Research Article

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
www.hcmr.gr
DOI: https://doi.org/10.12681/mms.39476

Marine Amphipods of the Macaronesian archipelagos and north-west African margin: checklist and geographical distribution

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Contributing Editor: Panayota KOULOURI

Received: 2 November 2024; Accepted: 28 April 2025; Published online: 27 June 2025

Abstract

An updated amphipod checklist for 2024 is given for the amphipods recorded from the adlittoralto abyssal zones of the Macaronesian archipelagos and the north-west African margin. Four marine regions are taken into account: 1) North West Africa (NWA), 2) Mauritania and Senegal (SEN), 3) Canary, Selvagens and Madeira Archipelagos (CAN-MAD) and 4) the Cabo Verde Archipelago (CV). The total number of species recorded in these four regions is 509. CAN-MAD is the region with the greatest species richness (302 species), followed by NWA (297 species), SEN (152 species) and finally CV (122 species). Among the 509 species recorded, 66 have been described from this region while 59 are endemic. The most diverse family is the Ampeliscidae Krøyer, 1842 (32 species), the Scinidae Stebbing, 1888 (29 species), the Caprellidae Leach, 1814 (22 species). Then, five other families are each represented by 16 species or more, the Photidae Boeck, 1871, Maeridae Krapp-Schickel, 2008 and Ischyroceridae Stebbing, 1899 (17 species), Aoridae Stebbing, 1899 and Hyalidae Bulyčeva, 1957 (16 species). Only five species are non-indigenous or possibly non-indigenous. The biogeographical affinities of the benthic amphipods are highlighted by comparing them with communities from the continental/insular shelf of the four regions studied here as well as with three neighbouring areas, i.e.: part of the Lusitanian maritime province (BIS-IBE), the Mediterranean shores of Morocco and Algeria (MOR-ALG) and the Azores Archipelago (AZO). The CV and SEN fauna are distinguishable from the others, which form two main groups: the NWA, MOR-ALG and BIS-IBE on the one hand, and the CAN-MAD and AZO archipelagos on the other. Future research should be focused along the coasts of Mauritania and Senegal and around the Cabo Verde Archipelago where there is a lack of knowledge not only on amphipods but also regarding marine invertebrate biodiversity in general. Special attention should be paid to biofouling in harbours since this is liable to increase the number of non-indigenous species which appears to be very low in the Macaronesian archipelagos in spite of the intense maritime traffic.

Keywords: Amphipods; biogeography; Macaronesia; Morocco; Madeira Archipelago; Canary Archipelago; Cabo Verde Archipelago; Mauritania; Senegal.

Introduction

Faced with the increase in marine human activities and the pressures on ecosystems, particularly in coastal environments, it is essential to measure the impacts generated by these anthropogenic stressors (Halpern *et al*., 2015). The macrobenthos is among the biological compartments most affected by the degradation of the marine environment due to trawler fishing, the extraction of aggregates, port dredging and spoil deposition as well as the installation of offshore wind turbines in Europe, the United States and China (Jiao *et al.*, 2015). To measure the impacts, it is mandatory in most cases to monitor the benthos affected by these activities. The BACI (Before After Control Impact) approach is most often proposed to assess these impacts. Such studies generate a lot of environmental data, including lists of benthic species sampled during these surveys. However, some of the species recorded during these surveys - often carried out by consultancy firms - are subject to caution and deserve to be verified by an expert (Dauvin, 2005). Nevertheless, these studies generate interesting data, including sightings of new species for a given site or region.

Many global inventories of marine fauna were carried out at the end of the 1990s. However, to obtain a better knowledge of the degradation of biodiversity in marine

areas, we need to integrate the data from consultancy engineers and ecologists and not merely from taxonomists. Moreover, these studies are habitually to be found in reports and other documents of the grey literature which need to be checked in detail to extract useful data.

