



# The marine Crustacea Decapoda of Sicily (central Mediterranean Sea): a checklist with remarks on their distribution

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## ABSTRACT

A checklist of the Crustacea Decapoda of Sicily, based on previously published records and on original data, is presented. The Sicilian waters were divided into three sectors to account for the different habitats present along the northern and western (sector A), eastern (B) and southern (C) coasts, for the sake of a better interpretation of the species distribution. A total of 186 species was recorded between 0 and 800 m depth, 31 of which are reported here for the first time. Sector A hosted 153 species, B 105 species, and C 117 species. The dissimilarities among the habitats present in the shallow waters of the three sectors accounted for the low co-occurrence of species: 30 species were common to A and C, 13 to A and B, and 2 to B and C. Seventy-two species co-occurred in the three sectors, recorded mainly in offshore soft bottoms investigated by trawl surveys. The importance of the aid given by such surveys, as well as by stomach contents analysis, in support of faunistic studies is highlighted. Lastly the affinity of the Mediterranean decapod fauna with that of the northeastern Atlantic is briefly discussed.

**KEY WORDS:** Crustacea - Decapoda - Biogeography - Sicily - Mediterranean Sea.

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## INTRODUCTION

The location of Sicily in the middle of the Mediterranean Sea, between the western and eastern basins, gives the island utmost importance for faunistic studies. Furthermore, the diversity of geomorphologic aspects, substratum types and hydrological features along its shores account for many different habitats in the coastal waters, and more generally on the continental shelf. Such diversity of habitats has already been pointed out by Arculeo *et al.* (1991) for the Sicilian fish fauna.

Crustacea Decapoda include benthic, nektobenthic and pelagic species (some of which targeted by artisan and industrial fisheries) living over an area from the intertidal rocks and sands to the abyssal mud flats (Brusca & Brusca, 1996). Occurrence, distribution and ecology of Sicilian decapods have been the subject of a number of papers in recent decades (Torchio, 1967, 1968; Ariani & Serra, 1969; Guglielmo *et al.*, 1973; Cavaliere & Berdar, 1975; Grippa, 1976; Andaloro *et al.*, 1979; Ragonese *et al.*, 1990, *Abstract* in 53° congr. U.Z.I.: 21-22; Pipitone & Tumbiolo, 1993; Pastore, 1995; Giacobbe & Spanò, 1996; Giacobbe *et al.*, 1996; Pipitone, 1998; Ragonese & Giusto, 1998; Rinelli *et al.*, 1998b, 1999; Spanò, 1998; Spanò *et al.*, 1999; Relini *et al.*, 2000; Pipitone *et al.*, 2001; Mori & Vacchi, 2003). Also the monograph by García-Gómez (1994) on the genus *Anapagurus* contains several Sicilian records (mainly from the Strait of Sicily), while a few papers have dealt with decapod larvae (Carli & Pessani, 1973; Calafiore, 1981). Some very useful information is also contained in papers and reports based on the results of experimental fishing surveys (Sarà, 1969; Arena & Bombace, 1970; Bombace & Sarà, 1972; Arena & Li Greci, 1973; Arculeo, 1987; Arculeo *et al.*, 1988, 1989, 1990, 1996; Franceschini *et al.*, 1993; Badalamenti & D'Anna, 1996).

The present paper puts together previously published information and original data, in an attempt (1) to build an updated checklist of the decapods occurring from shallow waters to the upper continental slope around Sicily, and (2) to find the relation between this baseline information and the different habitats that characterize different sectors of the Sicilian waters. Lastly the biogeography of the Sicilian decapod fauna is briefly discussed.

## MATERIALS AND METHODS

The collection locality of decapods as reported in the literature and from original data is shown in Figure 1. Single coastal sites and wide offshore areas were both treated as single stations, and are represented as single points on the map.

Two different sources of information (see Appendix I) were used for the compilation of the taxonomic list (Appendix II):

(i) Original data – These include samples collected between 1983 and 1998 in the context of several research programs carried out at the Authors' institutions as well as during episodic observations. Samples were collected in sites along the coast on hard and soft bottoms and on *Posidonia oceanica* (L.) Delile meadows, between 0 and about 40 m depth, as well as in areas from 10 to about 800 m depth explored during experimental fishing surveys.

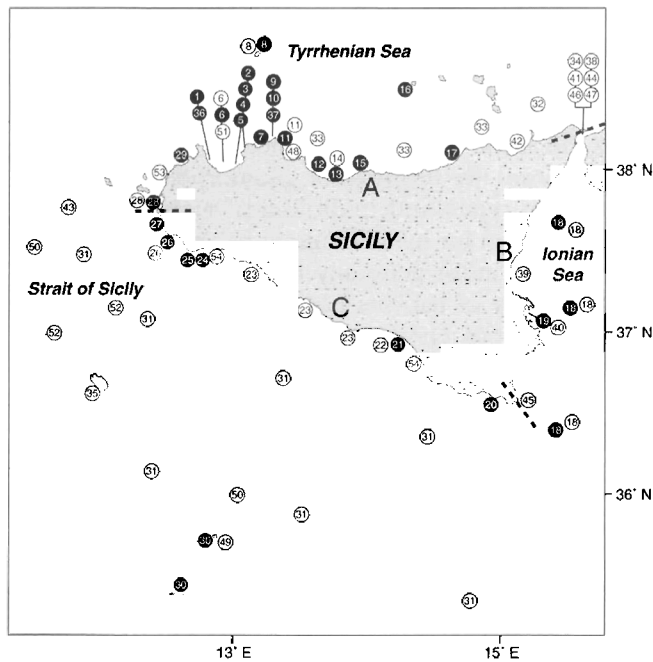


Fig. 1 - Map of Sicily with the indication of sectors (A, B, C) and of sampling sites (1 to 54). White numbers in solid circles stand for original data; black numbers in white circles stand for published records. Cf. Appendix I for the references to published records.

