010 (32)	8	0	0	0	0
36. Civitanova Marche #2	C Adriatic Sea	8	43°28′27″	14°21′51″	(36) 2004–2008 (118)	0	0	0	0	36
37. Porto Recanati	C Adriatic Sea	8	43°27′47″	13°38′54″	(14) 2009 (70)	14	0	0	0	0
38. Numana	C Adriatic Sea	8	43°30′23″	13°37′22″	(10) 2009–2011 (100)	10	0	0	0	0
39. Sirolo	C Adriatic Sea	8	43°32′33″	13°37′17″	(86) 2009–2011 (60)	6	0	0	0	0
40. Chioggia #1	N Adriatic Sea	9	45°11′37″	12°55′48″	(18) 2014 (36)	0	0	4	14	0
41. Chioggia #2	N Adriatic Sea	9	45°05′28″	12°34′53″	(71) 2006–2015 (714)	15	5	51	0	0
42. Trieste	N Adriatic Sea	9	45°38′35″	13°44′33″	(10) 2006 (30)	2	8	0	0	0

Specimens are available in the ISPRA's reference collection, based on the material collected in numerous monitoring surveys.

3. Results and Discussion

A total of 120 species of decapod crustaceans, belonging to 40 families distributed across the Italian biogeographical zones 1, 2, 3, 7, 8, and 9, were identified. Most of the study sites were located in zone 8 (38.1%) and in zone 2 (33.3%), followed by zone 3 (9.5%), zones 9 and 7 (7.1%), and zone 1 (4.8%). The largest number of stations fell between 30.1 and 50 m (32.3%), followed by the depth range >50 m (27.0%), 10.1–20 m (16.9%), 0–10 m (16.0%), and 10.1–20 m (7.8%).

The distribution of 120 species across biogeographical zones, as reported in the checklist of flora and fauna of the Italian seas [52], is presented in the white background in Table 2. Results arising from the ISPRA decapod crustacean dataset confirmed the presence (type 1 records) of 106 species in many biogeographical zones (in the light-gray background) and implemented the distribution (type 2 records) of 32 species (in the dark-gray background) if compared with the most recent Italian checklists [52] (Table 2). In addition, the results highlighted the existence in the Italian waters (type 3 records) of four species (in the black background) not yet documented in the Italian checklist [52] (Table 2). Overall, the results, if compared with the most recent Italian checklists [52], provided new information on 36 species through 43 records (type 2 records and type 3 records) if examined at the biogeographical zone level, and 78 records (type 2 records and type 3 records) if examined at the study area level. The largest number of records (type 2 records and type 3 records) was recorded in zone 2, followed by a larger number of records in zones 9, 8, and 7. The fewest records were found in zones 3 and 1 (Figure 2).

Table 2. Distribution of the 120 species by the nine biogeographical zones of the Italian seas according to [51,52]. In the white background, the distribution of the selected species as reported in the checklist of flora and fauna of the Italian seas [52]; in light-gray background, type 1 records: records confirming the species distribution in one or more biogeographical zones according to [52]; in the dark-gray background, type 2 records: records implementing the species distribution in one or more biogeographical zones not yet covered by the Italian checklist [52]; in the black background, type 3 records: records highlighting the presence of species in the Italian waters not yet present in the Italian checklist [52]. Species and family nomenclature follows the World Register of Marine Species (WoRMS) [35]. Within the families, the species are listed in alphabetical order.

Species	Biogeographical Zones of Italian Seas									Remark
	1	2	3	4	5	6	7	8	9	
Family Panaeidae										
Parapenaeus longirostris (Lucas, 1846)	+	+	+	+	+	+	+	+		
Family Sicyoniidae										
Sicyonia carinata (Brünnich, 1768)	+	+	+	+	+	+	+	+	+	
Family Solenoceridae										
Solenocera membranacea (Risso, 1816)	+	+	+	+	+	+	+	+	+	
Family Stenopodidae										
Richardina fredericii Lo Bianco, 1903	+	+	+					+		
Family Palaemonidae										
Balssia gasti (Balss, 1921)	+	+	+		+	+		+		
Palaemon adspersus Rathke, 1836	+	+	+	+		+	+	+	+	
Family Alpheidae										
Alpheus glaber (Olivi, 1792)	+	+	+	+	+	+	+	+	+	
Alpheus dentipes Guérin, 1832	+	+	+	+	+	+	+	+	+	
Athanas nitescens (Leach, 1814)	+	+	+	+	+	+	+	+	+	
Synalpheus gambarelloides (Nardo, 1847)	+	+	+	+	+	+		+	+	
Synalpheus africanus Crosnier and Forest, 1965			+							