Indeed, comprehensive checklists of the marine fauna have been published over the last few decades, thus increasing our knowledge of biodiversity, such as on the scale of the Mediterranean (Coll *et al.*, 2010) or on a regional scale as in the case of Italian marine molluscs (Renda *et al.*, 2022) or the marine molluscs of Spanish waters (Gofas *et al.*, 2017).

Similarly, a number of checklists of marine amphipods have been recently published for several regions of the world-wide Ocean, including Indian waters (Bhoi *et al.*, 2023), the tropical eastern Pacific (Garcia Madrigal, 2007), southeast Asia and neighbouring regions (Azman *et al.*, 2022), Pacific Mexican waters (Winfield *et al.*, 2020), the Gulf of Mexico (Escobar-Briones & Winfield, 2003), the English Channel (Dauvin, 2022), the Mediterranean Spanish coast (De-La-Ossa-Carretero *et al*., 2010) or for the southern part of the Mediterranean Sea (Bakalem *et al*., 2024). These latter authors (Bakalem *et al.*, 2024) added 26 species which were not included in the 'Amphipoda of the Mediterranean Sea', but which had been reported as species identified up until 1997 at the scale of this semi-enclosed Sea (Ruffo, 1982; 1989; 1993; 1998). Among these new records, seven species were described from the Mediterranean Sea and 19 correspond to new localities mainly found in Moroccan and Algerian waters.

The importance of amphipods has been recently pointed out, in view of the abundant pelagic and benthic populations of this group in marine ecosystems. In their review, Ritter & Bourne (2024) highlight the fact that amphipods provide an essential biological link between benthic and pelagic processes as well as between marine and atmospheric ecosystems. Amphipods fulfil many functional roles as predators and prey, bioturbators, mesograzers, secondary producers and facilitators of nutrient cycling, and also serve as indicators of marine and sediment health. In another review on the predation of birds, cephalopods, fish and marine mammals on marine amphipods, Dauvin (2024) showed that amphipods are important prey for fish and mammals. Along with cephalopod juveniles, they are also included in the trophic diet of shorebirds that consume amphipods mostly during low tide on tidal flats. They display diel migration, which reinforces the predation by demersal fish in the Benthic Boundary Layer, as well as by pelagic fish in the water column.

Other studies have also focused on this important group; Arfianti & Costello (2020) have presented a global biogeography of marine amphipods, Momtazi & Saeedi (2024) have explored the latitudinal gradients and environmental drivers of amphipod biodiversity patterns regarding depth and habitat variations, while Marchini & Cardeccia (2017) have contributed to a global review of the alien amphipods in a "sea of troubles". Horton *et al*. (2023) have provided an overview of the World Amphipoda Database (WAD), a global species database that is part of the World Register of Marine Species (WoRMS). Launched in 2013, the database contains entries for over 10,500 accepted species names. Further work remains to complete the linking of unaccepted names, original descriptions and environmental information. Once these tasks are completed, the database will be considered complete for 8 of the 13 priorities, and efforts will continue to input new taxa annually and focus on the remaining priorities, particularly the input of type localities (Horton *et al*., 2023).

Amphipods are distributed from the adlittoral to the hadal zones, but mostly live on the continental shelf from 0 to 200 m depth (Barnard & Karaman, 1991). Among these, about 8 000 are marine benthic species, while there are only about 300 marine pelagic species (Horton *et al*., 2023).

Given the geographical proximity and communication through the Strait of Gibraltar and the spreading of data on amphipods from the Macaronesian archipelagos and the north-west African coasts, it would appear interesting to summarize our knowledge on the amphipods of these regions. Our study follows on from a first inventory of amphipods of the southern Mediterranean (Bakalem *et al*., 2024). In this way, we aim to contribute to a better knowledge of amphipods recorded in the North-East Atlantic.

The main objective of this study is to provide an updated checklist of benthic and pelagic amphipods in coastal and continental shelf waters, as well as bathyal and abyssal zones in four Macaronesian achipelagos and the north-west African coasts.