The following sampling methods were used: hand collection, substrate scraping, hand-towed net, air sucker, dredge, grab, boat seine, trammel net, bottom trawl net, and analysis of fish stomach contents. In some cases, entire blocks of biological material (sponges, calcareous algae constructions, etc.) were collected. This body of data was unpublished prior to the present paper.

(ii) Published data - These include the species lists reported in academic papers and technical reports appearing in recent decades, that we were able to retrieve. Compared to original data, sampling covered a smaller variety of habitats located on the shelf and upper slope, investigated mainly during fishing surveys by means of trammel and bottom trawl nets. The results of a study on the diet of littoral fishes were also taken into consideration. Papers whose study area extended beyond Sicilian waters were not considered, if they did not allow any discrimination between Sicilian and non-Sicilian sampling sites. When a likely misidentification occurred in published records, we chose not to include the species here.

Nomenclature and phylogenetic order employed in the taxonomic list (Appendix II) follow generally those proposed by d'Udekem d'Acoz (1999). In several cases, the scientific name employed in published records has been kept in parentheses, if different from the one proposed here.

On the basis of the different habitats present in the sea, the Sicilian coast was subdivided into three sectors for a better interpretation of the distribution of the decapod fauna (Fig. 1). Sector A (from Marsala to Capo Peloro) is characterized by rocky shores and sandy beaches in its western half, and by beaches of sand or pebbles in its eastern half. Sector B (from Capo Peloro to Capo Isola delle Correnti) presents a mixed landscape with rocky shores and a few sandy beaches. Its upper region is heavily influenced by the hydrographical regime of the Strait of Messina, which determines strong currents and stranding events (De Domenico, 1987). The shelf is narrow and the bottom generally reaches great depth at a short distance from the shore. The coast in sector C (from Capo Isola delle Correnti to Marsala) is occupied almost entirely by sandy beaches. This sector has a wide shelf that includes large offshore rocky shoals in the middle of the Strait of Sicily.

## RESULTS AND DISCUSSION

Appendix II lists 186 species of Crustacea Decapoda belonging to 47 families recorded from Sicilian waters. Thirty-one species are reported here for the first time. This list includes 53% of the Mediterranean species [ $n = 349$ , according to Koukouras *et al.*, 1992 and updated with recently described species (Galil & Clark, 1993; Ingle, 1993; d'Udekem d'Acoz, 1993, 1996; García-Gómez, 1994; Pastore, 1995) and with new records of exotic species (CIESM, 2000)], and 66% of Italian species [ $n = 280$ , according to Froggia, 1995 updated with the record of *Percnon gibbesi* (H. Milne Edwards, 1853) (Relini *et al.*, 2000)]. The family with the largest number of species ( $n = 26$ ) was Majidae, followed by Paguridae ( $n = 17$ ) and Portunidae ( $n = 13$ ). The most frequent species, in terms of number of sites where they occurred, were *Pilumnus hirtellus* (Linnaeus, 1761) (15 occurrences), *Calcinus tubularis* (Linnaeus, 1767) and *Alpheus dentipes* Guérin-Méneville, 1832 (14 occ.), *Athanas nitescens* (Leach, 1814) and *Galathea bolivari* Zariquiey Alvarez, 1950 (13 occ.), *Pagurus forbesii* Bell, 1845 and *Pisidia longicornis longimana* (Risso, 1816) (11 occ.) and *Pachygrapsus marmoratus* (Fabricius, 1787) (10 occ.). Fifty-two species occurred in only one station.

Sector A hosted 82% of the recorded species ( $n = 153$ , 38 of which were exclusive to this sector). Sectors B and C hosted 56% ( $n = 105$ , 18 exclusive) and 63% of the species ( $n = 117$ , 13 exclusive) respectively. The number of species recorded in each sector was roughly proportional to the number of sampling stations (see Fig. 1). This reflects the intense effort applied by the research teams (CNR and Universities) traditionally operating along the northern and western coasts of Sicily. The smaller number of stations reported in sectors B and C is due to the fewer zoological studies carried out in eastern and southern Sicily.

The importance of experimental fishing surveys as a major source of faunistic data in the Italian context (Tursi & Costantino, 1998) is worth highlighting. The results of the trawl surveys cited here (Sarà, 1969; Arena & Bombace, 1970; Bombace & Sarà, 1972; Arena & Li Greci, 1973; Arculeo, 1987; Arculeo *et al.*, 1988, 1990) account for 101 species (54% of the total), collected in wide portions of the continental shelf and upper slope of all three sectors. This is a remarkable outcome, especially considering that the main objective of fishing surveys is generally the assessment of fishery resources for management purposes, and that they address the knowledge of the bottom fauna only as a minor task.

