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The amphipod (Crustacea: Peracarida) fauna of the Aegean Sea, and comparison with those of the neighbouring seas

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Examination of sampled material and review of the relevant literature revealed the presence of 299 benthic and 46 pelagic amphipod species from the Aegean Sea. Two of the species identified, Caprella hirsuta *Mayer, 1890 and* Apohyale crassipes *(Heller, 1866), are recorded for the first time in the Aegean Sea and the Levantine Basin respectively. A checklist of the Mediterranean amphipods is given, as well as their distribution in the Mediterranean territorial areas and the Black Sea. The faunal comparison of the Mediterranean areas showed that the number of species decreases from west to east. In terms of zoogeographical categories the Atlanto-Mediterranean species dominate in all Mediterranean areas followed by the endemic species concerning the benthic amphipods while in pelagic amphipods cosmopolitan species dominate and are then followed by Atlanto-Mediterranean. Three species,* Bemlos leptocheirus *(Walker, 1909) and* Linguimarea caesaris *Krapp-Schickel, 2003,* Photis lamellifera *Schellenberg, 1928, are lessepsian migrants and are reported in the Levantine and Central Mediterranean Seas.*

Keywords: Amphipoda, Aegean Sea, Mediterranean Sea, distribution

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INTRODUCTION

The first inventory of the Mediterranean amphipod fauna was made over a century ago by Carus (1885) and it comprised 216 species (189 benthic and 27 pelagic). Forty years later, Chevreux & Fage (1925) raised the number of Mediterranean amphipods to 270, reporting 237 benthic and 33 pelagic species.

However, it was only relatively recently that a complete survey regarding species description, geographical distribution and ecology of the Mediterranean benthic amphipods, comprising 451 species, was given by Ruffo (1982, 1989, 1993, 1998). Since then much additional information on the benthic amphipods of the Mediterranean has been provided, including descriptions of new species (e.g. Guerra-García *et al.*, 2001a; Messana & Ruffo, 2001; Bellan-Santini, 2005; d'Udekem d'Acoz & Vader, 2005; Sturaro & Guerra-García, 2011), descriptions of fauna of certain ecosystems (e.g. Sorbe & Galil, 2002; Cartes *et al.*, 2009, 2011) or regions (e.g. Stefanidou & Voultsiadou-Koukoura, 1995; Guerra-García *et al.*, 2001a, b, 2009; Sezgin & Katağan, 2007; Ruffo, 2010), new records (e.g. Krapp *et al.*, 2006; Bakir *et al.*, 2010), etc.

Information exclusively on the pelagic amphipod fauna is given only in a very restricted number of papers compared to the large amount of literature related to benthic amphipods. Stephensen (1918, 1924, 1925) was the first to give a complete list of the Mediterranean pelagic amphipods, after having examined material collected during the Danish oceanographic expedition and assigned it to 80 different species. Since then, very little information has been added, limited to less than a handful of papers (Bakalem & Dauvin, 1995; Vinogradov *et al.*, 1996; Zelickman, 2005; Ruffo, 2010).

The amphipod fauna of the different areas of the Mediterranean Sea has not been studied equally. The fauna of the Western Mediterranean, Adriatic Sea and, to a lesser extent, that of the Black Sea, have been studied fairly well, and a rich literature can be found on it. Conversely, existing information on the Central Mediterranean, Aegean Sea and Levantine Basin is more restricted.

The first information concerning the amphipod fauna of the Aegean Sea was given over 180 years ago (Guérin, 1832), followed by a restricted number of papers dealing with the systematic, ecology and zoogeography of this group (Vecchi, 1929; Stock, 1967; Myers, 1969a, b, 1972a, b; Geldiay *et al.*, 1970; Kocataş, 1976a; Bellan-Santini & Kaïm-Malka, 1977; Ruffo, 1982, 1989, 1993, 1998; Bellan-Santini, 1985; Karakiri & Nicolaidou, 1986, 1988; Kevrekidis & Koukouras, 1988). Stefanidou & Voultsiadou-Koukoura (1995), after extensive sampling, gave a list of the Aegean Sea amphipods, including 239 benthic species. Since then, new information (Sezgin *et al.*, 2006; Bakir *et al.*, 2010, 2011; d'Udekem d'Acoz, 2010; Özaydinli & Coleman, 2012) on the amphipods of the Aegean Sea has been added, increasing the number of Aegean Sea amphipods even more.

Scattered information on the amphipods of this area can also be found in general faunistic or ecological papers such as those by Ghigi *et al.* (1929), Drensky (1951), Demir (1952–1954), Pérès & Picard (1958), Tortonese (1959), Jacquotte (1962), Kocataş (1976b), Koukouras *et al.* (1985,

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1992), Voultsiadou-Koukoura *et al.* (1987), Kocataş *et al.* (2004), Bakir & Katağan, (2005), Sezgin *et al.* (2007) and Voultsiadou *et al.* (2007).

Regarding the pelagic amphipods found in the Aegean Sea, apart from the faunistic work of Stephensen (1918, 1924, 1925), information has only been given by Veini & Kiortsis (1974).

The aims of this paper are: (i) to give an up-to-date checklist of the benthic and pelagic amphipod fauna of the Aegean Sea, as well as of the Mediterranean and Black Seas, together with their distribution in different geographical areas; (ii) to compare the Aegean fauna to the faunas of the neighbouring seas; and (iii) to provide new information on the amphipod fauna of the Aegean Sea and the Levantine Basin.

MATERIALS AND METHODS

Samplings were carried out at six stations in the Aegean Sea and the Levantine Basin (Figure 1; Table 1). The samples were obtained by free or SCUBA diving at depths of 0–1 m in different habitats. The specimens have been deposited at the Museum of the Department of Zoology, Aristotle University of Thessaloniki.

In order to present the geographical distribution of the Mediterranean amphipods, a compartmentalization of the Mediterranean and Black Sea into the sub-basins was made according to Por & Dimentman (1989), with the exception of the Ionian Sea and the Sea of Sidra, which were considered as a single area: the Central Mediterranean. Thus, the Mediterranean and Black Sea region was divided into six areas: Western Mediterranean, Central Mediterranean, Adriatic Sea, Aegean Sea (including the Sea of Marmara), Levantine Sea and Black Sea. These areas represent individual sub-basins which are separated according to their individual geomorphologic and oceanographic characteristics (e.g. Pérès, 1967; Fredj & Laubier, 1985; Azov, 1991; Arvanitidis *et al.*, 2002; Por & Dimentamn, 2006).

Amphipod species are assigned to zoogeographical categories according to their distribution, as derived from the relevant literature: (1) species recorded only in the Mediterranean and the Black Seas have been considered as endemic (E); (2) species recorded in the Mediterranean and the Atlantic have been considered as Atlanto-Mediterranean (AM); (3) species recorded in the Mediterranean and the Indo-Pacific have been considered as Indo-Mediterranean (IM); (4) species recorded in the Atlantic, in the Mediterranean and in the Indo-Pacific have been considered as cosmopolitan (C); and (5) species following the criteria of Por (1978) have been considered as lessepsian migrants (LM).

Non-parametric multivariate techniques were used to estimate the affinities among the amphipod faunas in the different Mediterranean and Black Sea areas. All multivariate analyses were performed using the PRIMER v.6 statistical package (Clarke & Warwick, 1994). A matrix was constructed where species' presence/absence in each area was marked as 1 or 0, respectively. To derive similarity patterns from the above matrix the Jaccard coefficient was used. The resulting similarity matrix was used for cluster analysis, while the significance of any differences found was determined by a one-way analysis of similarity (ANOSIM) randomization test (Clarke, 1993).

RESULTS

Taxonomic list

A total of 613 amphipod species belonging to 89 families and 242 genera are recorded in the Mediterranean and the Black

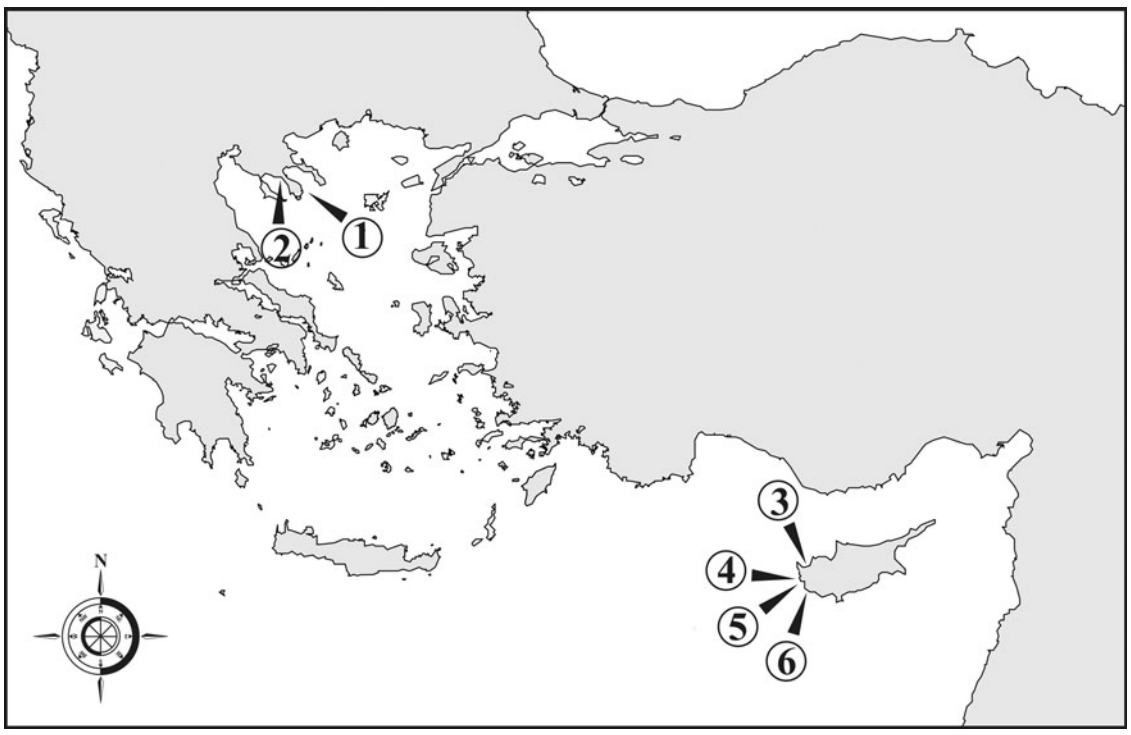

Fig. 1. Map of the Aegean Sea and Levantine Basin indicating the sampling stations.

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Table 1. Locality, geographical coordinates, depth (m) and physical characteristics of each sampling station.

Station code	Locality	Coordinates	Depth (m)	Habitat
Stn 1	Linaraki Beach, Sykia, Chalkikidi, Greece	40°02.25′ N23°59.99′ E	0–0.5	Rocky shore, moderately exposed. Photophilic algal assemblage dominated by *Corallina elongata* J. Ellis & Solander
Stn 2	Agios Ioannis Beach, Nikiti, Chalkidiki, Greece	40°11.45′ N23°41.39′ E	0.5–1.0	Rocky shore, moderately exposed. Photophilic algal assemblage dominated by *Cystoseira foeniculacea* f. *schiffneri* (Hamel) Gómez Garreta, Barceló, Ribera & Rull Lluch
Stn 3	Latsi Beach, Poli Chrysochous, Cyprus	35°04.60′ N32°18.97′ E	0–0.5	Rocky shore, moderately exposed. Photophilic algal assemblage dominated by *Cystoseira zosteroides* C. Agardh
Stn 4	Queen's bay, Milouria, Kissonerga, Paphos, Cyprus	34°49.69′ N32°23.33′ E	0–0.5	Rocky shore, moderately exposed. Photophilic algal assemblage dominated by *Laurencia obtusa* (Hudson) J.V. Lamouroux
Stn 5	Synthiana's bay, Milouria, Kissonerga, Paphos, Cyprus	34°49.32′ N32°23.33′ E	0–0.5	Rocky shore, exposed. Photophilic algal assemblage dominated by *Palisada perforata* (Bory de Saint-Vincent) K.W. Nam
Stn 6	Castle Beach, Kato Paphos, Cyprus	34°45.23′ N32°24.39′ E	0.5–1.0	Rocky shore, exposed. Photophilic algal assemblage dominated by *Cystoseira barbata* (Stackhouse) C. Agardh

Seas. Of these, 509 species are benthic (83.0% of the total Mediterranean amphipod fauna), found in marine and brackish waters, while the remaining 104 are pelagic (17.0%). Their presence or absence in the different geographical areas of the Mediterranean and the Black Seas, as well as in the Atlantic and the Indo-Pacific Oceans, along with their zoogeographical characterization, is given in Table 2. Although included in this table, the systematic validity of *Liljeborgia kinahani* (Spence Bate, 1862) has been questioned by d'Udekem d'Acoz (2012), and further research is needed to validate or not its status.

The material examined revealed the presence of 32 amphipod species (Table 2). From these, two species, *Caprella hirsuta* Mayer, 1890 and *Apohyale crassipes* (Heller, 1866) are new records for the Aegean Sea and the Levantine Basin, respectively. These species are presented below, along with information on their distribution.

NEW RECORDS

Family CAPRELLIDAE Leach, 1814
Genus *Caprella* Lamarck, 1801
Caprella hirsuta Mayer, 1890

MATERIAL EXAMINED

Seventy-four specimens; Station 1, among algae rich in *Corallina elongata* J. Ellis & Solander in lower midlittoral zone.

DISTRIBUTION

Caprella hirsuta is reported for the first time in the Aegean Sea. An Atlanto-Mediterranean species (Table 2) known from Western Mediterranean (Mayer, 1890; Chevreux & Fage, 1925; Ruffo & Wieser, 1952; Cavedini, 1982; Guerra-García *et al.*, 2000), Central Mediterranean (Monterosso, 1915; Ruffo & Wieser, 1952) and the Israel coasts of the Levantine Basin (Gottlieb, 1960). This species has also been reported from nearby areas of the Atlantic coast of Gibraltar, between Cape Spartel and Cape Blanc (Bellan-Santini & Ruffo, 1998).

Family HYALIDAE Bulycheva, 1957
Genus *Apohyale* Bousfield & Hendrycks, 2002
Apohyale crassipes (Heller, 1866)

MATERIAL EXAMINED

One hundred and eleven specimens; Station 4, among algae rich in *Laurencia obtusa* (Hudson) J.V. Lamouroux in lower midlittoral zone; Station 5, among algae rich in *Palisada perforata* (Bory de Saint-Vincent) K.W. Nam in lower midlittoral zone.

DISTRIBUTION

Apohyale crassipes is reported for the first time in the Levantine Basin. An Atlanto-Mediterranean species (Table 2) known from the Western Mediterranean (Mateus & Mateus, 1962 as *Hyale gulbenkiani*; Krapp-Schickel, 1993b as *H. crassipes*), Central Mediterranean (Krapp-Schickel, 1993b as *H. crassipes*), the Adriatic Sea (Heller, 1866 as *Nicea crassipes*; Krapp-Schickel, 1993b as *H. crassipes*), the Aegean Sea (Geldiay *et al.*, 1971 as *H. gulbenkiani*) and the Black Sea (Petrescu, 1998 as *H. crassipes*). *Apohyale crassipes* is also known from the Iberian Atlantic coasts (Bellan-Santini & Ruffo, 1998).

Geographical distribution

The distribution of the known benthic and pelagic amphipod species in the main geographical areas of the Mediterranean Sea and the Black Sea resulting from the present study is given in Figure 2A, B, respectively. As shown in Figure 2A the distribution of benthic species is not homogeneous throughout the Mediterranean area. While in the western basin of the Mediterranean Sea, there are 477 benthic amphipod species (93.7% of the total Mediterranean benthic amphipod species), in the central basin this number is reduced to 260 (51.1%). In the Adriatic Sea the number is increased slightly to 270 species (53.1%), while in the Aegean Sea, 299 (58.7%) species are known. The Levantine Basin is the second most impoverished area in species richness, hosting a total of 237 species (46.6%), while the Black Sea is the most impoverished from all the areas, with only 96 species (18.9%).

A similar distributional pattern to that of benthic amphipods has been observed in pelagic amphipods too. There are 77 species (74.0% of the total Mediterranean pelagic

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Table 2. Check list of the Mediterranean Amphipoda and their distribution in the Mediterranean territorial areas and the Black Sea with reference to their presence in the Atlantic and Indo-Pacific Oceans. •, new record for the Aegean Sea; ◆, new record for the Levantine Basin; *, species found in the present study; WM, Western Mediterranean; CM, Central Mediterranean; AD, Adriatic Sea; AS, Aegean Sea; LB, Levantine Basin; BS, Black Sea; AO, Atlantic Ocean; IP, Indo-Pacific Ocean; ZC, zoogeographical characterization; AM, Atlanto-Mediterranean; C, cosmopolitan; E, endemic; IP, Indo-Pacific; LM, lessepsian migrant.