Table 2. *Cont.*

Species	Biogeographical Zones of Italian Seas									Remark
	1	2	3	4	5	6	7	8	9	
Family Thoridae										
Eualus occultus (Lebour, 1936)	+	+	+		+			+	+	
Eualus cranchii (Leach, 1817)	+	+	+	+	+	+	+	+	+	A1
Family Hippolytidae										
Hippolyte leptocerus (Heller, 1863)	+	+	+			+	+	+	+	
Hippolyte inermis Leach, 1816	+	+	+	+	+	+	+	+	+	
Family Pandalidae										
Chlorotocus crassicornis (A. Costa, 1871)	+	+	+	+	+	+	+	+		
Family Processidae										
Processa acutirostris Nouvel and Holthuis, 1957	+	+	+	+	+	+	+	+	+	
Processa canaliculata Leach, 1815	+	+	+			+	+	+	+	
Processa edulis (Risso, 1816)	+	+	+	+	+	+	+	+	+	A2
Processa elegantula Nouvel and Holthuis, 1957	+	+	+			+		+	+	
Processa macrophthalma Nouvel and Holthuis, 1957	+	+	+	+	+	+	+	+	+	
Processa modica carolii Williamson in Williamson and Rochanaburanon, 1979	+	+	+		+	+		+	+	
Processa nouveli nouveli Al-Adhub and Williamson, 1975	+	+	+			+	+	+	+	
Family Crangonidae										
Aegaeon cataphractus (Olivi, 1792)	+	+	+			+	+	+		
Crangon allmanni Kinahan, 1860		+								
Crangon crangon (Linnaeus, 1758)			+				+	+	+	
Philocheras monacanthus (Holthuis, 1961)	+	+	+				+	+	+	
Philocheras bispinosus bispinosus (Hailstone, 1835)		+	+				+	+	+	
Philocheras sculptus (Bell, 1847)	+	+	+					+	+	
Philocheras trispinosus (Hailstone in Hailstone and Westwood, 1835)	+	+	+					+	+	
Family Axiidae										
Calocaris macandreae Bell, 1846	+	+	+		+	+	+	+	+	
Family Callianassidae										
Callianassa subterranea (Montagu, 1808)		+	+	+			+	+	+	
Gilvossius tyrrhenus (Petagna, 1792)		+	+			+			+	A3
Necallianassa acanthura (Caroli, 1946)			+				+	+	+	
Necallianassa truncata (Giard and Bonnier, 1890)		+	+				+	+	+	
Family Ctenochelidae										
Gourretia denticulata (Lutze, 1937)	+	+	+		+		+	+	+	
Family Laomediidae										
Jaxea nocturna Nardo, 1847		+	+		+		+	+	+	
Family Upogebiidae										
Upogebia deltaura (Leach, 1816)		+	+		+	+		+	+	
Upogebia mediterranea Noël, 1992	+	+	+		+	+		+	+	
Upogebia pusilla (Petagna, 1792)	+	+	+	+	+	+	+	+	+	
Upogebia stellata (Montagu, 1808)					+			+	+	
Upogebia tipica (Nardo, 1869)	+	+	+			+	+	+	+	
Family Scyllaridae										
Scyllarides latus (Latreille, 1803)	+	+	+	+	+	+	+	+		
Family Diogenidae										
Calcinus tubularis (Linnaeus, 1767)	+	+	+	+	+	+	+			
Dardanus arrosor (Herbst, 1796)	+	+	+	+	+	+	+	+	+	
Dardanus calidus (Risso, 1827)	+	+	+	+	+	+		+		
Diogenes pugilator (Roux, 1829)	+	+	+	+	+	+	+	+	+	
Paguristes eremita (Linnaeus, 1767)	+	+	+	+	+	+	+	+	+	
Paguristes syrtensis de Saint Laurent, 1971		+	+		+	+				
Family Paguridae										
Anapagurus bicorniger A. Milne-Edwards and Bouvier, 1892	+	+	+			+	+	+	+	
Anapagurus breviaculeatus Fenizia, 1937	+	+	+		+	+	+	+	+	
Anapagurus chiroacanthus (Liljeborg, 1856)	+	+	+		+	+	+		+	
Anapagurus laevis (Bell, 1845)	+	+	+	+	+	+	+	+	+	