Seventy-two species (39% of the total) were recorded in all the sectors: this co-occurrence is largely due to samples collected during trawl surveys, which yielded 64 of those species. This can be explained by the uniformity of the deep soft bottoms explored by trawlers. Only seven species co-occurring in the three sectors came from shallow water stations along the shore, which is an index of the differences existing between

the shores on the three sides of the Island. This aspect is further evidenced when paired sectors are considered. Thirty species were common to sectors A and C, 13 to sectors A and B, and only two to B and C. The low number of species common to paired sectors can be explained by the different habitats present in the respective coastal zone. In particular this is true for sectors B and C, dominated by rocky and sandy shores, respectively, whereas sector A is characterized by a much more diverse landscape that allows for a larger number of species in common with the other sectors as well as for a larger number of species overall. Also the different amount of studies carried out in each sector can be a possible cause of the different amount of species recorded in the three areas.

Fifty-five species were identified from stomach contents analysis (Arculeo *et al.*, 1993, unpubl. data). The fact that nine of them [*Brachycarpus biunguiculatus* (Lucas, 1846), *Eualus occultus* (Lebour, 1936), *Hippolyte leptometrae* Ledoyer, 1969, *Processa modica* Williamson & Rochanaburanon, 1979, *Philocheirus fasciatus* (Risso, 1816), *Upogebia deltaura* (Leach, 1815), *Galathea cennarroi* Zariquiey Alvarez, 1968, *Pirimela denticulata* (Montagu, 1808), and *Xaiva biguttata* (Risso, 1816)] were exclusive to this type of investigation highlights the remarkable role that the analysis of marine organisms diet can play in support of faunistic studies.

From a biogeographical viewpoint, the Mediterranean Sea (hence Sicily) should be included in the northern hemisphere warm-temperate area (Briggs, 1974). According to this Author – who partially disagreed with previous Authors (e.g., Ekman, 1967, and Tortonese, 1969) on this topic – the Mediterranean is a part of the Lusitanian province, which also includes the northeastern Atlantic waters from the English Channel to Cape Verde and in turn is a part of the Mediterranean-Atlantic region. In any case, the Mediterranean fauna has many elements in common with that of the northeastern Atlantic. Most Sicilian decapods span from typical temperate to warm tropical-temperate species (*sensu* d'Udekem d'Acoz, 1999), but include also cold temperate species like *Homarus gammarus* (Linnaeus, 1758) and subtropical species like *B. biunguiculatus*. Seventeen species (= 9% of Sicilian decapods) are endemic in the Mediterranean (Appendix II).

The central position of Sicily in the Mediterranean Sea suggests that it could be potentially colonized by species of recent introduction from the Atlantic or the Red Sea. In fact it seems that only two exotic species (among the 56 recognized exotic decapods occurring in the Mediterranean; CIESM, 2000) occur in Sicilian waters: the portunid crab *Portunus pelagicus* (Linnaeus, 1758) and the grapsid crab *P. gibbesi*. The first is a lessepsian crab common in the Levant Sea. Its absence from the Aegean Sea, where other lessepsian species do occur (Koukouras *et al.*, 1992), suggests that its presence along the Ionian coast of Sicily could be due mainly to larval drift (Torchio, 1968). The first Mediterranean

record of *P. gibbesi* comes from Linosa (site 49 in Fig. 1) (Relini *et al.*, 2000). This crab seems to be spreading rapidly along the southern and western coasts of Sicily (Pipitone *et al.*, 2001; Mori & Vacchi, 2003). Pipitone *et al.* (2001) suggested both larval drift and adult movements as possible diffusion mechanisms for this species in the western Mediterranean, while Mori & Vacchi (2003) suggested also possible passive transport through ships. Such a small number of exotic decapod species in Sicily might be easily linked to the island's distance from either of the access ways to the Mediterranean, i.e., the Strait of Gibraltar and the Suez Canal.

Sicily belongs to a biogeographical sector (which spans from the Balearic Islands to the Tyrrhenian Sea) that is considered the most representative biogeography-wise in the Mediterranean (Bianchi & Morri, 2000). The great specific richness of the Sicilian decapod fauna could be explained by the many diverse habitats and hydrological conditions existing along and off its coasts. Further research is likely to increase the number of decapod species from Sicily and to complete the knowledge of the dispersion mechanisms of marine organisms in the Mediterranean. Moreover further investigation, with the use of *ad hoc* sampling methods, should be dedicated to so far poorly known taxa (e.g. the Thalassinidea).

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APPENDIX I - Areas investigated, with the indication of the source of data, habitat and depth. Cf. Figure 1 for the localization of sectors and sites.