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Amphipoda									
Corophiidea									
Ampithoidae									
Ampithoe bizseli (Özaydinli & Coleman, 2012)				+				+	IP
**Ampithoe ferox* (Chevreux, 1902)	+	+	+	+	+		+		AM
**Ampithoe helleri* Karaman, 1975	+	+	+	+	+	+	+		AM
**Ampithoe ramondi* Audouin, 1826	+	+	+	+	+	+	+	+	C
**Ampithoe riedli* Krapp-Schickel, 1968	+	+	+	+	+				E
Cymadusa crassicornis (Costa, 1857)	+	+	+	+	+	+	+		AM
Cymadusa filosa Savigny, 1816	+	+			+		+	+	C
Peramphithoe spuria (Krapp-Schickel, 1978)			+	+					E
Sunamphitoe pelagica (H. Milne Edwards, 1830)	+	+	+	+	+		+	+	C
Aoridae									
Aora gracilis (Spence Bate, 1857)	+	+	+	+			+		AM
Aora spinicornis Afonso, 1976	+	+	+	+	+		+		AM
Autonoe angularis (Ledoyer, 1970)	+	+	+	+	+				E
Autonoe catalaunica Ruffo, Cartes & Sorbe, 1999	+								E
Autonoe karamani (Myers, 1976)			+	+					E
Autonoe rubromaculatus (Ledoyer, 1973)	+			+	+				E
Autonoe spiniventris (Della Valle, 1893)	+	+	+	+	+		+		AM
Autonoe viduarum (Myers, 1974)	+			+					E
Bemlos leptocheirus (Walker, 1909)					+			+	IP (LM)
Lembos websteri Spence Bate, 1857	+	+	+	+	+		+		AM
Microdeutopus algicola Della Valle, 1893	+	+	+	+	+	+	+		AM
Microdeutopus anomalus (Rathke, 1843)	+	+	+	+		+	+		AM
Microdeutopus armatus Chevreux, 1886	+						+		AM
Microdeutopus bifidus Myers, 1977	+	+		+					E
Microdeutopus chelifer (Spence Bate, 1862)	+	+	+	+		+	+		AM
Microdeutopus damnoniensis (Spence Bate, 1857)						+	+		AM
Microdeutopus gryllotalpa Costa, 1853	+	+	+	+	+	+	+		AM
Microdeutopus obtusatus Myers, 1973	+	+	+	+	+		+		AM
**Microdeutopus similis* Myers, 1977	+	+	+	+	+				E
Microdeutopus sporadhi Myers, 1969	+		+	+					E
Microdeutopus stationis Della Valle, 1893	+	+	+	+	+	+	+		AM
Microdeutopus versiculatus (Spence Bate, 1856)	+	+	+	+		+	+		AM
Tethylembos viguieri (Chevreux, 1911)	+	+	+	+			+		AM
Caprellidae									
Caprella acanthifera Leach, 1814	+	+	+	+	+	+	+		AM
Caprella andreae Mayer, 1890	+	+	+	+	+		+	+	C
Caprella caulerpensis Guerra-García, Sánchez-Moyano & García-Gómez, 2002	+								E
Caprella cavediniae Krapp-Schickel & Vader, 1998	+	+	+	+			+		AM
Caprella ceutae Guerra-García & Takeuchi, 2002	+								E
**Caprella danilevskii* Czerniavskii, 1868	+	+	+	+	+	+	+	+	C
Caprella dilatata Krøyer, 1843	+		+	+	+		+		AM
Caprella equilibra Say, 1818	+	+	+	+	+	+	+	+	C
Caprella erethizon Mayer, 1901	+						+		AM
Caprella fretensis Stebbing, 1878	+						+		AM
**Caprella grandimana* Mayer, 1882	+	+		+	+		+		AM
•*Caprella hirsuta* Mayer, 1890	+	+		+	+		+		AM
Caprella lilliput Krapp-Schickel & Ruffo, 1987	+			+					E
Caprella linearis (Linnaeus, 1767)	+						+		AM
**Caprella liparotensis* Haller, 1879	+	+	+		+	+	+		AM
Caprella mitis Mayer, 1890	+	+		+		+			E
Caprella monai Guerra-García, Sánchez-Moyano & García-Gómez, 2001	+								E
Caprella paramitis Guerra-García, Sánchez-Moyano & García-Gómez, 2001	+								E
**Caprella penantis* Leach, 1814	+		+	+	+		+	+	C

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Caprella pseudorapax Guerra-García, Sánchez-Moyano & García-Gómez, 2001	+								E
Caprella rapax Mayer, 1890	+			+	+	+	+		AM
Caprella sabulensis Guerra-García, Sánchez-Moyano & García-Gómez, 2001	+								E
Caprella santosrosasi Sánchez-Moyano, Jimenez-Martin & García-Gomez, 1995	+								E
Caprella scaura Templeton, 1836	+	+	+				+	+	C
Caprella takeuchi Guerra-García, Sánchez-Moyano & García-Gómez, 2001	+								E
Caprella tavolarensis Sturaro & Guerra-García, 2011	+								E
Caprella telarpax Mayer, 1890	+								E
Caprella tuberculata Guérin, 1836	+						+		AM
Deutella schieckei Cavedini, 1982	+								E
Liropus elongatus Mayer, 1890	+								E
Liropus minimus Mayer, 1890	+								E
Pariambus typicus (Krøyer, 1884)	+	+	+	+	+		+		AM
Parvipalpus linea Mayer, 1890	+	+	+	+	+				E
Parvipalpus major Cărăuşu, 1941	+			+			+		AM
Pedoculina bacescui Cărăuşu, 1940	+								E
Pedoculina garciagomezi Sanchez-Moyano, Carballo & Estacio, 1995	+								E
Phtisica marina Slabber, 1769	+	+	+	+	+	+	+	+	C
Pseudolirius kroyeri (Haller, 1897)	+	+	+	+	+				E
Pseudoprotella inermis Chevreux, 1927	+						+		AM
Pseudoprotella phasma (Montagu, 1804)	+	+	+	+	+	+	+		AM
Corophiidae									
Apocorophium acutum (Chevreux, 1908)	+	+	+	+	+		+	+	C
Cheiriphotis mediterranea Myers, 1985					+				E
Corophium orientale Schellenberg, 1928	+	+	+	+	+	+	+		AM
Corophium volutator (Pallas, 1766)						+	+		AM
Crassicorophium bonellii (H. Milne Edwards, 1830)						+	+		AM
Crassicorophium crassicorne (Bruzelius, 1859)						+	+		AM
Leptocheirus bispinosus Norman, 1908	+	+	+	+	+		+		AM
Leptocheirus guttatus (Grube, 1864)	+	+	+	+	+		+		AM
Leptocheirus hirsutimanus (Spence Bate, 1862)	+		+				+		AM
Leptocheirus longimanus Ledoyer, 1973	+								E
Leptocheirus mariae Karaman, 1973	+		+	+					E
Leptocheirus pectinatus (Norman, 1869)	+	+	+	+	+		+		AM
Leptocheirus pilosus Zaddach, 1844	+	+	+	+		+	+		AM
Medicorophium aculeatum (Chevreux, 1908)	+		+	+					E
Medicorophium annulatum (Chevreux, 1908)	+		+				+		AM
Medicorophium longisetosum Myers, De-La-Ossa-Carretero & Dauvin, 2010	+								E
Medicorophium minimum (Schiecke, 1978)	+			+					E
Medicorophium rotundirostre (Stephensen, 1915)	+	+		+					E
Medicorophium runcicorne (Della Valle, 1893)	+	+	+	+	+	+	+		AM
Monocorophium acherusicum (Costa, 1851)	+	+	+	+	+	+	+	+	C
Monocorophium insidiosum (Crawford, 1937)	+	+	+	+	+	+	+	+	C
Monocorophium sextonae (Crawford, 1937)	+	+	+	+	+		+	+	C
Cyamidae									
Syncyamus aequus Lincoln & Hurley, 1981	+						+	+	C
Dulichiidae									
Dulichiopsis nordlandica (Boeck, 1870)	+			+			+		AM
Dyopedos monacantha (Metzger, 1875)	+						+		AM
Isaeidae									
Isaea montagui H. Milne Edwards, 1830	+		+				+		AM
Ischyroceridae									
**Coxyschyrocerus inexpectatus* (Ruffo, 1959)	+	+	+	+	+				E
Ericthonius argenteus Krapp-Schickel, 1993			+		+				E
Ericthonius difformis H. Milne Edwards, 1830	+	+				+	+		AM
**Ericthonius punctatus* (Spence Bate, 1857)	+	+	+	+	+	+	+	+	C
Jassa cadetta Krapp, Rampin & Libertini, 2008	+		+						E
Jassa falcata (Montagu, 1808)	+					+	+		AM
**Jassa marmorata* (Holmes, 1903)	+	+	+	+	+	+	+	+	C

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Jassa ocia (Spence Bate, 1862)	+	+	+	+	+	+	+		AM
Microjassa cumbrensis (Stebbing & Robertson, 1891)	+		+	+			+		AM
Siphonoecetes dellavallei Stebbing, 1899	+	+	+			+	+		AM
Siphonoecetes kroyeranus Spence Bate, 1856	+						+		AM
Siphonoecetes neapolitanus Schiecke, 1979	+			+			+		AM
Siphonoecetes sabatieri de Rouville, 1894	+	+					+		AM
Kamakidae									
Cerapopsis longipes Della Valle, 1893	+	+		+			+		AM
Microprotopidae									
Microprotopus longimanus Chevreux, 1887	+					+	+		AM
Microprotopus maculatus Norman, 1867	+		+	+	+	+	+		AM
Photidae									
**Gammaropsis crenulata* Krapp-Schickel & Myers, 1979	+	+		+	+				E
Gammaropsis dentata Chevreux, 1900	+	+		+	+		+		AM
Gammaropsis emancipata Krapp-Schickel & Myers, 1979	+	+							E
**Gammaropsis maculata* (Johnston, 1828)	+	+	+	+	+		+		AM
Gammaropsis ostroumowi Sowinski, 1898	+	+	+	+			+		AM
Gammaropsis palmata (Stebbing & Robertson, 1891)	+	+	+	+	+	+	+		AM
Gammaropsis pseudostroumowi Ledoyer, 1977	+								E
Gammaropsis sophiae (Boeck, 1861)	+	+	+	+	+		+		AM
Gammaropsis togoensis (Schellenberg, 1925)	+				+		+	+	C
Gammaropsis ulrici Krapp-Schickel & Myers, 1979	+						+		AM
Megamphopus brevidactylus Myers, 1976	+			+	+				E
Megamphopus cornutus Norman, 1869	+	+	+	+		+	+		AM
Megamphopus katagani Bakir, Murat, Alan & Myers, 2011				+					E
Megamphopus longicornis Chevreux, 1911	+			+			+		AM
Photis lamellifera Schellenberg, 1928		+			+			+	IP (LM)
Photis longicaudata (Spence Bate & Westwood, 1862)	+	+	+	+	+	+	+	+	C
Podoceridae									
Laetmatophilus ledoyeri Ruffo, 1986	+		+	+	+				E
Parunciola seurati Chevreux, 1911	+								E
Podocerus chelonophilus (Chevreux & Guerne, 1888)	+	+		+	+		+	+	C
Podocerus schieckei Ruffo, 1987	+				+				E
**Podocerus variegatus* Leach, 1814	+	+	+	+	+		+		AM
Unciolidae									
Unciola crenatipalma (Spence Bate, 1862)	+	+			+		+		AM
Unciolella lunata Chevreux, 1911	+						+		AM
Gammaridea									
Acidostomatidae									
Acidostoma nodiferum Stephensen, 1923	+	+	+	+	+		+		AM
Acidostoma obesum (Spence Bate & Westwood, 1861)	+	+	+	+			+		AM
Allocrangonyctidae									
Pseudoniphargus adriaticus Karaman, 1955	+		+						E
Pseudoniphargus africanus Chevreux, 1901	+								E
Pseudoniphargus leucatensis Bréhier & Jaume, 2009	+								E
Ampeliscidae									
Ampelisca anophthalma Bellan-Santini & Kaïm-Malka, 1977	+						+		AM
Ampelisca antennata Bellan-Santini & Kaïm-Malka, 1977	+								E
Ampelisca brevicornis (Costa, 1853)	+		+	+	+		+	+	C
Ampelisca calypsonis Bellan-Santini & Kaïm-Malka, 1977	+			+	+		+		AM
Ampelisca dalmatina Karaman, 1975	+		+	+			+		AM
Ampelisca diadema (Costa, 1853)	+	+	+	+	+	+	+		AM
Ampelisca gibba G.O. Sars, 1883	+	+	+	+	+		+		AM
Ampelisca intermedia Bellan-Santini & Diviacco, 1990			+						E
Ampelisca jaffaensis Bellan-Santini & Kaïm-Malka, 1977	+		+	+	+				E
Ampelisca ledoyeri Bellan-Santini & Kaïm-Malka, 1977	+			+	+				E
Ampelisca massiliensis Bellan-Santini & Kaïm-Malka, 1977	+			+			+		AM
Ampelisca melitae Dauvin & Bellan-Santini, 1985	+			+					E
Ampelisca multispinosa Bellan-Santini & Kaïm-Malka, 1977	+	+		+			+		AM
Ampelisca planierensis Bellan-Santini & Kaïm-Malka, 1977	+			+					E
Ampelisca provincialis Bellan-Santini & Kaïm-Malka, 1977	+			+			+		AM
Ampelisca pseudosarsi Bellan-Santini & Kaïm-Malka, 1977	+	+		+	+	+	+		AM
Ampelisca pseudospinimana Bellan-Santini & Kaïm-Malka, 1977	+	+	+	+	+	+	+		AM

Continued

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Ampelisca rubella Costa, 1864	+	+	+	+	+		+		AM
Ampelisca ruffoi Bellan-Santini & Kaïm-Malka, 1977	+	+	+	+	+		+		AM
Ampelisca sarsi Chevreux, 1888	+	+	+	+	+	+	+		AM
Ampelisca serraticaudata Chevreux, 1888	+	+			+		+		AM
Ampelisca spinifer Reid, 1951	+	+			+		+		AM
Ampelisca spinimana Chevreux, 1900	+						+		AM
Ampelisca spinipes Boeck, 1861	+	+	+	+	+	+	+		AM
Ampelisca tenuicornis Liljeborg, 1855	+	+	+	+	+		+	+	C
Ampelisca truncata Bellan-Santini & Kaïm-Malka, 1977	+	+		+	+				E
Ampelisca typica (Spence Bate, 1856)	+	+	+	+	+		+		AM
Ampelisca uncinata Chevreux, 1887	+						+		AM
Ampelisca unidentata Schellenberg, 1936	+	+		+	+		+		AM
Ampelisca vervecei Bellan-Santini & Kaïm-Malka, 1977	+			+					E
Byblis guernei Chevreux, 1887	+		+		+		+		AM
Haploops dellavallei Stebbing, 1893	+		+	+	+				E
Haploops nirae Kaïm-Malka, 1976	+				+		+		AM
Haploops proxima Chevreux, 1919	+	+					+		AM
Amphilochidae									
Amphilochoides boecki G.O. Sars, 1892	+						+		AM
Amphilochoides serratipes (Norman, 1869)	+						+		AM
Amphilochus brunneus Della Valle, 1893	+	+	+	+			+	+	C
Amphilochus manudens Spence Bate, 1862	+						+		AM
Amphilochus neapolitanus Della Valle, 1893	+	+	+	+	+	+	+	+	C
**Amphilochus picadurus* Barnard, 1962	+	+		+	+		+		AM
Amphilochus planierensis Ledoyer, 1977	+								E
Amphilochus spencebatei (Stebbing, 1876)	+	+		+			+		AM
Gitana abyssicola G.O. Sars, 1895	+						+		AM
Gitana longicarpus Ledoyer, 1977	+								E
Gitana sarsi Boeck, 1871	+	+		+	+		+		AM
Argissidae									
Argissa hamatipes (Norman, 1869)	+			+			+	+	C
Aristiidae									
Aristias neglectus Hansen, 1888	+	+	+	+	+		+		AM
Perrierella audouiniana (Spence Bate, 1857)	+		+	+	+		+		AM
Atylidae									
Atylus guttatus (Costa, 1851)	+	+	+	+	+	+	+		AM
Atylus massiliensis Bellan-Santini, 1975	+	+	+	+		+			E
Atylus swammerdami (H. Milne Edwards, 1830)	+			+	+		+		AM
Atylus vedlomensis (Spence Bate & Westwood, 1862)	+	+	+	+	+		+		AM
Lepechinella manco Barnard, 1973	+	+	+	+	+		+		AM
Nototropis falcatus (Metzer, 1871)	+						+		AM
Bathyporeiidae									
Bathyporeia borgi d'Udekem d'Acoz & Vader, 2005	+	+	+						E
Bathyporeia elegans Watkin, 1938	+						+		AM
Bathyporeia guilliamsoniana (Spence Bate, 1857)	+	+	+	+	+	+	+		AM
Bathyporeia lindstromi Stebbing, 1906	+	+			+				E
Bathyporeia phaiophthalma Bellan-Santini, 1973	+		+	+					E
Behningiellidae									
Cardiophilus baeri G.O. Sars, 1896						+			E
Biancolinidae									
Biancolina algicola Della Valle, 1893	+	+	+	+		+	+	+	C
Bogidiellidae									
Aurobogidiella italica (Karaman, 1979)	+								E
Marinobogidiella tyrrhenica (Schiecke, 1979)	+								E
Medigidiella chappuisi (Ruffo, 1952)	+	+	+		+				E
Medigidiella dalmatina (Karaman, 1953)			+						E
Racovella birramea Jaume, Gràcia & Boxshall, 2007	+								E
Calliopiidae									
Amphithopsis depressa Schiecke, 1976	+								E
Apherusa alacris Krapp-Schickel, 1969	+		+	+			+		AM
Apherusa bispinosa (Spence Bate, 1857)	+	+	+	+	+	+	+		AM
Apherusa chiereghinii Giordani-Soika, 1949	+	+	+	+	+	+			E
Apherusa mediterranea Chevreux, 1911	+	+		+			+		AM
Apherusa ruffoi Krapp-Schickel, 1969	+	+	+	+					E