Table 2. *Cont.*

Species	Biogeographical Zones of Italian Seas									Remark
	1	2	3	4	5	6	7	8	9	
Anapagurus petiti Dechancé and Forest, 1962	+	+	+		+	+	+	+	+	
Anapagurus smythi Ingle, 1993		+	+							
Cestopagurus timidus (Roux, 1830)	+	+	+	+	+	+	+	+	+	
Pagurus alatus Fabricius, 1775	+	+	+	+	+	+	+	+		
Pagurus anachoretus Risso, 1827	+	+	+	+	+	+	+	+	+	
Pagurus chevreuxi (Bouvier, 1896)	+	+	+		+					
Pagurus cuanensis Bell, 1845	+	+	+	+	+	+	+	+	+	
Pagurus excavatus (Herbst, 1791)	+	+	+	+	+	+	+	+	+	
Pagurus forbesii Bell, 1845		+	+		+		+	+	+	
Pagurus prideaux Leach, 1815	+	+	+	+	+	+	+	+	+	
Family Galatheidae										
Galathea bolivari Zariquiey Álvarez, 1950	+	+	+		+			+	+	
Galathea cenarroi Zariquiey Álvarez, 1968	+	+	+		+			+	+	
Galathea dispersa Spence Bate, 1859	+	+	+		+	+	+	+	+	
Galathea intermedia Lilljeborg, 1851	+	+	+		+	+	+	+	+	
Galathea strigosa (Linnaeus, 1761)	+	+	+			+	+	+	+	
Family Munididae										
Dactylonida curvimana (A. Milne Edwards and Bouvier, 1894)					+	+		+		A4
Iridonida speciosa von Martens, 1878			+			+	+	+		A5
Munida intermedia A. Milne-Edwards and Bouvier, 1899		+	+		+	+	+	+		
Family Porcellanidae										
Pisidia longicornis (Linnaeus, 1767)		+		+		+	+	+	+	
Pisidia bluteli (Risso, 1816)	+	+	+	+	+	+	+	+	+	
Family Ethusidae										
Ethusa mascarone (Herbst, 1785)	+	+	+	+	+	+	+	+	+	
Family Dorippidae										
Medorippe lanata (Linnaeus, 1767)	+	+	+	+	+	+	+	+	+	
Family Leucosiidae										
Ilia nucleus (Linnaeus, 1758)	+	+	+	+	+	+	+	+	+	
Ebalia cranchii Leach, 1817		+	+				+	+	+	
Ebalia deshayesi Lucas, 1846	+	+	+	+	+				+	
Ebalia tuberosa (Pennant, 1777)	+	+	+		+	+	+	+	+	
Ebalia edwardsii O.G. Costa, 1838	+	+	+	+	+	+		+	+	
Ebalia granulosa H. Milne Edwards, 1837		+			+	+	+	+	+	
Ebalia tumefacta (Montagu, 1808)		+							+	
Family Inachidae										
Achaeus cranchii Leach, 1817	+	+	+		+	+	+	+	+	
Achaeus gracilis (O.G. Costa, 1839)	+	+	+		+	+	+	+	+	
Inachus dorsettensis (Pennant, 1777)	+	+	+	+	+	+	+	+	+	
Inachus parvirostris (Risso, 1816)	+	+	+	+	+	+		+		
Macropodia linaresi Forest and Zariquiey Álvarez, 1964		+	+		+		+	+	+	
Macropodia rostrata (Linnaeus, 1761)	+	+	+	+	+	+	+	+	+	
Family Majidae										
Eurynome aspera (Pennant, 1777)	+	+	+	+	+	+	+	+	+	
Family Epialtidae										
Pisa muscosa (Linnaeus, 1758)	+	+	+	+	+	+		+	+	
Pisa hirticornis (Herbst, 1804)	+	+	+	+		+		+	+	
Family Parthenopidae										
Derilambrus angulifrons (Latreille, 1825)	+	+	+	+	+	+	+	+	+	
Parthenopoides massena (Roux, 1830)	+	+	+	+	+	+	+	+	+	
Spinolambrus macrochelos (Herbst, 1790)	+	+	+		+	+	+	+		
Family Atelecyclidae										
Atelecyclus rotundatus (Olivi, 1792)	+	+	+	+		+	+	+	+	
Atelecyclus undecimdentatus (Herbst, 1783)		+				+				
Family Corystidae										
Corystes cassivelaunus (Pennant, 1777)	+					+		+	+	

Table 2. *Cont.*

Species	Biogeographical Zones of Italian Seas									Remark
	1	2	3	4	5	6	7	8	9	
Family Pirimelidae										
Pirimela denticulata (Montagu, 1808)	+	+	+		+	+	+	+	+	
Sirpus zariquieyi Gordon, 1953	+	+	+	+	+	+		+	+	
Family Thiidae										
Thia scutellata (Fabricius, 1793)		+	+	+		+				
Family Polybiidae										
Bathynectes longipes (Risso, 1816)	+	+	+	+	+	+	+	+		
Liocarcinus bolivari (Zariquiey Álvarez, 1948)	+	+	+		+				+	
Liocarcinus corrugatus (Pennant, 1777)	+	+	+	+	+	+	+	+	+	
Liocarcinus depurator (Linnaeus, 1758)	+	+	+	+	+	+	+	+	+	
Liocarcinus maculatus (Risso, 1827)	+	+	+	+	+	+	+	+	+	
Liocarcinus navigator (Herbst, 1794)	+	+	+	+	+	+	+	+	+	
Liocarcinus vernalis (Risso, 1827)	+	+	+	+		+	+	+	+	
Liocarcinus zariquieyi (Gordon, 1968)	+	+	+	+	+		+	+		
Family Goneplacidae										
Goneplax rhomboides (Linnaeus, 1758)	+	+	+	+	+	+	+	+	+	
Family Eriphiidae										
Eriphia verrucosa (Forskål, 1775)	+	+	+	+	+	+	+	+	+	
Family Xanthidae										
Monodaeus couchii (Couch, 1851)	+	+	+		+	+	+	+		
Xantho pilipes A. Milne-Edwards, 1867	+	+	+	+	+	+	+	+	+	
Family Pilumnidae										
Pilumnus hirtellus (Linnaeus, 1761)	+	+	+	+	+	+	+	+	+	
Pilumnus minutus De Haan, 1835			+							
Pilumnus spinifer H. Milne Edwards, 1834	+	+	+		+	+	+	+	+	
Family Varunidae										
Brachynotus gemmellari (Rizza, 1839)	+	+	+			+	+	+	+	
Brachynotus sexdentatus (Risso, 1827)	+	+	+			+	+	+	+	
Family Pinnotheridae										
Nepinnotheres pinnotheres (Linnaeus, 1758)	+	+	+		+	+	+	+	+	
Pinnotheres pisum (Linnaeus, 1767)	+	+	+			+	+	+	+	
Family Palicidae										
Palicus caronii (Roux, 1830)		+	+		+	+		+		