Site id.	Sector	Locality	Source	Habitat	Depth (m)
1	A	Zingaro - S. Vito	original data	rock	1-40
2	A	Alcamo Marina	original data	sand, concrete boulders	20
3	A	Trappeto	original data	rock, <i>Posidonia oceanica</i>	3-10
4	A	Balestrate	original data	rock	3-10
5	A	Terrasini	original data	rock	0-30
	A	Gulf of Castellammare	Arculeo <i>et al.</i> , 1988	sand, mud, detritus	10-800
	A	Gulf of Castellammare	Arena & Bombace, 1970	sand, mud, detritus	10-800
	A	Gulf of Castellammare	original data	sand, mud, detritus	10-800
7	A	Carini Bay	original data	rock, <i>Posidonia oceanica</i>	0-30
8	A	Ustica	Arculeo <i>et al.</i> , 1996	rock	30
8	A	Ustica	original data	rock	1-30
9	A	Sferracavallo	original data	rock	0-20
10	A	Capo Gallo	original data	rock, <i>Posidonia oceanica</i>	1-15
11	A	Vergine Maria (fish stomach content)	Arculeo <i>et al.</i> , 1993	rock, <i>Posidonia oceanica</i>	10-20
11	A	Vergine Maria (fish stomach content)	original data	sand, rock, <i>Posidonia oceanica</i>	10-20
12	A	Capo Grosso	original data	rock	1-3
13	A	Termini Imerese - Campofelice	original data	sand	5-10
14	A	Gulf of Termini Imerese	Arculeo, 1987	sand, mud	20-400
15	A	Cefalù	original data	<i>Posidonia oceanica</i>	3
16	A	Alicudi	original data	rock	0
17	A	S. Agata - Capo d'Orlando	original data	sand, rock, <i>Posidonia oceanica</i>	2-40
18	B	eastern Sicily	Franceschini <i>et al.</i> , 1993	sand, mud, detritus	10-800
18	B	eastern Sicily	original data	sand, mud, detritus	10-800
19	B	Augusta - Marina di Melilli	original data	rock	3-5
20	C	Sampieri - Marina di Ragusa	original data	rock	1-10
21	C	Gela	original data	rock	5-10
22	C	Gulf of Gela	Arculeo <i>et al.</i> , 1990	sand, mud	10-70
23	C	Sciacca - Licata	Arculeo <i>et al.</i> , 1989	sand	15-18
24	C	Tre Fontane	original data	rock	5-10
25	C	Capo Granitola	original data	sand, rock	10-20
26	C	Capo Feto	Badalamenti & D'Anna, 1996	<i>Posidonia oceanica</i>	3-20
26	C	Capo Feto	original data	sand, rock, <i>Posidonia oceanica</i>	1-20
26	C	Capo Feto	Pipitone, 1998	<i>Posidonia oceanica</i>	3
27	C	Petrosino	original data	sand	2
28	A	Stagnone di Marsala	Andaloro <i>et al.</i> , 1979	sand, <i>Posidonia oceanica</i>	1-3
28	A	Stagnone di Marsala	original data	sand, <i>Posidonia oceanica</i>	1-3
29	A	Bonagia	original data	rock, <i>Posidonia oceanica</i>	10
30	C	Pelagie Islands	original data	rock, <i>Posidonia oceanica</i>	0-30
31	C	Strait of Sicily	Bombace & Sarà, 1972	mud	450-750
31	C	Strait of Sicily - southern Sicily	Pipitone & Tumbiolo, 1993	sand, mud, detritus	10-800
31	C	Strait of Sicily	Sarà, 1969	sand, mud, detritus	100-560
32	A	north-eastern Sicily	Rinelli <i>et al.</i> , 1998a	sand, mud, detritus	10-800
33	A	northern Sicily	Rinelli <i>et al.</i> , 1998b	sand, mud, detritus	10-700
34	B	Strait of Messina	Rinelli <i>et al.</i> , 1999	rock	80-110
35	C	Pantelleria	Pipitone <i>et al.</i> , 2001	rock	1-3
36	A	Scopello	original data	rock	15
37	A	Isola delle Femmine	original data	rock	30
38	B	Strait of Messina	Grippa, 1976	n.a.	n.a.
39	B	Gulf of Catania	Pastore, 1975	detritus	50
40	B	Augusta	Torchio, 1968	sand	10-50
40	B	Augusta	Ariani & Serra, 1969	sand	1
41	B	north-eastern Sicily	Giacobbe & Spanò 1996	sand	5
42	A	Gulf of Patti	Arena & Bombace, 1970	sand, mud, detritus, rock	10-600
43	A	western Sicily	Arena & Li Greci, 1973	sand, mud, detritus	230-650
44	B	Strait of Messina	Spanò, 1998	sand, detritus, rock	5-206
45	B	Porto Palo di Capo Passero	Mori & Vacchi, 2003	artificial reef (concrete boulders)	0-6
46	B	Strait of Messina	Cavaliere & Berdar, 1975	sand	1
47	B	Strait of Messina	Guglielmo <i>et al.</i> , 1973	stranded specimens	
48	A	Gulf of Palermo	Ragonese <i>et al.</i> , 1990	mud	16-26
49	C	Linosa	Relini <i>et al.</i> , 2000	rock	1
50	C	Strait of Sicily	Garcia-Gomez, 1994	sand, mud, detritus	20-90
51	A	Gulf of Castellammare	Garcia-Gomez, 1994	mud	400
52	C	Strait of Sicily	Ingle, 1993	detritus, rock (?)	170
53	A	Trapani	Froggia & Manning, 1978	tuff wall on sand	0-1
54	C	Southern Sicily	Spanò <i>et al.</i> , 1999	fine sand	2-5

## APPENDIX II - List of Crustacea Decapoda recorded in Sicilian waters. Cf. Figure 1 for the localization of sectors and sites.