With a view to discussing biogeographic relationships of amphipods from the North-Eastern Atlantic Ocean, we present a comparison which covers benthic species from the continental shelf supplemented with a checklist for three adjacent marine regions: the Azores, part of the Lusitanian province (Bay of Biscay and Iberian coast) and the Mediterranean coasts of Morocco and Algeria.

Materials and Methods

Amphipod checklist method and data sources

In this paper, we report the marine amphipods recorded from the adlittoral to abyssal zones of the north-west African margin and the Macaronesian archipelagos. All available scientific papers (fauna, taxonomic and ecological studies), as well as the grey literature including reports and PhD theses available on the Internet, have been checked to access the amphipod lists for each country or region included in the present study (see Appendix listing all the available papers in which amphipods have been reported).

The World Register of Marine Species (WoRMS Editorial Board, 2025) was used to update the literature data.

As in a previous paper on amphipods from countries bordering the southern Mediterranean Sea (Bakalem *et al*., 2024), the present list is arranged in alphabetical or-

der of the family names, with a view to comparing the present checklist with the former checklist: a number of species are amalgamated under the previous classification: Caprellidea, Gammaridea, Ingolfiellidea and Hyperiidea. The checklist reports only taxa that are formally identified at the species level.

Marine regions

Following Freitas *et al*. (2019), Figure 1 shows the limits of the checklists for four marine regions: 1) North West Africa (NWA: from Gibraltar Strait to Cape Blanc), 2) Mauritania and Senegal (from Cape Blanc to Cape Skirring) (SEN), 3) Canary, Selvagens and Madeira Archipelagos (CAN-MAD). These three archipelagos (MAD, SEL and CAN) are included in the Macaronesian biogeographic region, along with 4) CAB or CV in the present study for Cabo Verde Archipelago, [but this latter is not included in the marine biogeographic region defined by the European Environment Agency].

To study the geographical affinities of amphipods of the north-eastern Atlantic, three other marine regions were selected: 1) the Azores Archipelago (AZO), 2) the Bay of Biscay and Iberian coast, belonging to the Lusitanian province (BIS-IBE), which includes the Gulf of Cadiz (CAD); the Portuguese coast (POR), the Asturias coast (AST) and the Bay of Biscay (BIS), and 3) the Mediterranean coasts of Morocco and Algeria (MOR-ALG). Only the benthic amphipods of the continental shelf (0-200 m) of these three regions are listed here and compared with the benthic amphipods reported in four sectors of the Macaronesian archipelagos and north-west African coast, i.e., covering a total of seven biogeographic regions.

Statistical analyses

The comparison of the checklists of amphipods (Presence/Absence of the species) is based here on Sørensen's coefficient which takes into account only the presence of the species and the construction of dendrograms using the group average algorithm generated from the PRIMER V6 software (Clarke & Gorley, 2006). Hierarchical Cluster Analysis (HCA) was carried out on all the amphipod species recorded from four Macaronesian archipelagos and the north -west African coasts, then a HCA including only continental shelf benthic amphipods (0-200 m); a final HCA was carried out only on benthic amphipods recorded from seven marine regions, i.e. the four regions of the present study plus three neighbouring regions (Azores, Atlantic Iberian Peninsula plus the Bay of Biscay and the Mediterranean coast of Morocco-Algeria).