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Apherusa vexatrix Krapp-Schickel, 1979	+	+	+	+	+				E
Leptamphopus massiliensis Ledoyer, 1977	+								E
Carangoliopsidae									
Carangoliopsis spinulosa Ledoyer, 1970	+	+	+	+			+		AM
Cheirocratidae									
Cheirocratus assimilis (Lilljeborg, 1852)	+	+		+	+		+		AM
Cheirocratus intermedius G.O. Sars, 1894	+						+		AM
Cheirocratus monodontis Karaman, 1977	+			+					E
Cheirocratus sundevalli (Rathke, 1843)	+	+	+	+	+	+	+		AM
Degocheirocratus spani Karaman, 1985			+						E
Cheluridae									
Chelura terebrans Philippi, 1839	+	+	+	+	+	+	+	+	C
Colomastigidae									
Colomastix pusilla Grube, 1861	+	+	+	+	+	+	+	+	C
Cressidae									
Cressa cristata Myers, 1969	+	+	+	+					E
**Cressa mediterranea* Ruffo, 1979	+	+		+			+		AM
Cyproideidae									
Peltocoxa gibbosa (Schiecke, 1977)	+			+			+		AM
Peltocoxa marioni Catta, 1875	+	+	+	+			+		AM
Peltocoxa mediterranea Schiecke, 1977	+	+		+	+		+		AM
Dexaminidae									
Dexamine spiniventris (Costa, 1853)	+	+	+	+	+	+	+		AM
Dexamine spinosa (Montagu, 1813)	+	+	+	+	+	+	+		AM
Dexamine thea Boeck, 1861	+		+	+	+	+	+		AM
Guernea coalita (Norman, 1868)	+	+		+			+		AM
Tritaeta gibbosa (Spence Bate, 1862)	+	+	+	+	+	+	+		AM
Dogielinotidae									
Parhyalella richardi (Chevreux, 1902)	+						+		AM
Endevouridae									
Ensayara carpinei Bellan-Santini, 1974	+								E
Epimeriidae									
Epimeria cornigera (Fabricius, 1779)	+		+	+	+		+		AM
Epimeria parasitica (M. Sars, 1858)	+						+		AM
Eusiridae									
Eusirus leptocarpus G.O. Sars, 1895	+						+		AM
Eusirus longipes Boeck, 1861	+	+	+	+	+		+		AM
Rhachotropis caeca Ledoyer, 1977	+	+		+	+		+		AM
Rhachotropis glabra Ledoyer, 1977	+	+					+		AM
Rhachotropis gracilis Bonnier, 1896	+						+		AM
Rhachotropis grimaldii (Chevreux, 1888)	+	+		+	+		+		AM
Rhachotropis inermis Ledoyer, 1977	+								E
Rhachotropis integricauda Cărăuşu, 1948	+		+	+			+		AM
Rhachotropis rostrata Bonnier, 1896	+	+	+	+	+		+		AM
Gammarellidae									
Gammarellus angulosus (Rathke, 1843)	+		+			+	+		AM
Gammaridae									
Echinogammarus dahli (Stock, 1968)	+								E
Echinogammarus foxi (Schellenberg, 1928)	+	+	+	+	+	+			E
Echinogammarus olivii (H. Milne Edwards, 1830)	+	+	+	+	+	+	+		AM
Echinogammarus planicrurus (Reid, 1940)	+		+	+	+		+		AM
Echinogammarus stocki Karaman, 1969	+		+	+					E
Echinogammarus veneris (Heller, 1865)	+	+	+	+	+				E
Gammarus aequicauda (Martynov, 1931)	+	+	+	+	+	+	+		AM
Gammarus crinicornis Stock, 1966	+	+	+	+	+	+	+		AM
Gammarus insensibilis Stock, 1966	+	+	+	+		+	+		AM
Gammarus subtypicus Stock, 1966	+	+	+	+	+	+			E
Longigammarus bruni Karaman, 1969	+								E
Longigammarus planasiae Messana & Ruffo, 2001	+								E
Lunulogammarus turcicus Krapp-Schickel, Ruffo & Schiecke, 1994					+				E
Neogammarus adriaticus Karaman, 1973			+						E
Neogammarus festai Ruffo, 1937	+								E
Neogammarus nudus Stock, 1971	+								E
Rhipidogammarus karamani Stock, 1971	+	+	+						E

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Rhipidogammarus rhipidiophorus (Catta, 1878)	+	+	+		+				E
Haustoriidae									
Haustorius algeriensis Mulot, 1968	+								E
Haustorius arenarius (Slabber, 1769)	+						+		AM
Haustorius orientalis Bellan-Santini, 2005					+				E
Hyalidae									
◆*Apohyale crassipes* (Heller, 1866)	+	+	+	+	+	+	+		AM
**Apohyale perieri* (Lucas, 1849)	+	+	+	+	+	+	+		AM
Apohyale stebbingi Chevreux, 1888	+		+	+	+		+		AM
Hyale camptonyx (Heller, 1866)	+	+	+	+	+	+	+		AM
Hyale michelini Krapp-Schickel & Bousfield, 2002	+								E
**Hyale pontica* Rathke, 1837	+	+			+	+	+		AM
Parhyale aquilina (Costa, 1857)	+	+	+	+	+	+	+		AM
Parhyale explorator Arresti, 1989					+		+		AM
Protohyale grimaldii (Chevreux, 1891)	+	+	+	+			+		AM
**Protohyale schmidti* (Heller, 1866)	+	+	+	+	+	+	+		AM
Ptilohyale eburnea (Krapp-Schickel, 1974)	+		+		+				E
Ptilohyale plumicornis (Heller, 1866)	+		+			+	+		AM
Serejohyale spinidactylus (Chevreux, 1926)	+						+		AM
Serejohyale youngi (Serejo, 2001)	+						+		AM
Iphimediidae									
Coboldus nitior Krapp-Schickel, 1974	+	+	+	+	+				E
Iphimedia brachygnatha Ruffo & Schiecke, 1979	+		+						E
Iphimedia carinata Heller, 1866	+	+	+						E
Iphimedia eblanae Spence Bate, 1857	+	+	+				+		AM
Iphimedia gibbula Ruffo & Schiecke, 1979	+								E
Iphimedia jugoslavica Karaman, 1975	+	+	+						E
Iphimedia minuta G.O. Sars, 1882	+	+	+	+	+		+		AM
Iphimedia obesa Rathke, 1843	+	+	+		+		+		AM
Iphimedia quasimodus Ruffo & Schiecke, 1979	+			+					E
Iphimedia serratipes Ruffo & Schiecke, 1979	+	+							E
Iphimedia vicina Ruffo & Schiecke, 1979	+	+			+				E
Kergueleniidae									
Kerguelenia reducta Ledoyer, 1977	+								E
Kuriidae									
Micropythia carinata (Spence Bate, 1862)	+	+	+			+	+		AM
Lafystiidae									
Lafystius sturionis Krøyer, 1842	+						+		AM
Leucothoidae									
Leucothoe euryonyx Walker, 1901	+	+	+	+			+		AM
Leucothoe incisa Robertson, 1892	+	+	+	+	+		+		AM
Leucothoe lilljeborgi Boeck, 1861	+	+	+	+	+		+		AM
Leucothoe oboa Karaman, 1971	+	+	+	+			+		AM
Leucothoe occulta Krapp-Schickel, 1975	+		+		+		+		AM
Leucothoe pachycera Della Valle, 1893	+	+	+						E
Leucothoe procera Spence Bate, 1857	+	+	+	+	+		+		AM
Leucothoe serraticarpa Della Valle, 1893	+		+	+	+				E
Leucothoe spinicarpa (Abildgaard, 1789)	+	+	+	+	+	+	+	+	C
Leucothoe venetiarum Giordani-Soika, 1950	+	+	+	+	+		+		AM
Liljeborgiidae									
Idunella excavata (Schecke, 1973)	+								E
Idunella nana (Schecke, 1973)	+								E
Idunella pirata Krapp-Schickel, 1975	+	+	+		+				E
Liljeborgia clytaemnestra d'Udekem d'Acoz, 2012	+	+							E
Liljeborgia dellavallei Stebbing, 1906	+	+		+					E
Liljeborgia kinahani (Bate, 1862)	+						+		AM
Liljeborgia pallida (Spence Bate, 1857)	+			+			+		AM
Liljeborgia psaltrica Krapp-Schickel, 1975	+		+	+	+				E
Lysianassidae									
Hippomedon ambiguus Ruffo, 1946	+	+	+						E
Hippomedon bidentatus Chevreux, 1903	+	+	+	+	+		+		AM
Hippomedon denticulatus (Spence Bate, 1857)	+			+			+		AM
Hippomedon massiliensis Bellan-Santini, 1965	+	+	+	+					E
Hippomedon oculatus Chevreux & Fage, 1925	+	+	+	+			+		AM

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Lepidepecreum crypticum Ruffo & Schiecke, 1977	+	+							E
Lepidepecreum longicornis (Spence Bate & Westwood, 1862)	+	+	+	+	+		+		AM
Lepidepecreum subclypeatum Ruffo & Schiecke, 1977	+		+	+					E
Lysianassa caesarea Ruffo, 1987				+	+				E
**Lysianassa costae* (H. Milne Edwards, 1830)	+	+	+	+	+		+		AM
Lysianassa insperata (Lincoln, 1979)	+						+		AM
**Lysianassa pilicornis* (Heller, 1866)	+	+	+	+	+		+		AM
Lysianassa plumosa Boeck, 1871	+	+	+	+	+		+		AM
Lysianassina longicornis (Lucas, 1849)	+	+	+	+	+				E
Lysianella dellavallei Stebbing, 1906	+	+	+	+	+				E
Nannonyx goesi (Boeck, 1871)						+	+		AM
Nannonyx propinquus Chevreux, 1911	+	+	+			+			E
Onesimoides mediterraneus Bellan-Santini, 1974	+								E
Orchomene grimaldii Chevreux, 1890	+	+	+	+	+				E
Orchomene humilis (Costa, 1853)	+	+	+	+	+	+	+		AM
Orchomene massiliensis Ledoyer, 1977	+		+	+	+				E
Orchomene similis (Chevreux, 1912)	+		+				+		AM
Paracentromedon crenulatum Chevreux, 1900	+	+		+	+		+		AM
Pardia punctata (Costa, 1851)	+	+					+		AM
Prachynella mediterranea Ruffo, 1975			+	+					E
Rhinolabia parthenopeia Ruffo, 1971	+		+						E
Socarnes filicornis (Heller, 1866)	+	+	+		+		+		AM
Trischizostoma nicaeense (Costa, 1853)	+						+		AM
Trischizostoma raschi Esmark & Boeck, 1861			+				+		AM
Tryphosa nana (Krøyer, 1846)	+	+	+	+	+		+		AM
Tryphosella dilatata (Chevreux, 1903)	+			+					E
Tryphosella longidactyla Ruffo, 1985	+		+				+		AM
Tryphosella minima (Chevreux, 1911)	+	+					+		AM
Tryphosella nanoides (Liljeborg, 1865)	+						+		AM
Tryphosella simillima Ruffo, 1985	+	+							E
Tryphosites alleni Sexton, 1911	+			+	+		+		AM
Tryphosites longipes (Spence Bate & Westwood, 1861)	+	+	+	+	+		+		AM
Maeridae									
Animoceradocus semiserratus (Spence Bate, 1862)	+			+	+		+		AM
Ceradocus orchestiipes Costa, 1853	+	+	+	+			+		AM
Elasmopus pectenicrus (Spence Bate, 1862)	+	+	+	+	+		+	+	C
**Elasmopus pocillimanus* (Spence Bate, 1862)	+	+	+	+	+		+	+	C
**Elasmopus rapax* Costa, 1853	+	+	+	+	+		+	+	C
Elasmopus vachoni Mateus & Mateus, 1966	+						+		AM
Linguimaera caesaris Krapp-Schickel, 2003		+			+			+	IP (LM)
Maera grossimana (Montagu, 1808)	+	+	+	+	+		+		AM
Maera hirondellei Chevreux, 1900	+	+	+	+	+		+		AM
Maera pachytelson Karaman & Ruffo, 1971	+	+			+				E
Maera schieckei Karaman & Ruffo, 1971	+								E
Maera sodalis Karaman & Ruffo, 1971	+		+	+	+				E
Maeropsis revelata (Krapp-Schickel, Martì & Ruffo, 1996)	+	+							E
Othomaera knudseni (Reid, 1951)	+						+		AM
Othomaera schmidti (Stephensen, 1915)	+	+	+	+	+				E
Quadrimaera ariadne (Krapp, Marti & Ruffo, 1996)				+					E
Quadrimaera aurora (Krapp-Schickel, Martì & Ruffo, 1996)	+	+	+	+	+				E
**Quadrimaera inaequipes* (Costa, 1851)	+	+	+	+	+		+		AM
Megaluropidae									
Megaluropus agilis Hoeck, 1889	+	+					+	+	C
Megaluropus massiliensis Ledoyer, 1976	+		+	+	+	+			E
Megaluropus monasteriensis Ledoyer, 1976	+	+	+	+	+				E
Melitidae									
Abludomelita aculeata (Chevreux, 1911)	+		+	+			+		AM
Abludomelita gladiosa (Spence Bate, 1862)	+	+	+				+		AM
Abludomelita obtusata (Montagu, 1813)	+						+		AM
Eriopisa coeca Karaman, 1955	+	+	+				+		AM
Eriopisa elongata (Bruzelius, 1859)	+	+	+	+	+		+	+	C
Eriopisa gracilis Ruffo & Schiecke, 1976	+	+							E
Eriopisella ruffoi Marti & Villora-Moreno, 1996	+								E
**Gammarella fucicola* (Leach, 1814)	+	+	+	+	+	+	+	+	C

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Gammarella garciai Marti & Villora-Moreno, 1995	+								E
Maerella tenuimana (Spence Bate, 1862)	+		+		+		+		AM
Melita bulla Karaman, 1978	+		+	+					E
Melita coroninii Heller, 1866	+		+	+			+		AM
Melita hergensis Reid, 1939	+	+	+	+	+		+		AM
**Melita palmata* (Montagu, 1804)	+	+	+	+	+	+	+		AM
Melita valesi Karaman, 1955	+		+	+	+				E
Melita virgula Krapp-Schickel, Ruffo & Schiecke, 1994					+				E
Nuuanu beatricis Jaume & Box, 2006	+								E
Melphidippidae									
Melphidippella macra (Norman, 1869)	+		+	+	+		+		AM
Oedicerotidae									
Arrhis mediterraneus Ledoyer, 1983	+	+					+		AM
Bathymedon acutifrons Bonnier, 1896	+						+		AM
Bathymedon banyulsensis Ledoyer, 1983	+								E
Bathymedon longirostris Jaume, Cartes & Sorbe, 1998	+	+					+		AM
Bathymedon monoculodiformis Ledoyer, 1983	+				+		+		AM
Deflexilodes acutipes (Ledoyer, 1983)	+	+		+			+		AM
Deflexilodes gibbosus (Chevreux, 1888)	+	+	+	+	+	+	+		AM
Deflexilodes griseus (Della Valle, 1893)	+	+	+	+		+			E
Deflexilodes subnudus (Norman, 1889)	+	+	+	+	+		+		AM
Halicreion aequicornis (Norman, 1869)	+						+		AM
Monoculodes carinatus (Spence Bate, 1857)	+	+	+	+	+		+		AM
Monoculodes latissimanus Stephensen, 1931	+						+		AM
Monoculodes packardi Boeck, 1871	+	+	+	+			+		AM
Oediceroides pilosa Ledoyer, 1983	+	+	+		+		+		AM
Oediceropsis brevicornis (Lilljeborg, 1865)	+				+		+		AM
Perioculodes aequimanus (Korssman, 1880)	+	+	+	+	+		+	+	C
Perioculodes longimanus (Spence Bate & Westwood, 1868)	+	+	+	+	+	+	+	+	C
Pontocrates altamarinus (Spence Bate & Westwood, 1862)	+	+		+			+		AM
Pontocrates arenarius (Spence Bate, 1858)	+	+	+	+	+		+		AM
Synchelidium haplocheles (Grube, 1864)	+	+	+	+	+		+	+	C
Synchelidium intermedium G.O. Sars, 1892				+			+		AM
Synchelidium longidigitatum Ruffo, 1947	+	+	+	+			+		AM
Synchelidium maculatum Stebbing, 1906	+	+		+	+	+	+		AM
Westwoodilla caecula (Spence Bate, 1857)	+			+			+		AM
Westwoodilla rectirostris (Della Valle, 1893)	+	+	+	+	+		+		AM
Opisidae									
Normanion abyssi Chevreux, 1903	+								E
Normanion chevreuxi Diviacco & Vader, 1988	+						+		AM
Normanion ruffoi Diviacco & Vader, 1988	+								E
Podoprionella fissicaudata Ledoyer, 1977	+								E
Pardaliscidae									
Arculfia trago Karaman, 1986	+								E
Halice abyssi Boeck, 1871	+	+	+	+	+		+		AM
Halice walkeri (Ledoyer, 1973)	+		+	+	+				E
Halicoides anomalus Walker, 1893	+	+					+		AM
Nicippe tumida Bruzelius, 1859	+	+	+	+			+		AM
Pardalisca brachydactyla Bellan-Santini, 1985	+								E
Pardalisca mediterranea Bellan-Santini, 1984	+						+		AM
Pardaliscella boecki (Malm, 1870)	+			+			+		AM
Pardaliscoides stebbingi Ledoyer, 1970	+	+							E
Pardaliscoides tenellus Stebbing, 1888	+								E
Phliantidae									
Pereionotus testudo (Montagu, 1808)	+	+	+	+	+		+		AM
Phoxocephalidae									
Harpinia agna Karaman, 1987	+			+	+				E
Harpinia ala Karaman, 1987	+	+							E
Harpinia antennaria Meinert, 1890	+	+	+	+			+		AM
Harpinia crenulata (Boeck, 1871)	+		+	+	+		+		AM
Harpinia dellavallei Chevreux, 1910	+	+	+	+	+	+	+		AM
Harpinia karamani King, 2004	+		+	+					E
Harpinia pectinata G.O. Sars, 1891	+	+	+	+	+		+		AM
Harpinia plumosa (Krøyer, 1842)			+				+		AM