Species	Endemic	First record	Site id.	Sector
DECAPODA				
DENDROBRANCHIATA				
PENAEOIDEA				
ARISTEIDAE				
<i>Aristeomorpha foliacea</i> (Risso, 1827)			6-18-31-42-43	A-B-C
<i>Aristeus antennatus</i> (Risso, 1816)			6-18-31-42-43	A-B-C
BENTHESICYMIDAE				
<i>Gennadas elegans</i> (S.I. Smith, 1882)			47	B
PENAEIDAE				
<i>Funchalia woodwardi</i> Johnson, 1867			38	B
<i>Parapenaeus longirostris</i> (Lucas, 1846)			6-14-18-22-31-42-43	A-B-C
<i>Penaeus kerathurus</i> (Forskål, 1775)			6-13-14-18-23-31	A-B-C
SICYONIIDAE				
<i>Sicyonia carinata</i> (Brünnich, 1768)			11-14-18-22-31-47	A-B-C
SOLENCERIDAE				
<i>Solenocera membranacea</i> (Risso, 1816)			6-14-18-31-32-33-42-43	A-B-C
SERGESTIDAE				
<i>Sergestes arachnipedus</i> (Cocco, 1832)			43-47	A-B
(= <i>S. corniculum</i> Krøyer, 1855)			43-47	A-B
<i>Sergestes arcticus</i> Krøyer, 1855			47	B
<i>Sergestes vigilax</i> Stimpson, 1860			6-31-42-43-47	A-B-C
<i>Sergia robusta</i> (S.I. Smith, 1882)				
CARIDEA				
PASIPHAEIDAE				
<i>Pasiphaea multidentata</i> Esmark, 1866			6-14-18-31-33-42-43	A-B-C
<i>Pasiphaea sivado</i> (Risso, 1816)			6-14-18-31-42-43-47	A-B-C
OPLOPHORIDAE				
<i>Acanthephyra eximia</i> S.I. Smith, 1884			6-31-43	A-C
<i>Acanthephyra pelagica</i> (Risso, 1816)			47	B
PALAEMONIDAE				
<i>Brachycarpus biunguiculatus</i> (Lucas, 1846)			11	A
<i>Palaemon adpersus</i> Rathke, 1837			28	A
<i>Palaemon elegans</i> Rathke, 1837			28	A
<i>Palaemon serratus</i> (Pennant, 1777)			11-28-31	A-C
<i>Palaemon xiphias</i> Risso, 1816			3-11-28	A
<i>Periclimenes amethysteus</i> (Risso, 1827)	x	x	36	A
<i>Periclimenes</i> cfr. <i>scriptus</i> (Risso, 1822)	x	x	2	A
ALPHEIDAE				
<i>Alpheus dentipes</i> Guérin-Méneville, 1832			1-3-4-7-10-11-12-14-15-17-20-21-26-30	A-C
<i>Alpheus glaber</i> (Olivi, 1792)			6-18-31-47	A-B-C
<i>Alpheus macrocheles</i> (Hailstone, 1835)			18-26-30	B-C
<i>Athanas nitescens</i> (Leach, 1814)			1-3-4-7-10-11-12-17-20-26-28-30-32	A-C
<i>Synalpheus gambarelloides</i> (Nardo, 1847)		x	1-11-30	A-C
HIPPOLYTIDAE				
<i>Eualus cranchii</i> (Leach, 1817)			1-3-4-7-11-12-17-26-30	A-C
(= <i>Tboralus cranchii</i> )				
<i>Eualus occultus</i> (Lebour, 1936)			11	A
<i>Hippolyte holthuisi</i> Zariquiey Alvarez, 1953	x	x	4	A
<i>Hippolyte inermis</i> Leach, 1815			4-11-28	A
<i>Hippolyte leptocerus</i> (Heller, 1863) <sup>a</sup>		x	1-3-7-11-17-26	A-C
<i>Hippolyte leptometrae</i> Ledoyer, 1969		x	11	A
<i>Ligur ensiferus</i> (Risso, 1816)			6-42	A
<i>Lysmata seticaudata</i> (Risso, 1816)			1-11-12-47	A-B
PROCESSIDAE				
<i>Processa canaliculata</i> Leach, 1815			31	C
<i>Processa edulis</i> (Risso, 1816)			3-4-11-17-28-47	A-B
<i>Processa macropthalma</i> Nouvel & Holthuis, 1957		x	11-17	A
<i>Processa modica</i> Williamson & Rochanaburanon, 1979		x	11	A
<i>Processa nouveli</i> Al-Adhub & Williamson, 1975			17-31	A-C
<i>Processa robusta</i> Nouvel & Holthuis, 1957			11-14-15-17	A

<sup>a</sup>, according to d'Udekem d'Acoz (1996), this species includes also specimens previously identified as *Hippolyte longirostris* (Czerniavsky, 1868).