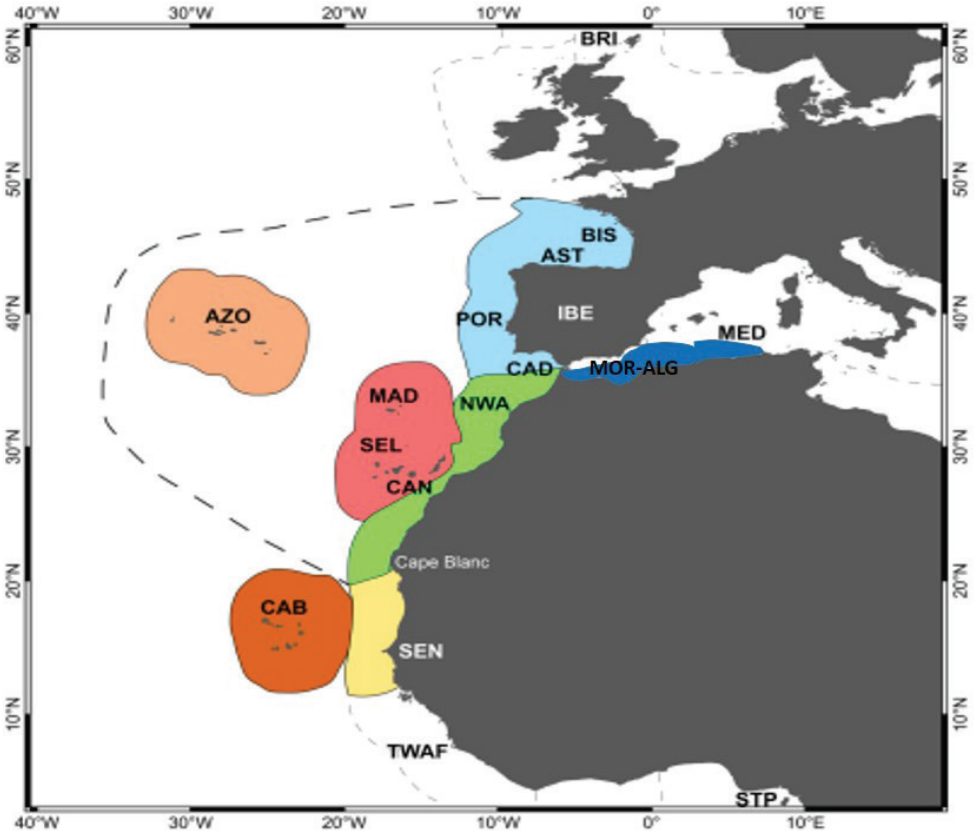

Fig. 1: Biogeographic regions considered in this study: North West Africa (NWA: from Gibraltar Strait to Cape Blanc); Mauritania (Cape Blanc) and Senegal (to Cape Skirring) (SEN); Canaries, Selvagens and Madeira Archipelagos (CAN-MAD) and the Cabo Verde Archipelago (CAB or CV in the present study). Three archipelagos (MAD, SEL and CAN) are included in the Macaronesian biogeographic region. The Azores (AZO) also belong to the Macaronesian archipelagos. The Bay of Biscay and Iberian coast form part of the Lusitanian province (BIS-IBE: the Gulf of Cadiz, CAD: the Portuguese coast: POR, the Asturias coast: AST and the Bay of Biscay: BIS), and the Mediterranean coasts of Morocco and Algeria (MOR-ALG) (Freitas *et al*., 2019, modified).

Results

Number of species and families

A total of 509 species have been reported for the four marine regions (or sectors) studied here (Table 1). The richest region is CAN-MAD (302 species), followed by NWA showing a similar biodiversity with 297 species. The two other regions show lower numbers of species with 152 for SEN and 122 for CV. For the four regions taken together, the deep-sea amphipods account for 28 species, while the number of pelagic species are well represented with 147 species, making up 29% of the total number.

Table 1. Checklist of the 509 amphipods from the four regions of the Macaronesian Archipelagos and North-Western Atlantic Africa, classified per alphabetical names of the families (NWA: Northwest African coasts; CAN-MAD: Canary & Madeira Archipelagos; SEN: Senegalese & Mauritanian coasts; CV: Cabo Verde).