Continued

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Harpinia zavodniki Karaman, 1987	+	+							E
Metaphoxus fultoni (Scott, 1890)	+	+	+	+	+		+		AM
Metaphoxus gruneri Karaman, 1986	+	+	+	+					E
Metaphoxus simplex (Spence Bate, 1857)	+	+	+	+	+		+		AM
Paraphoxus oculatus (G.O. Sars, 1879)	+		+	+			+	+	C
Phoxocephalus aquosus Karaman, 1985	+	+	+	+					E
Pleustidae									
Pleusymtes mediterraneus (Ledoyer, 1986)	+								E
Stenopleustes nodifer G.O. Sars, 1893	+						+		AM
Podoprionidae									
Podoprion bolivari Chevreux, 1891	+	+	+				+		AM
Podoprion mediterraneum Kaïm-Malka, 2004	+								E
Pontogeneiidae									
Dautzenbergia megacheir (Walker, 1897)	+						+	+	C
Eusiroides dellavallei Chevreux, 1899	+	+	+	+	+		+		AM
Scopelocheiridae									
Aroui setosus Chevreux, 1911	+			+					E
Scopelocheirus hopei (Costa, 1851)	+	+	+	+	+		+		AM
Scopelocheirus polymedus Bellan-Santini, 1985	+			+					E
Sebidae									
Seba aloe Karaman, 1971	+	+	+	+			+		AM
Sophrosynidae									
Sophrosyne hispana (Chevreux, 1888)	+	+	+	+	+		+		AM
Stegocephalidae									
Mediterexis mimonectes (Ruffo, 1975)	+		+				+		AM
Pseudo pseudophippsia (Bellan-Santini, 1985)				+					E
Stegocephaloides christianiensis Boeck, 1871	+		+	+	+		+		AM
Stenothoidae									
Metopa alderi (Spence Bate, 1857)	+						+		AM
**Stenothoe antennulariae* Della Valle, 1893	+			+					E
Stenothoe bosphorana Sowinsky, 1898	+		+	+	+		+		AM
Stenothoe cavimana Chevreux, 1908	+	+		+			+		AM
Stenothoe dollfusi Chevreux, 1887	+	+	+	+	+		+		AM
Stenothoe eduardi Krapp-Schickel, 1975	+			+	+		+		AM
Stenothoe elachista Krapp-Schickel, 1975	+	+		+	+				E
Stenothoe gallensis Walker, 1904	+	+		+	+		+	+	C
Stenothoe mandragora Krapp-Schickel, 1996	+	+	+	+					E
Stenothoe marina (Spence Bate, 1856)	+			+		+	+		AM
**Stenothoe monoculoides* (Montagu, 1815)	+	+	+	+	+	+	+	+	C
Stenothoe pieropan Krapp-Schickel, 1996	+	+							E
**Stenothoe tergestina* (Nebeski, 1881)	+	+	+	+	+	+	+		AM
Stenothoe valida Dana, 1852	+		+		+		+	+	C
Synopiidae									
Bruzelia typica Boeck, 1871	+		+	+	+		+		AM
Ileraustroe ilergetes (Barnard, 1964)	+	+			+				E
Pseudotiron bouvieri Chevreux, 1895	+			+	+				E
Syrrhoe affinis Chevreux, 1908	+	+	+		+		+	+	C
Syrrhoe angulipes Ledoyer, 1977	+								E
Syrrhoites barnardi Karaman, 1986	+								E
Syrrhoites capricornia Bellan-Santini, 1984	+								E
Syrrhoites cornuta Bellan-Santini, 1984	+								E
Syrrhoites pusilla Enequist, 1949	+						+		AM
Talitridae									
Britorchestia brito (Stebbing, 1891)	+			+		+	+		AM
Britorchestia ugolinii (Bellan-Santini & Ruffo, 1991)	+								E
Deshayesorchestia deshayesii (Audouin, 1826)	+	+	+	+	+	+	+		AM
Macarorchestia remyi (Schellenberg, 1950)	+		+	+					E
Orchestia cavimana Heller, 1865	+	+	+	+	+	+	+		AM
Orchestia gammarellus (Pallas, 1766)	+	+	+	+	+	+	+		AM
Orchestia kosswigi Ruffo, 1949					+				E
Orchestia mediterranea Costa, 1853	+	+	+	+	+	+	+		AM
Orchestia montagui Audouin, 1826	+	+	+	+	+	+			E
Orchestia stephenseni Cecchini, 1928	+	+	+	+	+	+			E
Platorchestia platensis Krøyer, 1845	+		+	+	+	+	+	+	C

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Sardorchestia pelecaniformis (Bellan-Santini & Ruffo, 1991)	+								E
Talitrus saltator (Montagu, 1808)	+	+	+	+	+	+	+		AM
Uristidae									
Caeconyx caeculus (G.O. Sars, 1891)	+				+		+		AM
Ichnopus spinicornis Boeck, 1861	+		+	+	+		+		AM
Ichnopus taurus Costa, 1853	+	+	+	+	+		+		AM
Tmetonyx nardonis (Heller, 1866)	+		+	+			+		AM
Tmetonyx similis (G.O. Sars, 1891)	+		+		+		+		AM
Urothoidae									
Urothoe corsica Bellan-Santini, 1965	+	+	+	+					E
Urothoe elegans (Spence Bate, 1857)	+	+	+	+	+		+	+	C
Urothoe grimaldii Chevreux, 1895	+		+	+	+		+	+	C
Urothoe hesperiae Conradi, Lopez-Gonzalez & Bellan-Santini, 1995	+						+		AM
Urothoe intermedia Bellan-Santini & Ruffo, 1986	+			+					E
Urothoe poseidonis Reibish, 1905	+		+	+			+		AM
Urothoe pulchella (Costa, 1853)	+	+	+	+	+		+		AM
Valettiidae									
Valettietta punctata Bellan-Santini, 1985				+					E
Ingolfiellidea									
Ingolfiellidae									
Ingolfiella ischitana Schiecke, 1973	+								E
Hyperiidea									
Anapronoidae									
Anapronoe reinhardti Stephensen, 1925					+		+	+	C
Bougisidae									
Bougisia ornata Laval, 1966	+				+		+	+	C
Brachyscelidae									
Brachyscelus crusculum Spence Bate, 1861	+	+	+	+	+		+	+	C
Brachyscelus globiceps (Claus, 1879)	+				+		+	+	C
Brachyscelus macrocephalus Stephensen, 1925	+	+	+	+	+		+	+	C
Brachyscelus rapax (Claus, 1879)	+	+		+	+		+	+	C
Thamneus rostratus Bovallius, 1887	+	+			+		+	+	C
Dairellidae									
Dairella californica (Bovallius, 1885)	+				+		+	+	C
Hyperiidae									
Hyperoche kroyeri Bovallius, 1887	+			+			+		AM
Hyperoche mediterranea Senna, 1908	+		+		+		+	+	C
Hyperoche picta Bovallius, 1889	+				+		+	+	C
Themisto gaudichaudii Guérin, 1825	+	+	+	+	+		+	+	C
Iulopididae									
Iulopis loveni Bovallius, 1887	+	+		+	+		+	+	C
Lestrigonidae									
Hyperietta luzoni (Stebbing, 1888)	+	+		+	+		+	+	C
Hyperietta stephenseni Bowman, 1973					+		+	+	C
Hyperietta vosseleri (Stebbing, 1888)					+		+	+	C
Hyperioides longipes Chevreux, 1900	+	+	+	+	+		+	+	C
Hyperioides sibaginis (Stebbing, 1888)					+		+	+	C
Hyperionyx macrodactylus (Stephensen, 1924)	+	+		+	+		+	+	C
Lestrigonus bengalensis Giles, 1887			+		+		+	+	C
Lestrigonus crucipes (Bovallius, 1889)					+		+	+	C
Lestrigonus latissimus (Bovallius, 1889)	+	+	+	+	+		+	+	C
Lestrigonus macrophthalmus (Vosseler, 1901)	+	+		+	+		+	+	C
Lestrigonus schizogeneios (Stebbing, 1888)	+	+	+	+	+		+	+	C
Lestrigonus shoemakeri Bowman, 1973					+		+	+	C
Phronimopsis spinifera Claus, 1879	+	+	+	+	+		+	+	C
Lycaeidae									
Lycaea bovallii Chevreux, 1900		+		+	+		+		AM
Lycaea bovallioides Stephensen, 1925		+		+			+		AM
Lycaea pachypoda (Claus, 1879)	+	+	+	+	+		+	+	C
Lycaea pauli Stebbing, 1888					+		+	+	C
Lycaea pulex Marion, 1874	+	+	+	+	+		+	+	C
Lycaea serrata Claus, 1879	+	+		+	+		+	+	C

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Simorhynchotus antennarius (Claus, 1871)	+	+	+		+		+	+	C
Lycaeopsidae									
Lycaeopsis themistoides Claus, 1879	+	+	+	+	+		+	+	C
Oxycephalidae									
Calamorhynchus pellucidus Streets, 1878	+	+	+	+	+		+	+	C
Cranocephalus scleroticus (Streets, 1878)	+	+			+		+	+	C
Glossocephalus milneedwardsi Bovallius, 1887	+		+		+		+	+	C
Leptocotis tenuirostris (Claus, 1871)					+		+	+	C
Oxycephalus clausii Bovallius, 1887	+		+		+		+	+	C
Oxycephalus latirostris Claus, 1889					+		+	+	C
Oxycephalus longipes Spandl, 1927					+		+	+	C
Oxycephalus piscator H. Milne Edwards, 1830	+	+	+	+	+		+	+	C
Rhabdosoma brevicaudatum Stebbing, 1888	+	+	+	+	+		+	+	C
Rhabdosoma whitei Spence Bate, 1862		+			+		+	+	C
Streetsia challengeri Stebbing, 1888	+	+		+	+		+	+	C
Streetsia mindanaonis (Stebbing, 1888)					+		+	+	C
Streetsia porcella (Claus, 1879)	+	+		+	+		+	+	C
Streetsia steenstrupi (Bovallius, 1887)					+		+	+	C
Paraphronimidae									
Paraphronima crassipes Claus, 1879	+	+	+	+	+		+	+	C
Paraphronima gracilis Claus, 1879	+	+	+	+	+		+	+	C
Parascelidae									
Euscelus steueri Spandl, 1924			+						E
Parascelus edwardsi Claus, 1879	+	+			+		+	+	C
Parascelus typhoides Claus, 1879	+	+	+	+	+		+	+	C
Schizoscelus ornatus Claus, 1879	+	+		+	+		+	+	C
Thyropus sphaeroma (Claus, 1879)					+		+	+	C
Phronimidae									
Phronima colletti Bovallius, 1887	+				+		+	+	C
Phronima curvipes Vosseler, 1901	+				+		+	+	C
Phronima pacifica Streets, 1887	+				+		+	+	C
Phronima sedentaria (Forskål, 1775)	+	+	+	+	+		+	+	C
Phronima solitaria Guérin-Meneville, 1836	+				+		+	+	C
Phronima stebbingi Vosseler, 1901	+				+		+	+	C
Phronimella elongata (Claus, 1862)	+	+	+	+	+		+	+	C
Phrosinidae									
Anchylomera blossevillei H. Milne Edwards, 1830	+	+	+	+	+		+	+	C
Phrosina semilunata Risso, 1882	+	+	+	+	+		+	+	C
Primno latreillei Stebbing, 1889					+		+	+	C
Primno macropa (Guérin-Méneville, 1836)	+	+	+	+	+		+	+	C
Platyscelidae									
Amphithyrus bispinosus Claus, 1879	+	+	+		+		+	+	C
Amphithyrus sculpturatus Claus, 1879	+	+	+		+		+	+	C
Amphithyrus similis Claus, 1879	+	+			+		+	+	C
Hemityphis rapax (H. Milne Edwards, 1830)					+		+	+	C
Hemityphis tenuimanus Claus, 1879	+	+		+	+		+	+	C
Paratyphis maculatus Claus, 1879					+		+	+	C
Paratyphis spinosus Spandl, 1924	+	+			+		+	+	C
Platyscelus armatus (Claus, 1879)					+		+	+	C
Platyscelus ovoides (Risso, 1816)	+	+	+	+	+		+	+	C
Platyscelus serratulus Stebbing, 1888	+	+	+	+	+		+	+	C
Tetrathyrus arafurae Stebbing, 1888					+		+	+	C
Tetrathyrus forcipatus (Claus, 1879)	+	+	+	+	+		+	+	C
Pronoidae									
Eupronoe maculata Claus, 1879	+	+	+	+	+		+	+	C
Eupronoe minuta Claus, 1879	+	+	+		+		+	+	C
Paralycaea gracilis Claus, 1879	+	+			+		+	+	C
Parapronoe parva Claus, 1879	+	+		+	+		+	+	C
Pronoe capito Guérin-Méneville, 1836					+		+	+	C
Scinidae									
Scina alberti Chevreux, 1919	+				+				E
Scina borealis (G.O. Sars, 1882)	+			+	+		+	+	C
Scina crassicornis (Fabricius, 1775)	+	+	+	+	+		+	+	C
Scina curvidactyla Chevreux, 1914	+				+		+	+	C

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Table 2. Continued

	WM	CM	AD	AS	LB	BS	AO	IP	ZC
Scina marginata (Bovallius, 1885)	+	+	+	+	+		+	+	C
Scina rattrayi Stebbing, 1895	+		+		+		+	+	C
Scina similis Stebbing, 1895	+			+	+		+	+	C
Scina spinosa Vosseler, 1901					+		+	+	C
Scina stebbingi Chevreux, 1919	+				+		+	+	C
Scina stenopus Stebbing, 1895	+				+		+	+	C
Scina tullbergi (Bovallius, 1885)	+		+		+		+	+	C
Tryphanidae									
Tryphana malmii Boeck, 1871					+		+	+	C
Vibiliidae									
Vibilia armata Bovallius, 1887	+	+	+	+	+		+	+	C
Vibilia australis Stebbing, 1888					+		+	+	C
Vibilia borealis Spence Bate & Westwood, 1868	+				+		+	+	C
Vibilia cultripes Vosseler, 1901	+	+	+		+		+	+	C
Vibilia gibbosa Bovallius, 1887	+				+		+	+	C
Vibilia jeangerardi Lucas, 1845	+	+	+	+	+		+	+	C
Vibilia propinqua Stebbing, 1888	+	+		+	+		+	+	C
Vibilia stebbingi Behning & Woltereck, 1912	+				+		+	+	C
Vibilia viatrix Bovallius, 1887	+	+	+		+		+	+	C

amphipod species) known to date in the Western Mediterranean, while in the Central Mediterranean Basin 56 species are found (53.9%). A total of 42 (40.4%) species has been reported from the Adriatic Sea, while from the Aegean Sea, 46 species (44.2%) are known. The Levantine Basin hosts the highest number of pelagic species (101; 97.1%), while the Black Sea is the most impoverished of the areas since no pelagic amphipod species have been reported to date.

Zoogeographical characterization

The participation of the four zoogeographical categories as percentages of the total Mediterranean species is given in Figure 3A, B for benthic and pelagic amphipods, respectively. As it is demonstrated, most benthic species (272; 53.4%) have an Atlanto-Mediterranean distribution, while 187 (36.8%) are Mediterranean endemics and only 46 species (9.1%) are cosmopolitan. Four species (0.8%) have Indo-Pacific origin from which, three are characterized as lessepsian migrants.

Unlike benthic, most pelagic species are cosmopolitan (99; 95.2%) while only three species (2.9%) are Antlanto-Mediterranean and two species (1.9%) are considered endemic.

In Figure 4, the percentages of the four zoogeographical categories, for the total of benthic species known from each Mediterranean area and the Black Sea, are shown. It is obvious that, in each Mediterranean area, Atlanto-Mediterranean species dominate, followed by endemic and cosmopolitan species. Species with Indo-Mediterranean distribution are found only in the Levantine Basin, Aegean Sea and the Central Mediterranean. In the Black Sea, the Atlanto-Mediterranean species dominate but the cosmopolitan species overrule the endemic ones.