Continued

APPENDIX II - *Continued*

Species	Endemic	First record	Site id.	Sector
<b>PANDALIDAE</b>				
<i>Chlorotocus crassicornis</i> (A. Costa, 1871)			14-18-31-32-43-47	A-B-C
<i>Plesionika acanthonotus</i> (S.I. Smith, 1882)			6-18-31-43	A-B-C
<i>Plesionika antigai</i> Zariquiey Alvarez, 1955			6-14-18-31-43	A-B-C
<i>Plesionika edwardsii</i> (Brandt, 1851)			6-8-14-18-31-43	A-B-C
<i>Plesionika gigliolii</i> (Senna, 1902)			6-18-31-43	A-B-C
<i>Plesionika heterocarpus</i> (A. Costa, 1871)			6-14-18-31-33-43	A-B-C
<i>Plesionika martia</i> (A. Milne-Edwards, 1883)			6-18-31-33-42-43	A-B-C
<i>Plesionika narval</i> (Fabricius, 1787)			1-6-8-18-42-43	A-B
<b>CRANGONIDAE</b>				
<i>Aegaeon cataphractus</i> (Olivi, 1792) (= <i>Pontocaris cataphractus</i> )			6-18-22-31	A-B-C
<i>Aegaeon lacazei</i> (Gourret, 1887) (= <i>Pontocaris lacazei</i> )			6-18-22-31-32-33-42-43	A-B-C
<i>Philocheras echinulatus</i> (M. Sars, 1861)			6-31	A-C
<i>Philocheras fasciatus</i> (Risso, 1816)		x	11	A
<i>Pontophilus norvegicus</i> (M. Sars, 1861)			31	C
<i>Pontophilus spinosus</i> (Leach, 1815)			31	C
<b>STENOPODIDEA</b>				
<b>STENOPODIDAE</b>				
<i>Stenopus spinosus</i> Risso, 1827		x	1-17-37	A
<b>REPTANTIA</b>				
<b>ERYONIDEA</b>				
<b>POLYCHELIDAE</b>				
<i>Polycheles typhlops</i> Heller, 1862			6-18-31-32-33-42-43	A-B-C
<b>PALINURIDEA</b>				
<b>PALINURIDAE</b>				
<i>Palinurus elephas</i> (Fabricius, 1787)			2-5-6-8-9-18-22-23-31	A-B-C
<i>Palinurus mauritanicus</i> Gruvel, 1911			6	A
<b>SCYLLARIDAE</b>				
<i>Scyllarides latus</i> (Latreille, 1803)		x	8	A
<i>Scyllarus arctus</i> (Linnaeus, 1758)			11-18-25-31-32-47	A-B-C
<i>Scyllarus pygmaeus</i> (Bate, 1888)			31	C
<b>NEPHROPIDEA</b>				
<b>NEPHROPIDAE</b>				
<i>Homarus gammarus</i> (Linnaeus, 1758)			5-8-23	A-C
<i>Nephrops norvegicus</i> (Linnaeus, 1758)			6-14-18-31-42-43	A-B-C
<b>THALASSINIDEA</b>				
<b>CALOCARIDIDAE</b>				
<i>Calocaris macandreae</i> Bell, 1846			31	C
<b>CALLIANASSIDAE</b>				
<i>Callianassa subterranea</i> (Montagu, 1808)			47	B
<i>Callianassa tyrrhena</i> (Petagna, 1792)			28	A
<i>Necallianassa truncata</i> (Giard & Bonnier, 1890) (= <i>Callianassa truncata</i> )		x	17	A
<b>CTENOCHELIDAE</b>				
<i>Gourretia denticulata</i> (Lütze, 1937) (= <i>Gourretia minor</i> (Gourret, 1887))		x	26	C
<b>UPOGEBIIDAE</b>				
<i>Upogebia deltaura</i> (Leach, 1815)		x	11	A
<i>Upogebia pusilla</i> (Petagna, 1792)			47	B
<i>Upogebia tipica</i> (Nardo, 1868)	x	x	17-27	A-C
<b>ANOMURA</b>				
<b>GALATHEIDEA</b>				
<b>GALATHEIDAE</b>				
<i>Galathea bolivari</i> Zariquiey Alvarez, 1950	x		1-3-4-7-10-11-12-14-15-17-19-26-30	A-B-C
<i>Galathea cenanroii</i> Zariquiey Alvarez, 1968	x		11	A
<i>Galathea dispersa</i> Bate, 1859			31	C
<i>Galathea intermedia parroceli</i> Gourret, 1887			1-7-11-19-30-31	A-B-C
<i>Galathea squamifera</i> Leach, 1814			11-47	A-B