Remarks: A1: reported as *Thoralus cranchii* (Leach, 1817) in the Italian checklist [52]. A2: reported as *Processa edulis edulis* (Risso, 1816) in the Italian checklist [52]. A3: reported as *Pestarella thyrrena* (Petagna, 1792) in the Italian checklist [52]. A4: reported as *Munida curvimana* (A. Milne Edwards and Bouvier, 1894) in the Italian checklist [52]. A5: reported as *Munida rutllanti* (Zariquiey Alvarez, 1952) in the Italian checklist [52].

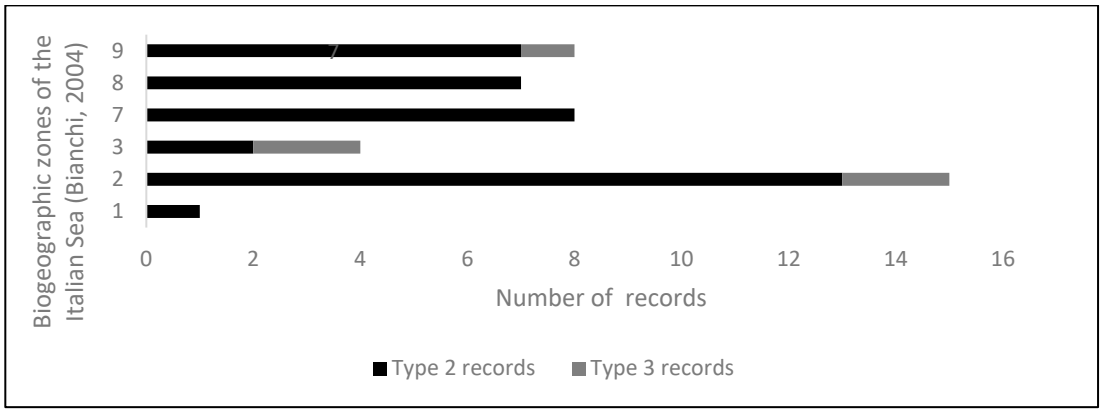

Figure 2. Number of type 2 records and number of type 3 records of our study for each Italian biogeographical zone according to [51,52]. Biogeographical zones 4, 5, and 6 were omitted, since no data were available for these zones in our study.

3.1. Record Information

For each species updated are shown below some information (the study areas investigated, the number of specimens, the bathymetric range, and the habitat details found in our work) at the biogeographical zone level about the 43 records (type 2 records and type 3 records). In addition, biogeographical data as reported in the World Register of Marine Species (WoRMS) are shown [35]. About the 78 records (type 2 records and type 3 records) at the study area level, further information (the sea depth, the number of specimens, the habitat, the year, and the season) is available in the Supplementary Materials (Table S1).

***Richardina fredericii* Lo Bianco, 1903**
Italian biogeographical zone: 8; study area: Pescara #1; *n* specimens: 1; depth: 116 m; habitat: the bottoms of sandy mud; WoRMS: no documented distribution in the Adriatic Sea [35].

***Balssia gasti* (Balss, 1921)**
Italian biogeographical zone: 8; study area: San Benedetto del Tronto; *n* specimens: 1; depth: 85 m; habitat: the bottoms of mud; WoRMS: documented distribution in the Adriatic Sea in [55].

***Synalpheus africanus* Crosnier and Forest, 1965**
Italian biogeographical zone: 3; study area: Milazzo #2; *n* specimens: 9; depth: from 3 to 7 m; habitat: rocky bottoms; WoRMS: no documented distribution in the Tyrrhenian Sea [35]; other remarks: the species was sampled as part of a macrofauna monitoring campaign where scratching was also carried out on rocky bottoms.