Multivariate analysis

The dendrogram resulting from the similarity matrix based on the Jaccard coefficient, for the total of benthic species known from each Mediterranean area and the Black Sea is presented in Figure 5. The Aegean Sea, Central Basin and Adriatic Sea areas form the first group with high similarity (58.8%). The Levantine Basin forms the second group and joins the first group at the level of 57.0%, while the Western Mediterranean (third group) is added at the level of 53.2%. The Black Sea forms the fourth group and is added at a much lower similarity level (25.4%). The ANOSIM test gave the value of 0.833 for the Global R ($P < 0.05$), which indicates that the previously identified groups seem to be significantly different. In contrast to the benthic, no strongly-supported differences were found among the pelagic species fauna of each area. The ANOSIM test gave the value of 0.889 for the Global R, but at a significance level of $P < 0.133$, which indicates no significant differences.

DISCUSSION

Amphipod fauna

Bellan-Santini & Ruffo (1998) numbered 451 Mediterranean benthic amphipod species. The review of the up-to-date literature revealed the presence of 509 benthic species that belong to 70 families and 197 genera in the Mediterranean and the Black Sea. Most of this increase in knowledge is due to the intensive research in some areas of the Mediterranean, as well as to the fact that more and more alien species have colonized the Mediterranean Sea.

Information given by Ortiz & Petrescu (2007) and Bakir (2012) regarding the benthic fauna of the Libya Sea and the Marmara Sea, respectively, were not included in this paper. The above authors have reported species not normally distributed in the Mediterranean Sea, and consequently, reservations are maintained until their presence in the Mediterranean Sea is confirmed satisfactorily and the probability of erroneous identifications is eliminated.

At the beginning of the 20th Century, Stephensen (1918, 1924, 1925) reported the presence of 80 pelagic amphipod

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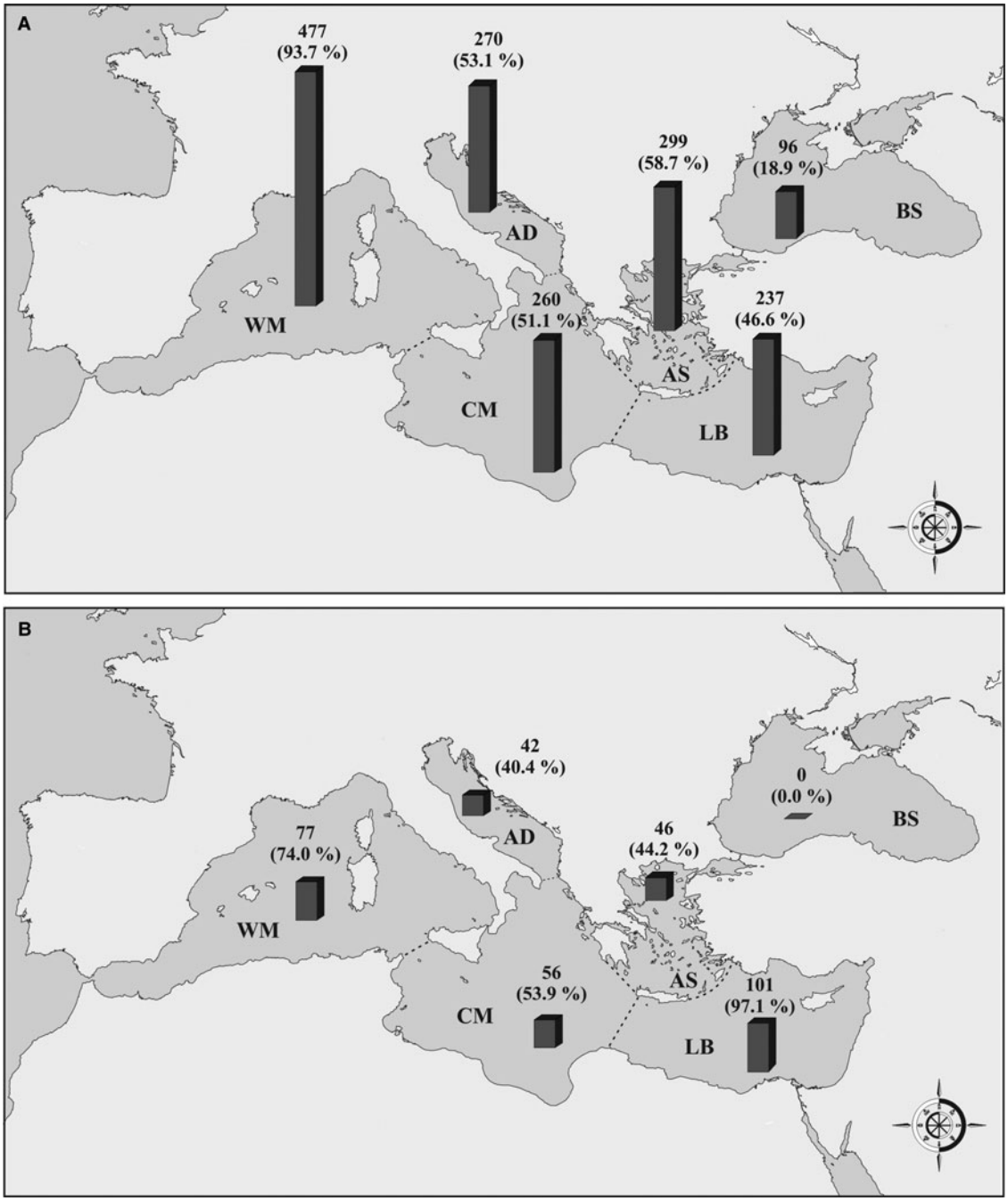

Fig. 2. Distribution of the known benthic (A) and pelagic (B) amphipod species in the main geographical areas of the Mediterranean and the Black Seas, as numbers and percentages of the total Mediterranean species number. Area abbreviations as in Table 2.

species from the Mediterranean Sea. Today, this number has been increased to 104 species belonging to 19 families and 45 genera. This increase is mainly due to the very recent research work done in the Levantine Basin by Zelickman (2005).

Comparison of the Aegean fauna to those of the neighbouring seas

Taking into account Table 2 and Figure 2A, B, data on the Mediterranean water masses and circulation (e.g. Ovchinnikov, 1966; The POEM Group, 1992; Poulos *et al.*, 1997; Pinardi & Masetti, 2000; Bergamasco & Malanotte-Rizzoli, 2010) along with data on temperature and salinity variations (e.g. Özsoy *et al.*, 1993; Artegiani *et al.*, 1997; Bas, 2009) and biogeographical aspects (e.g. Pérès, 1967; Bianchi & Morri, 2000; Por & Dimentman, 2006; Coll *et al.*, 2010), the following assertions can be made.

WESTERN MEDITERRANEAN (WM)

477 benthic species (Ruffo, 1982, 1989, 1993, 1998; Krapp-Schickel & Vader, 1998; Cartes & Sorbe, 1999; Conradi & López-Gonzalez, 1999; Guerra-García *et al.*, 2001a, b, c; Messana & Ruffo, 2001; Dauvin & Bellan-Santini, 2002; Guerra-García & Takeuchi, 2002;

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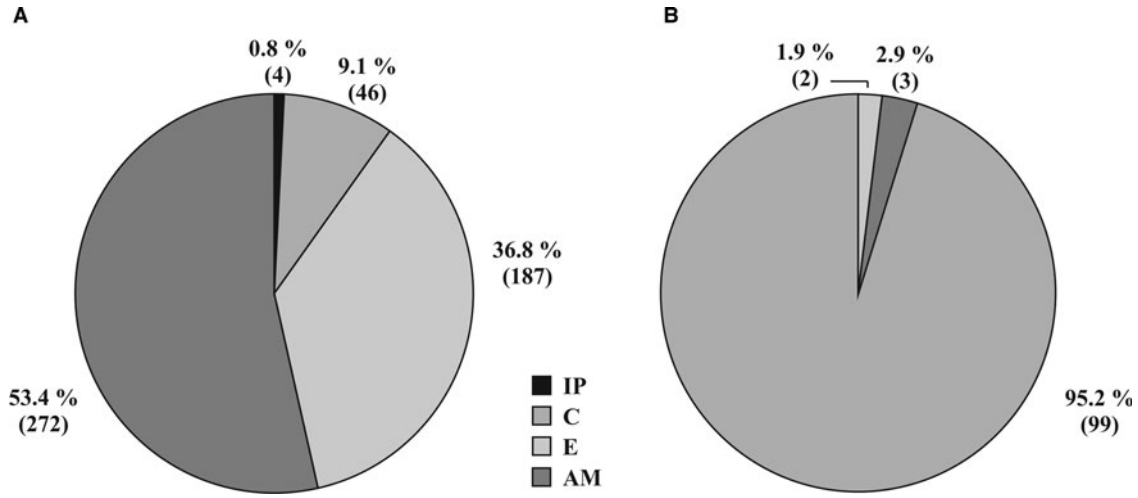

Fig. 3. Benthic (A) and pelagic (B) amphipod fauna composition in the Mediterranean and Black Seas (percentages and real numbers) regarding the zoogeographical characterization of the species. AM, Atlanto-Mediterranean; C, cosmopolitan; E, endemic; IP, Indo-Pacific.

Guerra-García *et al.*, 2002; Cartes *et al.*, 2003; King, 2004; Peart, 2004; Jaume & Box, 2006; Grimes *et al.*, 2009; Zakhama-Sraieb *et al.*, 2009; De-la-Ossa-Carretero *et al.*, 2010; Izquirtdo & Guerra-García, 2010; Myers *et al.*, 2010; Ruffo, 2010; Krapp-Schickel *et al.*, 2011; Sturaro & Guerra-García, 2011) and 77 pelagic species (Stephensen, 1918, 1924, 1925; Chevreux, 1919; Bakalem & Dauvin, 1995; Ruffo, 2010). The highest benthic amphipod species richness in the western Mediterranean Sea could be attributed to the fact that the influx of Atlantic species is initially limited to this large basin, which, having a wide range of physico-chemical parameters, permits the settlement of both cold and warm water species in its northern and southern parts, respectively (Koukouras *et al.*, 2001). The high species number observed in the Western Mediterranean should also be attributed to the extensive research efforts carried out in this area (Bellan-Santini & Ruffo, 1998). The Western Mediterranean comes second

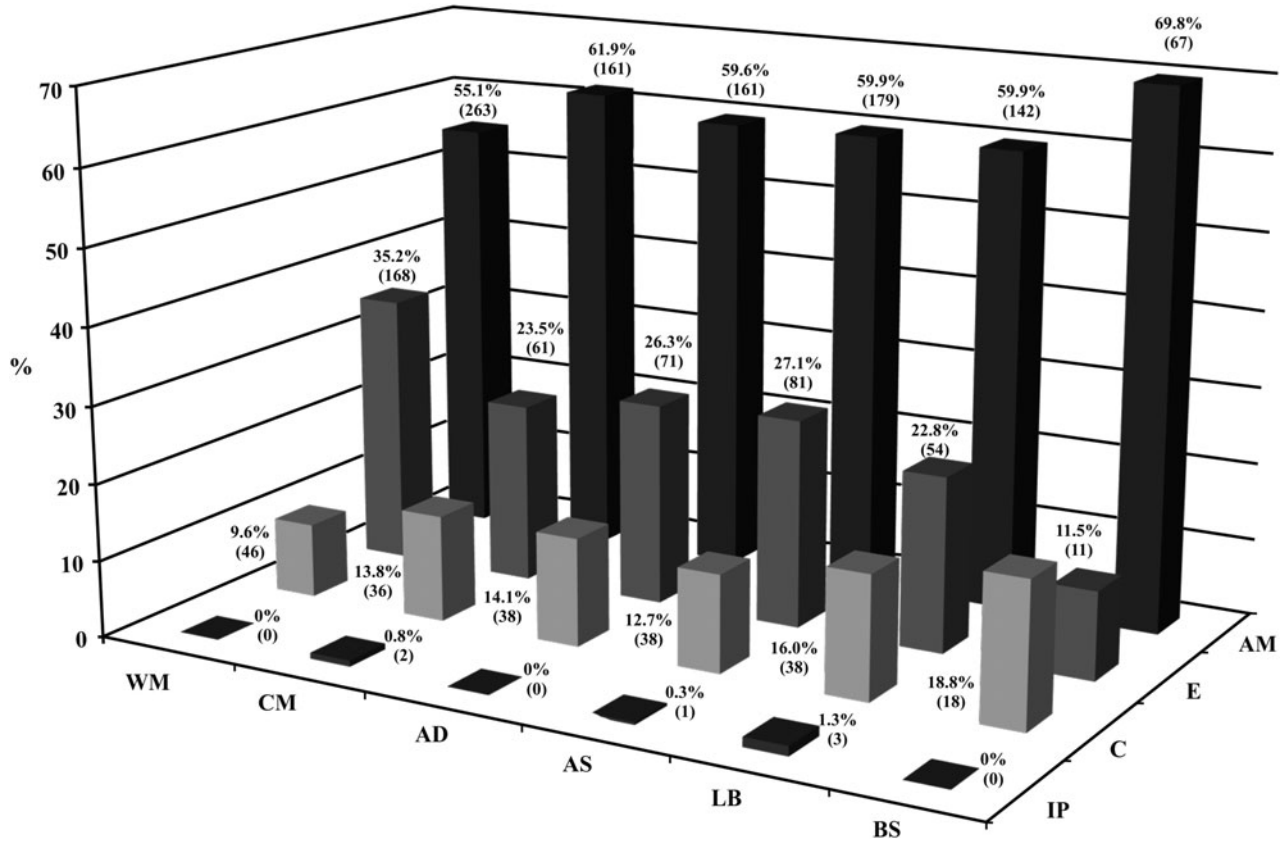

Fig. 4. Percentages (real numbers) regarding the zoogeographical categories in the Mediterranean territorial areas and the Black Sea (calculations have been made for the total of species known from each area). AM. Atlanto-Mediterranean; C, cosmopolitan; E, endemic; IP, Indo-Pacific.

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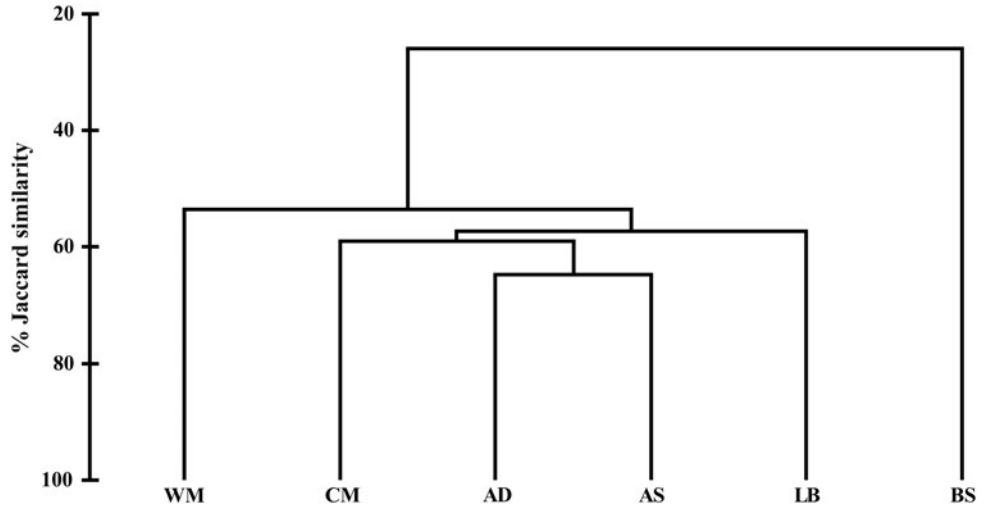

Fig. 5. Dendrogram resulting from the similarity matrix based on the Jaccard's coefficient. Area abbreviations as in Table 2.

in pelagic amphipod species number following the Levantine Basin. This should be attributed to the lack of recent information. It is likely that after future research efforts, the number of species in this area will exceed that of the Levantine Basin.

CENTRAL MEDITERRANEAN (CM)

260 benthic species (Ruffo, 1982, 1989, 1993, 1998; Stefanidou & Voultsiadou-Koukoura, 1995; Krapp-Schickel & Vader, 1998; Madurel & Cartes, 2003, 2006; Prato & Biancolino, 2005; Zakhama-Sraieb *et al.*, 2009, 2010; Ruffo, 2010; Zakhama-Sraieb & Charfi-Cheikhrouha, 2010; d' Udekem d' Acoz, 2012) and 56 pelagic species (Stephensen, 1918, 1924, 1925; Ruffo, 2010). The Central Mediterranean comes fourth in benthic amphipod species number following the Western Mediterranean, Aegean Sea and Adriatic Sea. The Central Mediterranean should have a higher species number compared to other areas of the Mediterranean Sea, because of its direct contact with the Western Mediterranean and its larger area. The reduced species number could be attributed to the limited sampling effort carried out in this area (especially on the coasts of Libya and Tunisia) (Zakhama-Sraieb *et al.*, 2009). It is expected that, with adequate sampling effort, the number of species in this area will reach approximately that of the Western basin and will exceed those in other Mediterranean areas. However, the Central Mediterranean comes third in pelagic amphipod species number. This should be attributed to its neighbouring with the Western Mediterranean Sea.