APPENDIX II - *Continued*

Species	Endemic	First record	Site id.	Sector
<i>Munida intermedia</i> A. Milne-Edwards & Bouvier, 1899			18-31-32-33-42-43	A-B-C
<i>Munida tenuimana</i> G.O. Sars, 1872			6	A
<i>Munida rugosa</i> (Fabricius, 1775)			6-14	A
PORCELLANIDAE				
<i>Pisidia longicornis bluteli</i> (Risso, 1816)			34-44	B
<i>Pisidia longicornis longicornis</i> (Linnaeus, 1767)			7-11-26-47	A-B-C
<i>Pisidia longicornis longimana</i> (Risso, 1816)			3-4-7-10-11-12-14-15-20-26-47	A-B-C
<i>Porcellana platycheles</i> (Pennant, 1777)			11-12-21-26-47	A-B-C
HIPPIDEA				
ALBUNEIDAE				
<i>Albunea carabus</i> (Linnaeus, 1758)			6-41-54	A-B-C
PAGURIDEA				
DIOGENIDAE				
<i>Calcinus tubularis</i> (Linnaeus, 1767)			2-3-7-9-10-11-12-14-15-17-19-26-30-44	A-B-C
<i>Clibanarius erythropus</i> (Latreille, 1818)		x	9-20-26	A-C
<i>Dardanus arrosor</i> (Herbst, 1796)			2-5-14-18-31-32-43-47-48	A-B-C
<i>Dardanus calidus</i> (Risso, 1827)			8-9-11-18-25-48	A-B-C
<i>Diogenes pugilator</i> (Roux, 1829)		x	4-9-17	A
<i>Paguristes eremita</i> (Linnaeus, 1767)			2-18-26-28-31-47-48	A-B-C
<i>Paguristes syrtensis</i> de Saint Laurent, 1971	x		26	C
PAGURIDAE				
<i>Anapagurus adriaticus</i> García-Gómez, 1994	x		50-51	A-C
<i>Anapagurus alboranensis</i> García-Gómez, 1994	x		50	C
<i>Anapagurus bicorniger</i> A. Milne-Edwards & Bouvier, 1892		x	3	A
<i>Anapagurus breviaculeatus</i> Fenizia, 1937			9-17-26-50	A-C
<i>Anapagurus chiroacanthus</i> (Lilljeborg, 1856)			50	C
<i>Anapagurus laevis</i> (Bell, 1845)			6-17-32-33-44	A-B
<i>Anapagurus longispina</i> A. Milne-Edwards & Bouvier, 1900			50	C
<i>Anapagurus petiti</i> Dechancé & Forest, 1962	x		17-50	A-C
<i>Anapagurus smythi</i> Ingle, 1993	x		52	C
<i>Cestopagurus timidus</i> (P. Roux, 1830)			1-9-11-19-26-30-34-44	A-B-C
<i>Pagurus alatus</i> (Fabricius, 1775)			6-13-14-18-31-43-44-48	A-B-C
<i>Pagurus anachoretus</i> Risso, 1827			2-7-9-14-15-18-26-31-32	A-B-C
<i>Pagurus chevreuxi</i> (Bouvier, 1896)		x	26	C
<i>Pagurus cuanensis</i> Bell, 1845			2-11-17-22-31-34-44-48	A-B-C
<i>Pagurus excavatus</i> (Herbst, 1791)			6-32-42	A
<i>Pagurus forbesii</i> Bell, 1845			18	B
(= <i>P. sculptimanus</i> Lucas, 1846)				
<i>Pagurus prideaux</i> Leach, 1815			6-13-14-17-18-22-31-43-44-47	A-B-C
BRACHYURA				
PODOTREMATA				
DROMIIDAE				
<i>Dromia personata</i> (Linnaeus, 1758)			1-6-8-18-31-47	A-B-C
HOMOLIDAE				
<i>Homola barbata</i> (Fabricius, 1793)			18-22-31-33-47	A-B-C
<i>Paromola cuvieri</i> (Risso, 1816)			6-18-31-42-43	A-B-C
LATREILLIIDAE				
<i>Latreillia elegans</i> P. Roux, 1830			18-31-32-33-42	A-B-C
HETEROTREMATA				
MAJIDAE				
<i>Acanthonyx lunulatus</i> (Risso, 1816)			9-10-11-17-26-30-47	A-B-C
<i>Achaeus cranchii</i> Leach, 1817		x	3-7-10-11-17	A
<i>Achaeus gracilis</i> O. G. Costa, 1839				
(= <i>A. gordonae</i> Forest & Zariquiey Alvarez, 1955)		x	7-11-17-26	A-C
<i>Ergasticus clouei</i> A. Milne-Edwards, 1882			31-43	A-C
<i>Eurynome aspera</i> (Pennant, 1777)			1-17-26-31	A-C
<i>Eurynome spinosa</i> Hailstone, 1835			1-7-17-30-44	A-B-C
<i>Herbstia condyliata</i> (Fabricius, 1787)			44-47	B
<i>Inachus communissimus</i> Rizza, 1839			6-13-18-22-31-32	A-B-C
<i>Inachus dorsettensis</i> (Pennant, 1777)			17-18-31-47	A-B-C