***Eualus occultus* (Lebour, 1936)**
Italian biogeographical zone: 2; study area: Porto Torres; *n* specimens: 7; depth: 35 m; habitat: the bottoms of sand; WoRMS: documented distribution in the Tyrrhenian Sea in [55] and in the Western Mediterranean [17,37].

***Hippolyte leptocerus* (Heller, 1863)**
Italian biogeographical zone: 8; study area: San Benedetto del Tronto; *n* specimens: 3; depth: 85 m; habitat: bottoms of mud; WoRMS: documented distribution in the Adriatic Sea in [17,55].

***Processa acutirostris* Nouvel and Holthuis, 1957**
Italian biogeographical zone: 2; study area: Castel Porziano, Porto Torres, Castelsardo, Porto Ercole, Follonica; *n* specimens: 21; depth: from 22 to 25 m; habitat: the bottoms of sand, muddy sand, sandy mud, and mud; WoRMS: documented distribution in the Tyrrhenian Sea [55] and in the Western Mediterranean [17].
Italian biogeographical zone: 7; study area: Bisceglie, Bari #2: *n* specimens: 30; depth: from 16 to 32 m; habitat: the bottoms of muddy sand; WoRMS: documented distribution in the Adriatic Sea in [17,55].

***Processa canaliculata* Leach, 1815**
Italian biogeographical zone: 9; study area: Chioggia #2; *n* specimens: 17; depth: from 18 to 28 m; habitat: the bottoms of sand, muddy sand, and sandy mud; WoRMS: documented distribution in the Adriatic Sea in [17,55].

***Processa elegantula* Nouvel and Holthuis, 1957**
Italian biogeographical zone: 8; study area: S. Benedetto del Tronto; *n* specimens: 9; depth: 85 m; habitat: the bottoms of mud; WoRMS: no documented distribution in the Adriatic Sea, except some OBIS occurrences in the Northern Adriatic Sea [35].
Italian biogeographical zone: 9; study area: Chioggia #2: *n* specimens: 88; depth: from 20 to 28 m; habitat: the bottoms of sand, muddy sand, and sandy mud; WoRMS: documented distribution in the Northern Adriatic Sea by OBIS occurrences [35].

***Crangon allmanni* Kinahan, 1860**
Italian biogeographical zone: 2; study area: Nettuno; *n* specimens: 2; depth: 6 m; habitat: the bottoms of muddy sand; WoRMS: no documented distribution in the Mediterranean Sea [35].

***Philocheras monacanthus* (Holthuis, 1961)**
Italian biogeographical zone: 7; study area: Bisceglie; *n* specimens: 1; depth: 32 m; habitat: the bottoms of muddy sand; WoRMS: documented distribution in the Adriatic Sea in [17,55].
***Philocheras sculptus* (Bell, 1847)**
Italian biogeographical zone: 2; study area: Porto Torres, Castelsardo; *n* specimens: 20; depth: from 23 to 35 m; habitat: the bottoms of sand and muddy sand; WoRMS: documented distribution in the Tyrrhenian Sea in [55] and in the Western Mediterranean [17].
***Calocaris macandreae* Bell, 1846**
Italian biogeographical zone: 9; study area: Chioggia #2; *n* specimens: 1; depth: 28 m; habitat: the bottoms of sand; WoRMS: documented distribution in the Adriatic Sea in [55].
***Necallianassa acanthura* (Caroli, 1946)**
Italian biogeographical zone: 7; study area: Bisceglie; *n* specimens: 2; depth: 32 m; habitat: the bottoms of muddy sand; WoRMS: documented distribution in the Adriatic Sea in [55].
***Necallianassa truncata* (Giard and Bonnier, 1890)**
Italian biogeographical zone: 7; study area: Bisceglie; *n* specimens: 4; depth: 32 m; habitat: the bottoms of muddy sand; WoRMS: documented distribution in the Adriatic Sea [55].
Italian biogeographical zone: 8; study area: S. Benedetto del Tronto: *n* specimens: 5; depth: 85 m; habitat: the bottoms of mud; WoRMS: documented distribution in the Adriatic Sea in [55].
***Gilvossius tyrrhenus* (Petagna, 1792)**
Italian biogeographical zone: 2; study area: Porto Ercole, Follonica; *n* specimens: 8; depth: from 22 to 32 m; habitat: the bottoms of mud and muddy sand; WoRMS: documented distribution in the Tyrrhenian Sea in [55].
***Gourretia denticulata* (Lutze, 1937)**
Italian biogeographical zone: 1; study area: Genova #1, Livorno; *n* specimens: 4; depth: from 11 to 16 m; habitat: the bottoms of debris; WoRMS: documented distribution in the Ligurian Sea by OBIS occurrences [35].
Italian biogeographical zone: 2; study area: Elba, Follonica, Montalto, Porto Torres, Castelsardo, Gaeta: *n* specimens: 204; depth: from 5 to 64 m; habitat: the bottoms of mud, sandy mud, muddy sand, sand, and debris; WoRMS: no documented distribution in the Tyrrhenian Sea [35].
***Jaxea nocturna* Nardo, 1847**
Italian biogeographical zone: 2; study area: Montalto, Torvaianica, Anzio, Nettuno, Sabaudia, Terracina, Gaeta; *n* specimens: 79; depth: from 5 to 101 m; habitat: the bottoms of mud and sandy mud; WoRMS: documented distribution in the Tyrrhenian Sea in [55].
***Upogebia deltaura* (Leach, 1816)**
Italian biogeographical zone: 3; study area: Castellamare del Golfo; *n* specimens: 5; depth: 42 m; habitat: the bottoms of mud; WoRMS: documented distribution in the Southern Tyrrhenian Sea by OBIS occurrences [35].
***Upogebia mediterranea* Noël, 1992**
Italian biogeographical zone: 2; study area: Castelsardo; *n* specimens: 1; depth: 26 m; habitat: the bottoms of sand; WoRMS: documented distribution in the Tyrrhenian Sea and in the Western Mediterranean Sea in [55].
***Upogebia stellata* (Montagu, 1808)**
Italian biogeographical zone: 9; study area: Trieste; *n* specimens: 1; depth: 16 m; habitat: the bottoms of sandy mud; WoRMS: no documented distribution in the Mediterranean Sea except some OBIS occurrences in the Southern Tyrrhenian Sea and the Western Mediterranean Sea [35].
***Upogebia tipica* (Nardo, 1869)**
Italian biogeographical zone: 1; study area: Livorno; *n* specimens: 1; depth: 11 m; habitat: the bottoms of debris; WoRMS: documented distribution in the Ligurian Sea by OBIS occurrences [35]. Italian biogeographical zone: 2; study area: Elba, Montalto, Porto Ercole, Castel Porziano, Torvaianica, Anzio, Nettuno, Sabaudia, Gaeta, Castelsardo, Porto Torres; *n*