ADRIATIC SEA (AD)

270 benthic species (Ruffo, 1982, 1989, 1993, 1998; Stefanidou & Voultsiadou-Koukoura, 1995; Krapp-Schickel & Vader, 1998; Fiser, 2002; King, 2004; Casellato *et al.*, 2007; Ruffo, 2010) and 42 pelagic species (Stephensen, 1918, 1924, 1925; Ruffo, 2010). The Adriatic Sea, although intensively sampled, displays a relatively low species number. This should mainly be attributed to: (a) its considerably restricted communication with the Western basin (Ovchinnikov, 1966; Theocharis *et al.*, 1993); (b) the higher range of temperature variations (Delépine *et al.*, 1987); and (c) the shallow waters of its northern part with relatively low winter temperatures and low salinity (Lacombe & Tchernia, 1960). Based on the above, Pérès (1967) and Por & Dimentman (1989) characterized the Adriatic fauna as impoverished compared to the other Mediterranean areas. Por & Dimentman (2006) emphasized the differentiation of this basin and stated that it should be treated separately from all the other Mediterranean areas.

AEGEAN SEA (AS)

299 benthic species (Ruffo, 1982, 1989, 1993, 1998; Stefanidou & Voultsiadou-Koukoura, 1995; Krapp-Schickel & Vader, 1998; Çinar *et al.*, 2002; Bakir & Katağan, 2005; Doğan *et al.*, 2005; Sezgin *et al.*, 2006, 2007; Voultsiadou *et al.*, 2007; Bakir *et al.*, 2010, 2011; Aslan-Cihangir & Pancucci-Papadopoulou, 2011; Özaydinli & Coleman, 2012) and 46 pelagic species (Stephensen, 1918, 1924, 1925; Veini & Kiortsis, 1974). Although the Aegean Sea is located further away from Gibraltar (the main pathway of enrichment for the Mediterranean fauna) (Ekman, 1967) than the Adriatic and Central Mediterranean, it is inhabited by a larger number of species. The main reasons for a higher species number in the Aegean could be: (a) the higher habitat variability; and (b) its more direct exchange with the Western basin (Ovchinnikov, 1966; Pérès, 1967; Por & Dimentman, 2006). Pérès (1967) considered the benthic fauna of the Aegean Sea (especially that of the northern Aegean), very similar to that of the Western Mediterranean area (especially the northern part).

LEVANTINE BASIN (LB)

237 benthic species (Ruffo, 1982, 1989, 1993, 1998; Stefanidou & Voultsiadou-Koukoura, 1995; Kocataş *et al.*, 2001; Sorbe & Galil, 2002; Sorbe *et al.*, 2002; Krapp-Schickel, 2003; Peart, 2004; Bellan-Santini, 2005; Bakir *et al.*, 2008; Sezgin *et al.*, 2009) and 101 pelagic species (Stephensen, 1918, 1924, 1926; Zelickman, 2005). The relative low number of benthic species should probably be attributed to the ongoing adverse conditions, high temperatures, high salinity, oligotrophic conditions, low concentration of nutrients, high sediment deposition (e.g. Por & Dimentman, 1989; Azov, 1991; Psarra *et al.*, 2000), prevailing in this area combined with the instability of its environment in the recent geological scale which have led to an impoverished fauna (Por & Dimentman, 1989; Koukouras *et al.*, 2001; Arvanitidis *et al.*, 2002; Sorbe *et al.*, 2002). According to Sarà (1985), the higher temperature and salinity values in the area seem to be restrictive for many

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Atlanto-Mediterranean species. However, it should be taken into serious consideration the fact that the Levantine Basin is suffering from reduced sampling effort (Bellan-Santini & Ruffo, 1998; Por & Dimentman, 2006). Conversely, the fauna of the Levantine Basin became enriched with three lessepsian migrants, two of which, *Photis lamellifera* and *Linguimaera caesaris,* have extended their distribution to the Central Mediterranean. In contrast to the benthic amphipods, the Levantine Basin hosts the highest number of pelagic species in the Mediterranean. This finding is exclusively due to the recent work of Zelickman (2005) where, after having examined a large collection of pelagic amphipods from the coast of Israel, reported 63 species for the first time from the Mediterranean Sea. Zelickman (2005) increased the number of the until-then known species from 38 to 101.

BLACK SEA (BS)

96 benthic species (Ruffo, 1982, 1989, 1993, 1998; Alexeev, 1991; Stefanidou & Voultsiadou-Koukoura, 1995; Sezgin *et al.*, 2001; Balkis *et al.*, 2002; Gönlügür-Demirci, 2006; Kalkan *et al.*, 2006; Kirkim *et al.*, 2006; Sezgin & Katağan, 2007; Taeca & Gomoiu, 2007) and no pelagic species. The extremely low species number of the Black Sea benthic fauna, as well as the complete absence of pelagic species, is a result of the unfavourable hydrological conditions prevailing in the area, especially the low salinities and temperatures and the abiotic conditions in its deeper part. The restricted vertical water interchange allows hydrogen sulphide to form and persist below 150 m, thus most of the fauna occupies only the uppermost 130–140 m of the water column (13% of the Black Sea) (Caspers, 1957; Tortonese & Demir, 1960; Longhurst, 1998; Sezgin & Katağan, 2007). The odd hydrological conditions prevailing in the area seem to be unfavourable for other pelagic groups too, like cephalopods (Vafidis *et al.*, 2009).

Based on the number of species hosted in each area, a west–east gradient with decreasing values can be observed in agreement with differences in environmental variables, such as latitude, salinity, temperature, and water circulation, as well as the distance from the Strait of Gibraltar. This eastward decline of species number has been observed for the total macrobenthic fauna (e.g. Pérès & Picard, 1958; Fredj, 1974; Băcescu, 1985; Koukouras *et al.*, 2001) as well as for many animal groups separately (e.g. Arvanitidis, 2000, Arvanitidis *et al.*, 2002; Koukouras & Karachle, 2005; Koukouras *et al.*, 2007).

Zoogeographical characterization

As it is shown in Figure 3A, most benthic species are Atlanto-Mediterranean, followed by Mediterranean endemics, cosmopolitan and finally Indo-Pacific species. A similar pattern was observed by Fredj (1974) and Koukouras *et al.* (2001) while studying the fauna of the Mediterranean as a whole, and also by Stefanidou & Voultsiadou-Koukoura (1995) and Bellan-Santini & Ruffo (1998) while studying the benthic amphipod fauna exclusively.

The above results may be interpreted as a result of the possible evolutionary history of the Mediterranean and Black Seas' fauna. The fact that more than half (53.4%) of the benthic species are common to the Atlantic Ocean and the Mediterranean Sea shows the great affinity between the faunas hosted in the two areas but also suggests to a large extent that the Mediterranean fauna is of Atlantic origin (Bellan-Santini & Ruffo, 1998).

The high percentage of the endemic species in the Mediterranean and the Black Seas which approaches 37% in the case of benthic amphipods, can be interpreted as a result of the relatively low vagility of the benthic amphipods and the absence of pelagic larval stages in their biological cycle (Bellan-Santini & Ruffo, 1998). However, other ecological or geological factors probably play a significant role: (1) the eventful geological history of the region, which has led to an important diversification of habitats; and (2) the diversity in the origin of the species, which have either colonized the Mediterranean Sea after its last re-opening or remained as relics of the Tethys Sea (Ekman, 1967; Bellan-Santini, 1985; Bianchi & Mori, 2000; Por & Dimentman, 2006). The Western Mediterranean presents the highest endemism in benthic amphipods (168 endemic species, 65 found exclusively in WM) which can be explained by the great diversity of biotopes and the fact that the majority of these endemics are of Atlantic origin (neoendemics) (Bellan-Santini & Ruffo, 1998; Koukouras *et al.*, 2001).

Cosmopolitan species comprise only 9.1% of the benthic fauna. Most of these cosmopolitan amphipods are eurythermal or/and euryahaline or they can disperse passively (fouling species). In the case of some species cosmopolitanism still needs confirmation, since they probably consist of species complexes (e.g. *Ampithoe ramondi*) with diverse geographical distribution (Bellan-Santini & Ruffo, 1998).

Only three species (0.6% of the total number of benthic amphipod species) seem to follow the criteria of Por (1978) and thus are characterized as lessepsian migrants. These species are:

- *Bemlos leptocheirus* (Walker, 1909): reported from the coasts of Egypt in the Mediterranean (Bellan-Santini *et al.*, 1998). This species is characterized as lessepsian migrant with reservation since its presence in the Mediterranean is based only on one single reference. Zenetos *et al.* (2010) characterized this species as casual and not-established in the area.
- *Linguimarea caesaris* Krapp-Schickel, 2003: one of the new species created after the splitting up of the 'superspecies' *Maera hamigera* Haswell, 1879. Krapp-Schickel (2003) after having studied previously named *M. hamigera* material from the Mediterranean, Red Sea, Madagascar and Western Samoa distinguished differences that allowed her to assign this material to a different species with an Indo-Mediterranean distribution.
- *Photis lamellifera* Schellenberg, 1928: widely distributed in the Indo-Pacific Ocean and it is known in the Mediterranean from the coasts of Israel (Ruffo, 1959) and of Catania (Krapp-Schickel, 1993a). *Photis lamellifera* as in the case of *B. leptocheirus and L. caesaris* has been introduced in the Mediterranean through the Suez Canal (Galil, 2011).

The number of lessepsian migrants is much less than in other species groups like Decapoda and Mollusca, where lessepsian migrants represent about 12% and 9% of the total Mediterranean fauna, respectively (Koukouras *et al.*, 2010; Tzomos *et al.*, 2012). More intensive research especially on the south coasts of the Levantine Basin could reveal more Lessepsian amphipod species in the future. In addition, the difficulty faced by benthic amphipods regarding dispersion due to the lack of planktonic larvae should also be taken

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into consideration for the low number of lessepsian amphipods (Bellan-Santini *et al.*, 1998). Apart from the three species mentioned above, six more species (*Cymadusa filosa* Savigny, 1816, *Unciolella lunata* Chevreux, 1911, *Gammaropsis togoensis* (Schellenberg, 1925), *Elasmopus pectenicrus* (Spence Bate, 1862), *Stenothoe gallensis* Walker, 1904 and *Caprella scaura* Templeton, 1836)) were reported as lessepsian migrants (Zakhama-Sraieb & Charfi-Cheikhrouha, 2010) in the past, but according to the relevant literature and careful verification and reference cross-checking (Bachelet *et al.*, 2003; Peart, 2004; Zenetos *et al.*, 2005, 2010; Krapp *et al.*, 2006; Winfield *et al.*, 2006; Galil, 2007; Martínez & Adarraga, 2008; Lowry & Hughes, 2009; Galil, 2011) these species should no longer be considered lessepsian migrants. One species (0.2%), *Ampithoe bizseli* (Özaydinli & Coleman, 2012), is also of Indo-Pacific origin but it was introduced into the Mediterranean by travelling on ship hulls from the Indian Ocean to one of the big harbours of Turkey (Izmir; Özaydinli & Coleman, 2012) thus it should not be considered as a lessepsian migrant.

In contrast to benthic amphipods, species with cosmopolitan origin (95.2%) dominate in pelagic amphipods, while only 2.9% (three species) of the total pelagic fauna are of Atlanto-Mediterranean origin. From the 104 pelagic species found in the Mediterranean only two species (1.9%), *Euscelus steueri* Spandl, 1924 and *Scina alberti* Chevreux, 1919, are endemic. This difference between benthic and pelagic amphipods regarding their distributional ability should be mainly attributed to the different mobility pattern and different life cycle adopted by the pelagic species. Pelagic amphipods combine active with passive movement while benthic amphipods move only actively. Furthermore, many are, to some extent, obligate commensals or parasites of cosmopolitan tunicates, medusae, coelenterates or siphonophores (Vinogradov *et al.*, 1996) and thus disperse passively in the oceans of the world.

Faunal similarities

The Aegean Sea, although less studied than some other regions of the Mediterranean and being located far away from Gibraltar, hosts a rich amphipod fauna (second in species diversity after the Western Mediterranean) making it more similar to the western areas faunas.

The Western Mediterranean presents a quite distinct fauna and shows less affinity with the faunas of the rest of the Mediterranean areas due to the high species number it hosts, as well as the high number of species found only in this area. One hundred and ten species are found exclusively in the Western Mediterranean in contrast to an impressively lower number of species found exclusively in each of the other areas (six species in the Black Sea, none in the Central Mediterranean, six in the Adriatic Sea, six in the Aegean Sea, seven in the Levantine Basin). The Black Sea has a very low affinity with the faunas of the Mediterranean areas, mainly because of its impoverishment (presence of 96 species only), but also because of species found only in this area (e.g. ponto-caspian species, *Cardiophilus baeri* Sars, 1896). The marine inhabitants of the Black Sea are divided into three categories according to their origin: (1) Pontian relics: the most ancient inhabitants found in waters with low salinity. These species used to occupy dominant positions in the water bodies that existed before the formation of the present Black Sea, Caspian Seas and the Azov Sea; (2) Boreal–Atlantic relics (cold-water relics): marine species originating from cold seas and living in deeper layers of the sea; and (3) Mediterranean species: these species constitute the highest ratio in the Black Sea fauna, comprising up to 80% of the total fauna. However, not all species inhabiting the Mediterranean have been able to adapt and become naturalized. Some have been prevented from doing so by low water salinity, some by low water temperatures during winter, and others by the lack of suitable deep water habitats (Zaitsev & Mamaev, 1997).

In the case of the pelagic amphipods no strongly supported differences were found among the faunas of each area. This should be attributed to the different mobility pattern adopted by the pelagic species.

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REFERENCES

Alexeev R.P. (1991) Amphipods from hydrotechnical structures in the north-western part of the Black Sea. *Hydrobiologia* 223, 79–80.

Artegiani A., Bregant D., Paschini E., Pinardi N., Raicich F. and Russo A. (1997) The Adriatic Sea general circulation. Part II: Baroclinic circulation structure. *Journal of Physical Oceanography* 27, 1515–1532.

Arvanitidis C. (2000) Polychaete fauna of the Aegean Sea: inventory and new information. *Bulletin of Marine Science* 66, 73–96.

Arvanitidis C., Bellan G., Drakopoulos P., Valavanis V., Dounas C., Koukouras A. and Eleftheriou A. (2002) Seascape biodiversity patterns along the Mediterranean and the Black Sea: lessons from the biogeography of benthic polychaetes. *Marine Ecology Progress Series* 244, 139–152.

Aslan-Cihangir H. and Pancucci-Papadopoulou M.A. (2011) Spatial and temporal variation of soft-bottom peracarid (Crustacea, Peracarida) infauna in the Canakkale Strait (Turkey). *Mediterranean Marine Science* 12, 153–182.

Azov Y. (1991) Eastern Mediterranean — a marine desert? *Marine Pollution Bulletin* 23, 225–32.

Băcescu M. (1985) The effect of the geological and physicochemical factors on the distribution of marine plants and animals in the Mediterranean. In Moraitou-Apostolopoulou M. and Kiortsis V. (eds) *Mediterranean marine ecosystems*. New York and London: Plenum Press, pp. 195–212.

Bachelet G., Dauvin J.-C. and Sorbe J.C. (2003) An updated checklist of marine and brackish water Amphipoda (Crustacea, Peracarida) of the southern Bay of Biscay (NE Atlantic). *Cahiers de Biologie Marine* 44, 121–151.

Bakalem A. and Dauvin J.-C. (1995) Inventaire des crustacés amphipodes (Gammaridea, Caprellidea, Hyperiidea) des côtes d'Algérie: essai de synthèse. *Mésogée* 54, 49–62.

Bakir K. (2012) Contributions to the knowledge of crustaceans on soft bottoms in the Sea of Marmara, with a checklist. *Crustaceana* 85, 219–236.

https://doi.org/10.1017/S002531541200183X Published online by Cambridge University Press

Bakir K. and Katağan T. (2005) Crustacean diversity of the coralligenous beds of Markiz Island (Aegean coast of Turkey). *Crustaceana* 78, 873–883.

Bakir K., Katağan T. and Sezgin M. (2008) *Parhyale explorator* Arresti, 1989 (Amphipoda, Talitroidea): first Mediterranean record of this Atlantic amphipod. *Crustaceana* 81, 557–562.

Bakir K., Sezgin M. and Katağan T. (2010) First record of *Abludomelita aculeata* (Crustacea, Amphipoda) from the eastern Mediterranean. *Marine Biodiversity Records* 3, e33. DOI: 10.1017/S175526720999090X.

Bakir K., Sezgin M. and Myers A.A. (2011) A new species of amphipod, *Megamphopus katagani* sp. nov. (Crustacea, Peracarida, Photidae) from the Sea of Marmara (Turkey), with a key to the species of *Megamphopus* in the North Atlantic, Mediterranean and associated Seas. *Zootaxa* 2791, 63–67.

Balkis N., Aibayrak S. and Balkis H. (2002) Check-list of the Crustacea fauna of the Bosphorus. *Turkish Journal of Marince Sciences* 8, 157–164.

Bas C. (2009) The Mediterranean: a synoptic overview. *Contributions to Science* 5, 25–39.

Bellan-Santini D. (1985) Amphipodes profonds de Méditerranée (Campagnes Biomède I, Polymède I et II). *Bollettino del Museo Civico di Storia Naturale di Verona* 10, 263–313.

Bellan-Santini D. (2005) European species of *Haustorius* (Crustacea, Amphipoda, Haustoriidae), with description of a new Mediterranean species. *Journal of Natural History* 39, 1101–1110.

Bellan-Santini D. and Kaïm-Malka M.A. (1977) *Ampelisca* nouvelles de Méditerranée (Crustacea, Amphipoda). *Bollettino del Museo Civico di Storia Naturale di Verona* 4, 479–523.