## APPENDIX II - Continued

Species	Endemic	First record	Site id.	Sector
<i>Inachus parvirostris</i> (Risso, 1816)	x		32	A
<i>Inachus phalangiium</i> (Fabricius, 1775)			3-9-11-18-22-36	A-B-C
<i>Inachus thoracicus</i> P. Roux, 1830			31-47	B-C
<i>Lissa chiragra</i> (Fabricius, 1775)			18-26-31-32	A-B-C
<i>Macropodia czernjawska</i> (Brandt, 1880)		x	1-10-11-17	A
<i>Macropodia longirostris</i> (Fabricius, 1775)	x		18-47	B
<i>Macropodia rostrata</i> (Linnaeus, 1761)			6-13-17-18-22-24-31-32	A-B-C
<i>Macropodia tenuirostris</i> (Leach, 1814)			6-17-18-31-32-33	A-B-C
= <i>M. longipes</i> (A. Milne-Edwards & Bouvier, 1899)				
<i>Maja crispata</i> Risso, 1827			5-6-9-18-22-24-31-47	A-B-C
<i>Maja goltziana</i> d'Oliveira, 1888			31-32	A-C
<i>Maja squinado</i> (Herbst, 1788)	x		6-8-18-31-47	A-B-C
<i>Pisa armata</i> (Latreille, 1803)			3-17-31	A-C
<i>Pisa corallina</i> (Risso, 1816)	x		47	B
<i>Pisa muscosa</i> (Linnaeus, 1758)	x	x	11-12-17-26	A-C
<i>Pisa nodipes</i> (Leach, 1815)			4-32-33	A
<i>Pisa tetraodon</i> (Pennant, 1777)		x	1-7-10-11-15-17-26-30	A-C
<i>Rochinia rissoana</i> (P. Roux, 1828)			6-31-43	A-C
(= <i>Anamathia rissoana</i> )				
DORIPPIDAE				
<i>Ethusa mascarone</i> (Herbst, 1785)			11-31-44	A-B-C
<i>Medorippe lanata</i> (Linnaeus, 1767)			6-14-18-22-31-32-33-47	A-B-C
LEUCOSIIDAE				
<i>Ebalia cranchii granulosa</i> H. Milne Edwards, 1837		x	17	A
(= <i>E. granulosa</i> H. Milne Edwards, 1837)				
<i>Ebalia deshayesi</i> Lucas, 1846			10-26-30-44	A-B-C
<i>Ebalia edwardsi</i> O. G. Costa, 1838			10-11-44	A-B
<i>Ilia nucleus</i> (Linnaeus, 1758)			11-17-25-47	A-B-C
CALAPPIDAE				
<i>Calappa granulata</i> (Linnaeus, 1758)			6-14-18-31-32-33-47	A-B-C
THIIDAE				
<i>Thia scutellata</i> (Fabricius, 1793)			44	B
ATELECYCLIDAE				
<i>Atelecyclus rotundatus</i> (Olivi, 1792)			17-22-31	A-C
PIRIMELIDAE				
<i>Pirimela denticulata</i> (Montagu, 1808)		x	11	A
<i>Sirpus zariquieyi</i> Gordon, 1953		x	3-7-11-26-30	A-C
GERYONIDAE				
<i>Geryon longipes</i> A. Milne-Edwards, 1882			6-31-32-33-42-43	A-C
PORTUNIDAE				
<i>Bathynectes longipes</i> (Risso, 1816)			33	A
<i>Bathynectes maravigna</i> (Prestandrea, 1839)			6-31-33	A-C
<i>Callinectes sapidus</i> Rathbun, 1896			18-46	B
<i>Carcinus aestuarii</i> Nardo, 1847			18-28-29	A-B
<i>Polybius arcuatus</i> (Leach, 1814)			11-17-18-26-28	A-B-C
(= <i>Liocarcinus arcuatus</i> )				
<i>Polybius corrugatus</i> (Pennant, 1777)			6-10-11-13-18-25-31-44-47	A-B-C
(= <i>Liocarcinus corrugatus</i> )				
<i>Polybius depurator</i> (Linnaeus, 1758)			6-14-18-22-31-32-33-47	A-B-C
(= <i>Liocarcinus depurator</i> )				
<i>Polybius vernalis</i> (Risso, 1827)			6-11-13-14-17-22-31-44	A-B-C
(= <i>Liocarcinus vernalis</i> )				
<i>Polybius tuberculatus</i> (P. Roux, 1830)			6-14-18-31-32-33-43	A-B-C
(= <i>Macropipus tuberculatus</i> )				
<i>Polybius zariquieyi</i> (Gordon, 1968)		x	11-26	A-C
(= <i>Liocarcinus zariquieyi</i> )				
<i>Portunus hastatus</i> (Linnaeus, 1767)			6-11-18-22-31-32-47	A-B-C
<i>Portunus pelagicus</i> (Linnaeus, 1758)			40	B
<i>Xaiva biguttata</i> (Risso, 1816)		x	11	A
PARTHENOPIDAE				
<i>Heterocrypta maltzami</i> Miers, 1881		x	17	A
<i>Parthenope angulifrons</i> Latreille, 1825			6-13-18-31	A-B-C
<i>Parthenope expansa</i> (Miers, 1879)			39	B
<i>Parthenope macrochelous</i> (Herbst, 1790)			6-31-32-33-43	A-C
<i>Parthenope massena</i> (P. Roux, 1830)			18-31-44	A-B-C

APPENDIX II - *Continued*

Species	Endemic	First record	Site id.	Sector
<b>XANTHIDAE</b>				
<i>Monodaeus</i> sp.			31-43	A-C
<i>Paractaea monodi</i> Guinot, 1969			47	B
<i>Xantho incisus</i> Leach, 1814			11-19-47	A-B
<i>Xantho pilipes</i> A. Milne-Edwards, 1867			11-44	A-B
<i>Xantho poressa</i> (Olivi, 1792)			34-44-47	B
<b>ERIPHIIDAE</b>				
<i>Eriphia verrucosa</i> (Forskål, 1775)			5-9-10-28-47	A-B
<b>PILUMNIDAE</b>				
<i>Pilumnus hirtellus</i> (Linnaeus, 1761)			3-4-7-9-10-11-12-14-15-18-19- -21-26-30-47	A-B-C
<i>Pilumnus inermis</i> A. Milne-Edwards & Bouvier, 1894			32-34-44	A-B
<i>Pilumnus hirtellus spinifer</i> H. Milne Edwards, 1834			11-14-17-18-31	A-B-C
<i>Pilumnus villosissimus</i> (Rafinesque, 1814)			2-11-17-30-44	A-B-C
<b>GONEPLACIDAE</b>				
<i>Goneplax rhomboides</i> (Linnaeus, 1758)			6-14-18-22-31-32-42-43	A-B-C
<b>PINNOTHERIDAE</b>				
<i>Pinnotheres pisum</i> (Linnaeus, 1767)		x	2	A
<b>THORACOTREMATA</b>				
<b>GRAPSIDAE</b>				
<i>Brachynotus sexdentatus</i> (Risso, 1827)			53	A
<i>Pachygrapsus marmoratus</i> (Fabricius, 1787)			1-5-7-9-10-12-16-28-30-47	A-B-C
<i>Percnon gibbesi</i> (H. Milne Edwards, 1853)			8-35-45-49	A-B-C
<i>Planes minutus</i> (Linnaeus, 1758)			47	B