specimens: 116; depth: from 2 to 90 m; habitat: the bottoms of mud, sandy mud, muddy sand, sand, and debris; WoRMS: no documented distribution in the Tyrrhenian Sea [35].

***Calcinus tubularis* (Linnaeus, 1767)**

Italian biogeographical zone: 7; study area: Bisceglie; *n* specimens: 1; depth: 32 m; habitat: the bottoms of muddy sand; WoRMS: documented distribution in the Adriatic Sea in [55].

***Dardanus arrosor* (Herbst, 1796)**

Italian biogeographical zone: 9; study area: Chioggia #2; *n* specimens: 2; depth: 28 m; habitat: the bottoms of sand; WoRMS: documented distribution in the Adriatic Sea in [55].

***Dardanus calidus* (Risso, 1827)**

Italian biogeographical zone: 2; study area: Porto Ercole; *n* specimens: 1; depth: 32 m; habitat: the bottoms of mud; WoRMS: documented distribution in the Tyrrhenian Sea in [55].

***Paguristes syrtensis* de Saint Laurent, 1971**

Italian biogeographical zone: 2; study area: Elba; *n* specimens: 5; depth: from 32 to 39 m; habitat: the bottoms of sand and debris; WoRMS: documented distribution in the Central Tyrrhenian Sea by OBIS occurrences [35].

***Anapagurus laevis* (Bell, 1845)**

Italian biogeographical zone: 7; study area: Bisceglie, Bari #2; *n* specimens: 8; depth: from 16 to 32 m; habitat: the bottoms of mud; WoRMS: documented distribution in the Adriatic Sea in [55]. Italian biogeographical zone: 8; study area: S. Benedetto del Tronto, Civitanova Marche #1: *n* specimens: 2; depth: from 85 to 87 m; habitat: the bottoms of mud and sand; WoRMS: documented distribution in the Adriatic Sea in [55].

Italian biogeographical zone: 9; study area: Chioggia #1, Chioggia #2: *n* specimens: 13; depth: from 5 to 30 m; habitat: the bottoms of sand and debris; WoRMS: documented distribution in the Adriatic Sea in [55].

***Anapagurus petiti* Dechancé and Forest, 1962**

Italian biogeographical zone: 7; study area: Bisceglie; *n* specimens: 4; depth: 32 m; habitat: the bottoms of muddy sand; WoRMS: no documented distribution in the Adriatic Sea [35].

***Anapagurus smythi* Ingle, 1993**

Italian biogeographical zone: 2; study area: Porto Ercole; *n* specimens: 2; depth: 32 m; habitat: the bottoms of mud; WoRMS: no documented distribution in the Mediterranean Sea [35], except some occurrences in the Ionian Sea [55].

***Dactylonida curvimana* (A. Milne Edwards and Bouvier, 1894)**

Italian biogeographical zone: 8; study area: S. Benedetto del Tronto; *n* specimens: 2; depth: 85 m; habitat: the bottoms of mud; WoRMS: no documented distribution in the Adriatic Sea [35].