Bellan-Santini D. and Ruffo S. (1998) Faunistics and zoogeography. In Ruffo (ed.) *The Amphipoda of the Mediterranean, Part 4. Mémoires de l'Institut Océanographique, Monaco* 13, 895–911.

Bergamasco A. and Malanotte-Rizzoli P. (2010) The circulation of the Mediterranean Sea: a historical review of experimental investigations. *Advances in Oceanography and Limnology* 1, 11–28.

Bianchi C.N. and Morri C. (2000) Marine biodiversity of the Mediterranean Sea: situation, problems and prospects for future research. *Marine Pollution Bulletin* 40, 367–376.

Cartes J.E. and Sorbe J.C. (1999) Deep-water amphipods from the Catalan Sea slope (western Mediterranean): bathymetric distribution, assemblage composition and biological characteristics. *Journal of Natural History* 33, 1133–1158.

Cartes J.E., Jaume D. and Madurell T. (2003) Local changes in the composition and community structure of suprabenthic peracarid crustaceans on the bathyal Mediterranean: influence of environmental factors. *Marine Biology* 143, 745–758.

Cartes J.E., Mamouridis V. and Fanelli E. (2011) Deep-sea suprabenthos assemblages (Crustacea) off the Balearic Islands (western Mediterranean): mesoscale variability in diversity and production. *Journal of Sea Research* 65, 340–354.

Cartes J.E., Maynou F., Fanelli E., Romano C., Mamouridis V. and Papiol V. (2009) The distribution of megabenthic, invertebrate epifauna in the Balearic Basin (western Mediterranean) between 400 and 2300 m: environmental gradients influencing assemblages composition and biomass trends. *Journal of Sea Research* 61, 244–257.

Carus J.V. (1885) *Prodromus faunae Mediterraneae. Volume 1: Coelenterata, Echinodermata, Vermes, Arthropoda*. Stuttgart: E. Schwizerbart'sche Verlagshandlung (E. Koch).

Casellato S., Masiero L., Sichirollo E. and Soresi S. (2007) Hidden secrets of the Northern Adriatic: 'Tegnúe', peculiar reefs. *Central European Journal of Biology* 2, 122–136.

Caspers H. (1957) Black Sea and Sea of Azov. *Geological Society of America Memoirs* 67, 801–890.

Cavedini P. (1982) Contributo alla conoscenza dei caprellidi del Mediterraneo (Crustacea, Amphipoda). *Bollettino del Museo Civico di Storia Naturale di Verona* 8, 493–531.

Chevreux E. (1919) Révision des Scinidae provenant de S.A.S. le Prince de Monaco. *Bulletin de l'Institut Océanographique, Monaco* 352, 1–17.

Chevreux E. and Fage L. (1925) *Faune de France. Volume 9: Amphipodes*. Paris: P. Lechevalier.

Çinar M.E., Katağan T., Ergen Z. and Sezgin M. (2002) Zoobenthos-inhabiting *Sarcotragus muscarum* (Porifera: Demospongiae) from the Aegean Sea. *Hydrobiologia* 482, 107–117.

Clarke K.R. (1993) Non-parametric multivariate analyses of changes in community structure. *Australian Journal of Ecology* 18, 117–143.

Clarke K.R. and Warwick R.M. (1994) *Change in marine communities: an approach to statistical analysis and interpretation*. 2nd edition. Plymouth: Natural Environment Research Council, Plymouth Marine Laboratory.

Coll M., Piroddi C., Steenbeek J., Kaschner K., Ben Rais Lasram F., Aguzzi J., Ballesteros E., Bianchi C.N., Corbera J., Dailianis T., Danovaro R., Estrada M., Froglia C., Galil B.S., Gasol J.M., Gertwagen R., Gil J., Guilhaumon F., Kesner-Reyes K., Kitsos M.-S., Koukouras A., Lampadariou N., Laxamana E., López-Fé de la Cuadra C.M., Lotze H.K., Martin D., Mouillot D., Oro D., Raicevich S., Rius-Barile J., Saiz-Salinas J.I., San Vicente C., Somot S., Templado J., Turon X., Vafidis D., Villanueva R. and Voultsiadou E. (2010) The biodiversity of the Mediterranean Sea: Estimates, patterns, and threats. *PLoS ONE* 5, e11842.

Conradi M. and López-González P.J. (1999) The benthic Gammaridea (Crustacea, Amphipoda) fauna of Algeciras Bay (Strait of Gibraltar): distributional ecology and some biogeographical considerations. *Helgoland Marine Research* 53, 2–8.

Dauvin J.-C. and Bellan-Santini D. (2002) Les crustacés amphipodes Gammaridea benthiques des côtes françaises metropolitaines: bilan des connaissances. *Crustaceana* 75, 299–340.

De-la-Ossa-Carretero J.A., Dauvin J.-C., Del-Pilar-Ruso Y., Giménez-Casalduero F. and Sánchez-Lizaso J.L. (2010) Inventory of benthic amphipods from fine sand community of the Iberian Peninsula east coast (Spain), western Mediterranean, with new records. *Marine Biodiversity Records* 3, e119. DOI: 10.1071/S1755267210001065.

Delépine R., Boudouresque C.F., Frada-Orestano C., Noailles M.C. and Asensi A. (1987) Algues et autres végétaux marins. In Fischer W., Bauchot M.L. and Schneider M. (eds) *Fishes FAO d'identification des espèces pour les besoins de la pêche (Revision 1), Mediterranèe et mer Noire. Zone de pêche 37. Volume 1. Végétaux et Invertébres*. Rome: FAO, pp. 3–136.

Demir M. (1952–1954) The invertebrate benthos of the Bosporus and of the littoral of the Sea of Marmara closer to the Bosporus. *Hidrobiyoloji Araştırma Enstitüsünün Yayinl* 3, 1–615.

Doğan A., Çinar M.E., Önen M., Ergen Z. and Katağan T. (2005) Seasonal dynamics of soft bottom zoobenthic communities in polluted and unpolluted areas of Izmir Bay (Aegean Sea). *Senckenbergiana maritima* 35, 133–145.

Drensky P. (1951) Über Entomostraca und Malacostraca (Cr.) aus dem Ägäischen Meer. *Annuaire de l'Université de Sofia (Biologie)* 46, 235–250.

d'Udekem d'Acoz C. (2010) Contribution to the knowledge of European Liljeborgiidae (Crustacea, Amphipoda), with considerations on the family and its affinities. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Biologie* 80, 127–259.

d'Udekem d'Acoz C. (2012) The genus *Liljeborgia* in the Mediterranean Sea, with the description of a new species (Crustacea, Amphipoda, Liljeborgiidae). *Zootaxa* 3310, 51–65.

d'Udekem d'Acoz C. and Vader W. (2005) The Mediterranean *Bathyporeia* revisited (Crustacea, Amphipoda, Pontoporeiidae), with the description of a new species. *Bollettino del Museo Civico di Storia Naturale di Verona* 29, 3–38.

Ekman S. (1967) *Zoogeography of the sea*. London: Sidgwick and Jackson.

Fiser C. (2002) A contribution to the knowledge of amphipods of the group Gammaridea (Amphipoda, Gammaridea) on the Slovene coast. *Natura Sloveniae* 4, 33–39.

Fredj G. (1974) Stockage et exploitation des données en écologie marine. Considérations biogéographiques sur le peuplement benthique de la Mediterranée. *Mémoires de l'Institut Océanographique, Monaco* 7, 1–88.

Fredj G. and Laubier L. (1985) The deep Mediterranean benthos. In Moraitou-Apostolopoulou M. and Kiortsis V. (eds) *Mediterranean marine ecosystems*. New York: Plenum Press, pp. 109–145.

Galil B.S. (2007) Seeing Red: alien species along the Mediterranean coast of Israel. *Aquatic Invasions* 2, 281–312.

Galil B.S. (2011) The alien crustaceans in the Mediterranean Sea: an historical review. In Galil B.S., Clark P. and Carlton J.T. (eds) *In the wrong place—Alien marine crustaceans: distribution, biology and impacts*. (*Invading nature; Springer series in Invasion Ecology, no. 6*). Berlin: Springer Verlag, pp. 377–401.

Geldiay R., Kocataş A. and Krapp-Schickel G. (1970) Some littoral amphipods from the Gulf of Izmir (Egean Sea, Turkey, Mediterranean). *Memorie del Museo civico di storia naturale di Verona* 18, 369–387.

Ghigi A., Issel R., Brian A., Santucci R., Citterio V. and Alzani F. (1929) Ricerche faunistiche nelle isole Italiane dell' Egeo. *Archivio Zoologico Italiano* 12/13, 423–460.

Gönlügür-Demirci G. (2006) Crustacea fauna of the Turkish Black Sea coasts: a checklist. *Crustaceana* 79, 1129–1139.

Gottlieb E. (1960) The benthonic Amphipoda of the Mediterranean coast of Israel. l. Notes on the geographical distribution. *Bulletin of the Research Council* of *Israel, Zoology* 9, 157–166.

Grimes S., Dauvin J.-C. and Ruellet T. (2009) New records of marine amphipod fauna (Crustacea: Peracarida) on the Algerian coast. *Marine Biodiversity Records* 2, e134. DOI: 10.1017/S1755267209990522.

Guérin M.F.E. (1832) I.re Classe. Crustacés. In Brullé A. (ed.) *Deuxième Section—des animaux articulés. Expédition Scientifique du Morée. Section des Sciences Physiques, Tome 3 (1re Partie) (Zoologie)*. Paris: Levrault, pp. 30–50, plate 27.

Guerra-García J.M. and Takeuchi I. (2002) The Caprellidea (Crustacea, Amphipoda) from Ceuta, North Africa, with the description of three species of *Caprella*, a key to the species of *Caprella*, and biogeographical discussion. *Journal of Natural History* 36, 675–713.

Guerra-García J.M., Cabezas P., Baeza-Rojano E., Espinosa F. and García-Gómez J.C. (2009) Is the north side of the Strait of Gibraltar more diverse than the south side? A case study using the intertidal peracarids (Crustacea, Malacostraca) associated to the seaweed *Corallina elongata*. *Journal of the Marine Biological Association of the United Kingdom* 89, 387–397.

Guerra-García J.M., Sánchez-Moyano J.E. and García-Gómez J.C. (2000) Redescription of *Caprella hirsuta* Mayer, 1890 (Crustacea, Amphipoda, Caprellidea) from the Strait of Gibraltar. *Miscellània Zoològica* 23, 69–78.

Guerra-García J.M., Sánchez-Moyano J.E. and García-Gómez J.C. (2001a) Two new hairy species of *Caprella* (Amphipoda) from the strait of Gibraltar, with a redescription of *Caprella grandimana*. *Journal of Crustacean Biology* 21, 1014–1030.

Guerra-García J.M., Sánchez-Moyano J.E. and García-Gómez J.C. (2001b) A new species of *Caprella* (Amphipoda, Caprellidea) from Algeciras Bay, Southern Spain. *Crustaceana* 74, 211–219.

Guerra-García J.M., Sánchez-Moyano J.E. and García-Gómez J.C. (2001c) Two new species of *Caprella* (Crustacea, Amphipoda, Caprellidea) collected from sandy bottoms in the Strait of Gibraltar. *Hydrobiologia* 448, 181–192.

Guerra-García J.M., Sánchez-Moyano J.E. and García-Gómez J.C. (2002) *Caprella caulerpensis* (Crustacea, Amphipoda), a new species associated with *Caulerpa prolifera* from the Strait of Gibraltar. *Journal of the Marine Biological Association of the United Kingdom* 82, 843–846.

Heller C. (1866) Beiträge zur näheren Kenntniss der Amphipoden des Adriatischen Meeres. *Denkschriften der Kaiserlichen Akademie der Wissenschaften, Mathematischs–Naturwissenschaftliche Klasse* 26, 1–62.

Izquirtdo D. and Guerra-García J.M. (2010) Distribution patterns of the peracarid crustaceans associated with the alga *Corallina elongata* along the intertidal rocky shores of the Iberian Peninsula. *Helgoland Marine Research* 65, 233–243.

Jacquotte R. (1962) Etude des fonds de maërl de Méditerranée. *Recueil des Travaux de la Station Marine d' Endoume* 26, 141–235.

Jaume D. and Box A. (2006) A new species of *Nuuanu* (Amphipoda, Gammaridea, Melitidae) from shallow sandy bottoms of the Balearic Islands (W Mediterranean). *Scientia Marina* 70, 735–747.

Kalkan E., Karhan S.U. and Mutlu E. (2006) Preliminary investigations on crustaceans associated with the Mediterranean mussel (*Mytilus galloprovincialis* Lamarck, 1819) beds in the upper infralittoral of the Bosporus (Turkey). *Annales Series Historia Naturalis* 16, 5–8.

Karakiri M. and Nicolaidou A. (1986) Some notes on the Amphipoda collected during benthic surveys in Greek waters. *Rapport de la Commission Internationale de la Mer Méditerranée* 30, 1–2.

Karakiri M. and Nicolaidou A. (1988) On a collection of Amphipoda from the Northern Sporades, Aegean Sea. *Crustaceana* 13, 107–114.

Kevrekidis T. and Koukouras A. (1988) Bionomy of the amphipods in the Evros Delta (North Aegean Sea). *Marine Ecology* 9, 199–212.

King R.A. (2004) A description of *Harpinia karamani* sp. nov. (Amphipoda, Phoxocephalidae) from the Mediterranean, with a redescription of *Harpinia truncata* Sars, 1891. *Zootaxa* 724, 1–10.

Kirkim F., Sezgin M., Katağan T., Bat L. and Aydemir E. (2006) Some benthic soft-bottom crustaceans along the Anatolian coast of the Black Sea. *Crustaceana* 79, 1323–1332.

Kocataş A. (1976a) Note preliminaire sur les amphipodes recueillis dans les horizons supérieurs de l'étage infralittoral rocheux du Golfe d'Izmir (Turquie). *Téthys* 7, 235–240.

Kocataş A. (1976b). Note sur le peuplement à *Cystoseira crinita* Bory dans le Golfe d'Izmir (Turquie). *Téthys* 7, 241–248.

Kocataş A., Katağan T. and Benli H.A. (2001) Contribution to the knowledge of the crustacean fauna of Cyprus. *Israel Journal of Zoology* 47, 147–160.

Kocataş A., Katağan T., Sezgin M., Kirkim F. and Koçak C. (2004) Crustacean diversity among the *Cystoseira* facies of the Aegean Coast of Turkey. *Turkish Journal of Zoology* 28, 309–316.

Koukouras A. and Karachle P. (2005) The polyplacophoran (Eumollusca, Mollusca) fauna of the Aegean Sea with the description of a new species, and comparison with those of the neigbouring seas. *Journal of Biological Research* 3, 23–28.

Koukouras A., Kitsos M.-S., Tzomos Th. and Tselepides A. (2010) Evolution of the entrance rate and of the spatio-temporal distribution of Lessepsian Crustacea Decapoda in the Mediterranean Sea. *Crustaceana* 83, 1409–1430.

Koukouras A., Russo A., Voultsiadou-Koukoura E., Dounas C. and Chintiroglou C. (1992) Relationship of sponge macrofauna with the morphology of their hosts in the North Aegean Sea. *Internationale Revue der Gesamten Hydrobiologie und Hydrographe* 77, 609–619.

Koukouras A., Sinis A.I., Bobori D., Kazantzidis S. and Kitsos M.-S. (2007) The echinoderm (Deuterostomia) fauna of the Aegean Sea, and comparison with those of the neighbouring seas. *Journal of Biological Research* 7, 67–92.

Koukouras A., Voultsiadou-Koukoura E., Chintiroglou C. and Dounas C. (1985) Benthic bionomy of the North Aegean Sea. III. A comparison of the macrobenthic animal assemblages associated with seven sponge species. *Cahiers de Biologie Marine* 26, 301–319.

Koukouras A., Voultsiadou E., Kitsos M.-S. and Doulgeraki S. (2001) Macrobenthic fauna diversity in the Aegean Sea, affinities with other Mediterranean regions and the Black Sea. *Bios (Macedonia, Greece)* 6, 61–76.

Krapp-Schickel G. (1993a) Do algal-dwelling amphipods react to the 'critical zones' of a coastal slope? *Journal of Natural History* 27, 883–900.

Krapp-Schickel G. (1993b) *Hyale* Rathke, 1837. In Ruffo (ed.) *The Amphipoda of the Mediterranean, Part 3. Mémoires de l'Institut Océanographique, Monaco* 13, 728–738.

Krapp-Schickel T. (2003) *Linguimaera* Pirlot, 1936 (Crustacea, Amphipoda, Melitidae), a valid genus. *Memoirs of the Museum of Victoria* 60, 257–283.

Krapp-Schickel T. and Vader W. (1998) What is, and what is not, *Caprella acanthifera* Leach, 1814 (Amphipoda, Caprellidae)? Part 1: the *Acanthifera*-group. *Journal of Natural History* 32, 949–967.

Krapp-Schickel T., Guerra-García J.M., Baeza-Rojano E. and Cabezas M.P. (2011) Taxonomy and ecology of some gammaridean species (Crustacea, Amphipoda) from Tarifa Island, southern Spain. *Journal of the Marine Biological Association of the United Kingdom* 91, 447–453.

Krapp T., Lang C., Libertini A. and Melzer R.R. (2006) *Caprella scaura* Templeton, 1836 sensu lato (Amphipoda, Caprellidae) in the Mediterranean. *Organisms, Diversity and Evolution* 6, 77–81.

Lacombe H. and Tchernia P. (1960) Quelques traits généraux de l'hydrologie Méditerranéenne. *Cahiers Océanographiques* 12, 527–547.

Longhurst A. (1998) *Ecological geography of the sea*. London: Academic Press.

Lowry J.K. and Hughes L.E. (2009) Maeridae, the *Elasmopus* group. *Zootaxa* 2260, 643–702.

Madurel T. and Cartes J.E. (2003) The suprabenthic peracarid fauna collected at bathyal depths in the Ionian Sea (Eastern Mediterranean). *Crustaceana* 76, 611–624.

Madurel T. and Cartes J.E. (2006) Trophic relationships and food consumption of slope dwelling macrourids from the bathyal Ionian Sea (Eastern Mediterranean). *Marine Biology* 148, 1325–1338.

Martínez J. and Adarraga I. (2008) First record of invasive caprellid *Caprella scaura* Templeton, 1836 sensu lato (Crustacea, Amphipoda, Caprellidae) from the Iberian Peninsula. *Aquatic Invasions* 3, 165–171.

Mateus A. and Mateus E. (1962) Une nouvelle espèce d'*Hyale* (Amphipoda) de la Méditerranée. *Vie et Milieu* 12, 595–603.

Mayer P. (1890) Die Caprelliden des Golfes von Neapel und der angrenzenden Meeres -Abschnitte. *Fauna und Flora des Golfes von Neapel* 17, 1–55.

Messana G. and Ruffo S. (2001) A new species of *Longigammarus* (Crustacea, Amphipoda, Gammaridae) from the Pianosa Island (Tuscany Archipelago). *Italian Journal of Zoology* 68, 161–164.

Monterosso B. (1915) Caprellidae del golfo di Catania. *Atti della Accademia Gioenia di scienze naturali in Catania* 8, 1–16.

Myers A.A. (1969a) A revision of the amphipod genus *Microdeutopus* Costa (Gammaridea, Aoridae). *Bulletin of the British Museum (Natural History), (Zoology)* 17, 93–148.

Myers A.A. (1969b) The ecology and systematics of gammaridean Amphipoda of the island of Khios. *Biologia Gallo-Hellenica* 2, 19–34.

Myers A.A. (1972a) The genus *Aora* Krøyer, 1845 (Amphipoda, Gammaridea) in the Mediterranean. *Memorie del Museo Civico di Storia Naturale di Verona* 20, 283–301.

Myers A.A. (1972b) A new species of Amphipoda (*Microdeutopus obtusatus* sp. nov.) from the Aegean Sea. *Memorie del Museo civico di storia naturale di Verona* 20, 303–312.

Myers A.A., De-La-Ossa-Carretero J.A. and Dauvin J.-C. (2010) A new species of *Medicorophium* Bousfield, *M. longisetosum* n. sp. from the western Mediterranean, coast of Spain. *Zootaxa* 2450, 53–60.

Ortiz M. and Petrescu I. (2007) The marine Amphipoda (Crustacea, Gammaridea) of the republic of Libya, Southeastern Mediterranean. *Travaux du Muséum National d'Histoire Naturelle 'Grigore Antipa'* L, 11–23.

Özaydinli M. and Coleman CH.O. (2012) *Ampithoe bizseli* n. sp. (Crustacea, Amphipoda) from the west coast of Turkey. *Zootaxa*, 3388, 17–28.

Özsoy E., Hecht A., Ünlüta Ü., Brenner S., Sur H.I., Bishop J., Latif M. A., Rozentraub Z. and Oğuz T. (1993) A synthesis of the Levantine Basin circulation and hydrography, 1985–1990. *Deep-Sea Research Part II: Topical Studies in Oceanography* 40, 1075–1119.

Ovchinnikov I.M. (1966) Circulation in the surface and intermediate layer of the Mediterranean. *Oceanology* 6, 48–59.

Peart R.A. (2004) A revision of the *Cymadusa filosa* complex (Crustacea, Amphipoda, Corophioidea, Ampithoidae). *Journal of Natural History* 38, 301–336.

Pérès J.M. (1967) The Mediterranean benthos. *Oceanography and Marine Biology: an Annual Review* 5, 449–533.

Pérès J.M. and Picard J. (1958) Campagne de la 'Calypso' en Méditerranée Nord-Orientale. 2. Recherches sur les peuplements benthiques de la Méditerranée Nord-Orientale. *Annales de l'Institut Océanographique, Paris* 34, 213–281.

Petrescu I. (1998) Contributions to the knowledge of amphipods (Crustacea, Amphipoda) from Romania. 7. Amphipods from Agigea (Black Sea). *Travaux du Muséum National d'Histoire Naturelle 'Grigore Antipa'* 48, 51–73.

Pinardi N. and Masetti E. (2000) Variability of the large scale general circulation of the Mediterranean Sea from observations and modelling: a review. *Paleogeography, Palaeoclimatology, Palaeoecology* 158, 153–173.

POEM group (Robinson A.R., Malanote-Rizzoli P., Hecht A., Michelato A., Roether W., Theocharis A., Ünlüta Ü., Pinardi N., Artegiani A., Bergamasco A., Bishop J., Brenner S., Christianidis S., Gacic M., Georgopoulos D., Golnaraghi M., Hausmann M., Junghaus G.H., Lascaratos A., Latif A.M., Leslie W.G., Oguz T., Özsoy E., Papageorgiou E., Paschini E., Rozentroub Z., Sansone E., Scarazzato P., Schlitzer R., Spezie G.-C., Zodiatis G., Athanassiadou L., Gerges M. and Osman M.) (1992) General circulation of the Eastern Mediterranean. *Earth-Science Reviews* 32, 285–309.

https://doi.org/10.1017/S002531541200183X Published online by Cambridge University Press

Por F.D. (1978) *Lessepsian migration. The influx of Red Sea biota into the Mediterranean by way of the Suez Canal (Ecological studies, 23)*. Berlin: Springer-Verlag.

Por F.D. and Dimentman Ch. (1989) The Legacy of Tethys: an aquatic biogeography of the Levant. In Dumont H.J. and Werger M.J.A. (eds) *Monographiae biologicae. Volume 63*. Dordrecht and Boston: Kluwer Academic Publishers, pp. 1–214.

Por F.D. and Dimentman Ch. (2006) *Mare Nostrum. Neogene and anthropic natural history of the Mediterranean Basin, with emphasis on the Levant*. Sofia–Moscow: Pensoft Publishers.

Poulos S.E., Drakopoulos P.G. and Collins M.B. (1997) Seasonal variability in sea surface oceanographic conditions in the Aegean Sea (Eastern Mediterranean): an overview. *Journal of Marine Systems* 13, 225–244.

Prato E. and Biandolino F. (2005) Amphipod biodiversity of shallow water in the Taranto seas (north-western Ionian Sea). *Journal of the Marine Biological Association of the United Kingdom* 85, 333–338.

Psarra S., Tselepides A. and Ignatiades L. (2000) Primary productivity in the oligotrophic Cretan Sea (NE Mediterranean): Seasonal and interannual variability. *Progress in Oceanography* 46, 187–204.

Ruffo S. (1959) Contributo alla conoscenze degli anfipodi del Mar Rosso (materiali raccolti a Ghardaqa e nel Golfo di Aqaba). Contributions to the knowledge of the Red Sea No. 13. *Bulletin of the Sea Fisheries Research Station, Haifa* 20, 1–26.

Ruffo S. (ed.) (1982) The Amphipoda of the Mediterranean. Part 1. Gammaridea (Acanthonozomatidae to Gammaridae). *Mémoires de l'Institut Océanographique, Monaco* 13, 1–364.

Ruffo S. (ed.) (1989) The Amphipoda of the Mediterranean. Part 2. Gammaridea (Haustoriidae to Lysianassidae). *Mémoires de l' Institut Océanographique, Monaco* 13, 365–576.

Ruffo S. (ed.) (1993) Gammaridea (Melphidipiidae to Talitridae) — Ingolfiellidea—Caprellidea. The Amphipoda of the Mediterranean, Part 3. *Mémoires de l'Institut Océanographique, Monaco* 13, 577–813.

Ruffo S. (ed.) (1998) The Amphipoda of the Mediterranean, Part 4. Localities and map. Addenda to Parts 1–3. Key to families. Ecology. Faunistics and zoogeography. Bibliography. Index. *Mémoires de l'Institut Océanographique, Monaco* 13, 815–959.

Ruffo S. (2010) Amphipoda. In Relini G. (ed.) *Checklist della Flora e della Fauna dei Mari Italiani (Parte II). Biologia Marina Mediterranea* 17, 499–515.

Ruffo S. and Wieser W. (1952) Untersuchungen über die Algenbewohnende Mikrofauna mariner Hartboden. II. Observazioni sistematiche ed ecologiche su alcuni Anfipodi delle xoste mediterranee italiane. *Memorie Museo Civico di Storia Naturale di Verona* 3, 11–30.

Sarà M. (1985) Ecological factors and their biogeographic consequences in the Mediterranean ecosystems. In Moraitou-Apostolopoulou M. and Kiortsis V. (eds) *Mediterranean Marine Ecosystems. (NATO Conference Series I, Ecology, Volume. 8)*. London and New York: Plenum Press, pp. 1–17.

Sezgin M. and Katağan T. (2007) An account of our knowledge of the amphipod fauna of the Black Sea. *Crustaceana* 80, 1–11.

Sezgin M., Ateş A.S., Katağan T., Bakir K. and Yalçin Özdilek Ş. (2009) Notes on amphipods *Caprella andreae* Mayer, 1890 and *Podocerus chelonophilus* (Chevreux & Guerne, 1888) collected from the loggerhead sea turtle, *Caretta caretta*, off the Mediterranean and the Aegean coasts of Turkey. *Turkish Journal of Zoology* 33, 433–437.

Sezgin M., Katağan T. and Kocataş A. (2006) A new record of *Peltocoxa gibbosa* (Schiecke, 1977) (Amphipoda) from the eastern Mediterranean. *Crustaceana* 79, 1011–1014.

Sezgin M., Katağan T., Kirkim F. and Aydemir E. (2007) Soft-bottom crustaceans from the Saros bay (NE Aegean Sea). *Rapport de la Commission International de la Mer Méditerranée* 38, 599.

Sezgin M., Kocataş A. and Katağan T. (2001) Amphipod fauna of the Turkish Central Black Sea Region. *Turkish Journal of Zoology* 25, 57–61.

Sorbe J.-C. and Galil B.S. (2002) The bathyal Amphipoda off the Levantine coast, Eastern Mediterranean. *Crustaceana* 75, 957–968.

Sorbe J.-C., Basin A. and Galil B.S. (2002) Contribution to the knowledge of the Amphipoda (Crustacea) of the Mediterranean coast of Israel. *Israel Journal of Zoology* 48, 87–110.

Stefanidou D. and Voultsiadou-Koukoura E. (1995) An account of our knowledge of the amphipod fauna of the Aegean Sea. *Crustaceana* 68, 597–615.

Stephensen K. (1918) Hyperiidea–Amphipoda (Part 1: Lanceolidae, Scinidae, Vibiliidae, Thaumathopsidae). In Schmidt J. (ed.) *Report on the Danish Oceanographical Expedition 1908–1910 to the Mediterranean and Adjacent Seas. Volume 2, Biology, D.2*. Copenhagen: Host A.F. and Son, pp. 1–70.

Stephensen K. (1924) Hyperiidea–Amphipoda (Part 2: Paraphronimidae, Hyperiidae, Dairellidae, Phronimidae, Anchylomeridae). *Report on the Danish Oceanographical Expedition 1908–1910 to the Mediterranean and Adjacent Seas. Volume 2, Biology, D.4*, Copenhagen: Host A.F. and Son, pp. 71–150.

Stephensen K. (1925) Hyperiidea–Amphipoda (Part 3: Lycoeopsidae, Pronoidae, Brachyscelidae, Oxycephalidae. Parascelidae, Platyscelidae). *Report on the Danish Oceanographical Expedition 1908–1910 to the Mediterranean and Adjacent Seas. Volume 2, Biology, D.5*. Copenhagen: Host A.F. and Son, pp. 151–252.

Stock J.H. (1967) A revision of the European species of the *Gammarus locusta*-group (Crustacea, Amphipoda). *Zoologische Verhandelingen, Leiden* 90, 1–56.

Sturaro N. and Guerra-García J.M. (2011) A new species of *Caprella* (Crustacea, Amphipoda) from the Mediterranean Sea. *Helgoland Marine Research* 66, 33–42.

Taeca A. and Gomoiu M.-T. (2007) Contributions to species knowledge of *Ampelisca* genus at the Black Sea Romanian littoral. *Rapport de la Commission International de la Mer Méditerranée* 38, 613.

Theocharis A., Georgopoulos D., Lascaratos A., and Nittis K. (1993) Water masses and circulation in the central region of the Eastern Mediterranean: Eastern Ionian, South Aegean and Northwest Levantine, 1986–1987. *Deep-Sea Research. Part II: Topical Studies in Oceanography* 40, 1121–1142.

Tortonese E. (1959) Osservazioni sul bentos del Mar di Marmara e del Bosforo. *Natura, Milano* 50, 18–26.

Tortonese E. and Demir M. (1960) The echinoderm fauna of the Sea of Marmara and the Bosporus. *Hydrobiologi Istanbul* 5, 1–16.

Tzomos T., Kitsos M.-S., Koutsoubas D. and Koukouras A. (2012) Evolution of the entrance rate and of the spatio-temporal distribution of Lessepsian Mollusca in the Mediterranean Sea. *Journal of Biological Research* 17, 81–96.

Vafidis D., Kallianiotis A., Chartosia N. and Koukouras A. (2009) The Sepioidea (Cephalopoda, Mollusca) fauna of the Aegean Sea: comparison with the neighbouring seas and notes on their diet composition. *Journal of Biological Research* 11, 57–71.

Vecchi A. (1929) Ricerche faunistiche nelle isole Italiane dell' Egeo. Anfipodi. *Archivio Zoologico Italiano* 13, 249–257.

Veini M. and Kiortsis V. (1974) Amphipodes et isopodes planctoniques de mer Egée. *Rapport de la Commission International de la Mer Méditerranée* 22, 93–95.

https://doi.org/10.1017/S002531541200183X Published online by Cambridge University Press

Vinogradov M.E., Volkov A.F. and Semenova T.N. (1996) *Hyperiid amphipods (Amphipoda, Hyperiidea) of the world oceans*. Lebanon, NH: Science Publishers.

Voultsiadou-Koukoura E., Koukouras A. and Eleftheriou A. (1987) Macrofauna associated with the sponge *Verongia aerophoba* in the north Aegean Sea. *Estuarine, Coastal and Shelf Science* 24, 265–278.

Voultsiadou E., Pyrounaki M.M., and Chintiroglou Ch. (2007) The habitat engineering tunicate *Microcosmus sabatieri* Roule, 1885 and its associated peracarid epifauna. *Estuarine, Coastal and Shelf Science* 74, 197–204.

Winfield I., Escobar-Briones E. and Morrone J.J. (2006) Updated checklist and identification of areas of endemism of benthic amphipods (Caprellidea and Gammaridea) from offshore habitats in the SW Gulf of Mexico. *Scientia Marina* 70, 99–108.

Zakhama-Sraieb R. and Charfi-Cheikhrouha F. (2010) First record of two lessepsian amphipods in Tunisia: *Elasmopus pectenicrus* and *Stenothoe gallensis*. *Journal of the Marine Biological Association of the United Kingdom* 90, 1291–1295.

Zakhama-Sraieb R., Sghaier Y.-R. and Charfi-Cheikhrouha F. (2009) Amphipod biodiversity of the Tunisian coasts: Update and distributional ecology. *Marine Biodiversity Records* 2, e155. DOI: 10.1017/S1755267209990820.

Zakhama-Sraieb R., Karaa S., Nejmeddine Bradai M., Jribi I. and Charfi-Cheikhrouha F. (2010) Amphipod epibionts of the sea turtles *Caretta caretta* and *Chelonia mydas* from the Gulf of Gabès (Central Mediterranean). *Marine Biodiversity Records* 3, e38. DOI: 10.1017/S1755267210000333.

Zelickman E.A. (2005) Amphipoda: Hyperiidea of Israel: a morphological atlas. In Por F.D. (ed.) *Fauna Palestina (Crustacea)*; (Series, no. 1). Jerusalem: Israel Academy of Sciences and Humanities, pp. 1–440

Zenetos A., Çinar M.E., Panucci-Papadopoulou M.A., Harmelin J.G., Furnari G., Andaloro F., Bellou N., Streftaris N. and Zibrowius H. (2005) Annotated list of marine alien species in the Mediterranean with records of the worst invasive species. *Mediterranean Marine Science* 6, 63–118.

Zenetos A., Gofas S., Verlaque M., Çinar M.E., García Raso J.E., Bianchi C.N., Morri C., Azzurro E., Bilecenoglu M., Froglia C., Siokou I., Violanti D., Sfriso A., San Martín G., Giangrande A., Katağan T., Ballesteros E., Ramos-Esplá A., Mastrototaro F., Ocaña O., Zingone A., Gambi M.C. and Streftaris N. (2010) Alien species in the Mediterranean Sea by 2010. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part I. Spatial distribution. *Mediterranean Marine Science* 11, 381–493.

and

Zaitsev Yu. and Mamaev V. (1997) *Marine biological diversity in the Black Sea: a study of change and decline*. New York: United Nations Publications.

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