***Pisidia bluteli* (Risso, 1816)** Italian biogeographical zone: 3; study area: Milazzo #1, Castellamare del Golfo; *n* specimens: 5; depth: from 35 to 43 m; habitat: the bottoms of mud and sandy mud; WoRMS: documented distribution in the Tyrrhenian Sea in [55].

***Ebalia granulosa* H. Milne Edwards, 1837**

Italian biogeographical zone: 9; study area: Chioggia #2; *n* specimens: 1; depth: 28 m; habitat: the bottoms of sand; WoRMS: documented distribution in the Adriatic Sea in [55].

***Ebalia tumefacta* (Montagu, 1808)**

Italian biogeographical zone: 2; study area: Montalto, Porto Torres; *n* specimens: 5; depth: from 34 to 50 m; habitat: the bottoms of mud, sandy mud, and muddy sand; WoRMS: no documented distribution in the Tyrrhenian Sea [35].

Italian biogeographical zone: 9; study area: Chioggia #2; *n* specimens: 1; depth: 28 m; habitat: the bottoms of sand; WoRMS: documented distribution by OBIS occurrences in the Northern Adriatic Sea [35].

***Atelecyclus undecimdentatus* (Herbst, 1783)**

Italian biogeographical zone: 2; study area: Porto Torres; *n* specimens: 1; depth: 40 m; habitat: the bottoms of sand; WoRMS: documented distribution in the Tyrrhenian Sea in [55].

***Pilumnus minutus* De Haan, 1835**
Italian biogeographical zone: 3; study area: Milazzo #2; *n* specimens: 1; depth: 7 m; habitat: rocky bottoms; WoRMS: documented distribution in the Mediterranean Sea as alien species in [25,56–58]. Other remarks: species was sampled as part of a macrofauna monitoring campaign where scratching was also carried out on rocky bottoms.
***Brachynotus gemmellari* (Rizza, 1839)**
Italian biogeographical zone: 7; study area: Bisceglie; *n* specimens: 1; depth: 32 m; habitat: the bottoms of muddy sand; WoRMS: documented distribution in the Adriatic Sea in [55].
***Palicus caronii* (Roux, 1830)**
Italian biogeographical zone: 2; study area: Elba; *n* specimens: 1; depth: 51 m; habitat: the bottoms of debris; WoRMS: documented distribution in the Tyrrhenian Sea in [55].

Results for type 2 records and type 3 records showed mismatches between the Italian national checklist [52] and the World Register of Marine Species (WoRMS) [35]. Since the WoRMS is also constantly updated relative to other data information systems, it was obviously found to be more up-to-date than the Italian checklist. Despite this, 29 records (type 2 records and type 3 records) corresponding to 37.2% also provided useful information for the World Register of Marine Species, as they are currently not present in the register. Further information about mismatches between the Italian checklist [52] and the World Register of Marine Species (WoRMS) [35] is available in in the Supplementary Materials (Table S1). Photographic and other details about the records, highlighting species presence not yet included in the Italian checklist [52] (type 3 records), are available in Report S1.

3.2. Record Considerations

New relevant evidence emerged from the comparison of the results of this study with pre-existing knowledge, analyzing the distribution of 120 species of crustacean decapods in the Italian seas. The present study contributes to the knowledge of soft-bottom marine invertebrate biodiversity of the Central Mediterranean Sea, highlighting 78 records (type 2 records and type 3 records).

With the idea of providing useful data to assist the stakeholders in updating checklists and registers at the national and global scales, two reference datasets were taken into account by a double-step analysis. Firstly, the Italian checklist [52] was compared with data from our study, since it represents the most recent datasets at the national level officially accepted, with the hope to support the next updates of these checklists. In this regard, we provided new information about 36 species, some of which have never been reported in the Italian seas from this national checklist [52]. Secondly, the World Register of Marine Species (WoRMS) [35] was selected; since it proves to be a worldwide register, it contains a huge amount of information constantly updated relative to other data information systems, and it is now usually taken as a reference at the international level. In this regard, direct comparisons among the information contained in the Italian checklists [52], the World Register of Marine Species [35], and our data highlighted several mismatches which could be of great use to all researchers.

In addition, although the ecological issue is not the main objective of this work, bathymetry and habitat data reported for each recorded species will be able to provide ecological data to researchers for further studies and investigations.

To take a closer look at the four species reported in our work not included in the Italian checklist (type 3 records), additional information can be acquired.

1. *Synalpheus africanus* Crosnier and Forest, 1965: no distribution in the Italian seas is reported in the Italian national checklists [52]. Likewise, no distribution in the Tyrrhenian Sea is reported in the World Register of Marine Species, relegating its distribution from the warm–temperate sector of the Atlantic Ocean to the Eastern and Western Mediterranean Sea [35]. Despite this, *S. africanus* was recorded in the Southern Tyrrhenian Sea for the first time in 2006 [59], during a baseline port survey in Milazzo #2, Sicily, aimed at detecting nonindigenous species in port areas. The report of the presence of *S. africanus* in Italian waters confirms, therefore, the hypothesis

of continuity between Mediterranean and Atlantic populations [59], as already expressed by [17] and successively by other authors [60–63], species formerly considered exotic and later revealed to be not indigenous. *S. africanus* was also reported in the Mediterranean Sea in [50].

2. *Crangon allmanni* Kinahan, 1860: no distribution in the Italian seas is reported in the Italian national checklists [52]. Likewise, no distribution in the Mediterranean Sea is reported in the World Register of Marine Species, relegating its distribution in the Northeast Atlantic Ocean [35], as also reported in [64]. Our work reports for the first time the record of *C. allmanni* in the Mediterranean Sea; in the Tyrrhenian Sea (Nettuno), it was collected during monitoring activities in 2011.
3. *Ebalia tumefacta* (Montagu, 1808): no distribution in the Italian seas is reported in the Italian national checklists [52]. The World Register of Marine Species relegates its distribution in the Atlantic Ocean and in some areas of the Eastern and Western Mediterranean Sea, as well as in the Northern Adriatic Sea by OBIS occurrences [35]. Our work confirms the presence of *E. tumefacta* in the Adriatic Sea (Chioggia #2) and highlights its presence in the Tyrrhenian Sea (Montalto, Porto Torres), collected during different monitoring activities between 2001 and 2011. No other record is to date available about *E. tumefacta* in the Italian seas, except in [30], where its presence is already recorded in the Central Tyrrhenian Sea.
4. *Pilumnus minutus* De Haan, 1835: no distribution in the Italian seas was reported in the Italian national checklists [52]. The World Register of Marine Species relegates its distribution in the Indo-West Pacific, as well as in the Eastern Basin of Mediterranean Sea [35]. In this regard, *P. minutus* was classified as an alien species in the Mediterranean Sea, as its origin is Indo-Pacific, and the first Mediterranean record was recorded in 1936 [56], with a single record from Egypt [25,57,60,63]. Other records were reported referring to the biodiversity in marine caves of the Eastern Mediterranean Sea in [34,58]. In this work, we emphasize the presence of *P. minutus* also in the southern Tyrrhenian Sea, since it was collected in 2006 during a baseline port survey in Milazzo #2, Sicily, aimed at detecting nonindigenous species in port areas.

Since the knowledge on the distribution of decapod crustaceans in the Italian seas is connected to the intensity of the research activity performed in the various geographical zones [18], there are still significant gaps today on this issue. A higher sampling effort increases the chances of rare species being found. This is also shown, for example, by our data in geographical zone 2, characterized by the second-largest number of the ISPRA's study areas and with the highest number of sampling stations investigated. This relationship between the number of sampling stations investigated and the number of records (type 2 records and type 3 records) is confirmed by most of our data. Sampling frequency can obviously further affect the possibilities of catching new species, as shown, for example, in geographical sector 9, where a large study area was investigated by the ISPRA for many years. Differently, despite a few samplings being carried out by the ISPRA in geographical sector 7, it showed a significant number of records (type 2 records and type 3 records), probably suggesting a poor current knowledge of the area.

This study outlines the importance of environmental monitoring programs related to anthropogenic impact studies as a source of important scientific data to support the research. Frequent monitoring surveys and common sampling methodologies, like those of our research, allow the collection of numerous and comparable data from different study areas, allowing the integration of multidisciplinary information, also opening the way to more specific research and experiments [10]. In this regard, there is a large amount of environmental data collected by a variety of subjects, both public and private, such as data derived from environmental characterizations and monitoring required for environmental assessment (e.g., EIA) procedures. These data, although collected frequently and often with high detail on a local scale in areas of particular interest, often remain available only as gray literature, and are rarely valued and made accessible to the scientific community. Information from these sources is fragmented and not available due to the absence of

specific and adequate centralized systems that help to organize and collect this type of detailed data in a homogeneous and functional way [65].

The importance of accessibility of environmental data is even more evident when the information refers to biodiversity, as in the case of macrozoobenthic assemblages, the issue of this research. An accurate identification of macrozoobenthos requires the intervention of specialist taxonomists, an excellent conservation of the organisms, and the presence of a reliable fauna description. Some diagnostic characters are sometimes of doubtful detection, and the specimen cannot always be rechecked over time, since the reference collections do not necessarily always remain available, and the specimens can be partially or totally lost for various reasons [66–70]. For all these reasons, it is very important to have a redundancy of information from different sources to mutually confirm the information acquired and to have increasingly robust official reference datasets.

We hope that our work might improve the knowledge of the biodiversity of the marine decapod species in the Mediterranean Basin, suggest specific studies aimed at filling current information gaps, and stimulate the centralization of environmental data on the anthropic impact as valuable data for the scientific community.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/d16010002/s1, Table S1: Type 2 records and type 3 records for decapod crustaceans; Report S1: Photographic details for the type 3 record of decapod crustaceans.

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