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Alicellidae Lowry & De Broyer, 2008				
Alicella gigantea Chevreux, 1899		1		
Paralicella tenuipes Chevreux, 1908		1		1
Amaryllididae Lowry & Stoddart, 2002				
Bathyamaryllis haswelli (Stebbing, 1888)	1	1	1	
Bathyamaryllis pulchellus (Bonnier, 1896)	1			
Ampeliscidae Krøyer, 1842				
Ampelisca aequicornis Bruzelius, 1859	1	1	1	
Ampelisca anophthalma Bellan-Santini & Kaim-Malka, 1977	1			
Ampelisca armoricana Bellan-Santini & Dauvin, 1981	1		1	
Ampelisca bidentata Schellenberg, 1925			1	
Ampelisca brevicornis (A. Costa, 1853)	1	1	1	
Ampelisca cavicoxa Reid, 1951		1		1
Ampelisca ctenopus Schellenberg, 1925			1	
Ampelisca diadema (A. Costa, 1853)	1		1	
Ampelisca gibba G.O. Sars, 1883	1		1	
Ampelisca heterodactyla Schellenberg, 1925	1		1	
Ampelisca hupferi Schellenberg, 1925			1	
*Ampelisca latifrons*Schellenberg, 1925			1	
Ampelisca lusitanica Bellan-Santini & Marques, 1987	1			
Ampelisca monoculata Dauvin & Bellan-Santini, 1985			1	
Ampelisca palmata K.H. Barnard, 1916			1	
Ampelisca pectenata Reid, 1951			1	
Ampelisca rubella A. Costa, 1864	1	1	1	
Ampelisca sarsi Chevreux, 1888			1	
Ampelisca senegalensis Chevreux, 1925	1		1	
Ampelisca serraticaudata Chevreux, 1888	1	1	1	
Ampelisca spinifer Reid, 1951			1	
Ampelisca spinimana Chevreux, 1887	1		1	
Ampelisca spinipes Boeck, 1861	1		1	
Ampelisca tenuicornis Lilljeborg, 1855			1	
Ampelisca typica (Spence Bate, 1857)	1		1	
Ampelisca uncinata Chevreux, 1887	1		1	
*Ampelisca unidentata*Schellenberg, 1936	1			

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Ampelisca verga Reid, 1951			1	
Byblis guernei Chevreux, 1887	1		1	
Haploops lodo J.L. Bernard,1961	1			
Haploops proxima Chevreux, 1919	1		1	
Haploops tubicola Liljeborg, 1856	1			
Amphilochidae Boeck, 1871				
Amphilochus manudens Spence Bate & Westwood, 1862		1		
Apolochus brunneus (Della Valle, 1893)		1		
Apolochus neapolitanus (Della Valle, 1893)	1	1	1	
Apolochus picadurus (J.L. Barnard, 1962)	1			
Apolochus spencebatei (Stebbing, 1876)	1	1	1	
Amphithyridae Zeidler, 2016				
Amphithyrus bispinosus Claus, 1879	1	1		
Amphithyrus glaber Spandl, 1924	1			
Amphithyrus muratus Volkov, 1982				1
Amphithyrus sculpturatus Claus, 1879	1	1		
Amphithyrus similis Claus, 1879		1		
Paralycaea gracilis Claus, 1879		1		
Ampithoidae Boeck, 1871				
Amphitholina cuniculus (Stebbing, 1874)	1			
Ampithoe ferox (Chevreux, 1902)	1	1		
Ampithoe grubiformis Reid, 1951				1
Ampithoe kergueleni Stebbing, 1888			1	1
Ampithoe ramondi Audouin, 1826	1	1		1
Ampithoe riedli Krapp-Schickel, 1968	1	1		
Ampithoe rubricata (Montagu, 1808)	1	1		
Cymadusa crassicornis (A. Costa, 1853)	1			
Cymadusa filosa Savigny, 1816	1	1	1	1
Pleonexes gammaroides Spence Bate, 1857	1	1	1	
Pleonexes helleri (Karaman, 1975)	1	1		
Sunamphitoe pelagica (H. Milne Edwards, 1830)	1	1	1	
Aoridae Stebbing, 1899				
Aora gracilis (Spence Bate, 1857)	1	1		
Aora spinicornis Afonso, 1976	1			
Aora typica Krøyer, 1845	1	1	1	1
Autonoe hirsutipes (Stebbing, 1895)		1	1	
Autonoe longipes (Liljeborg, 1852)		1		
Globosolembos francanni (D. M. Reid, 1951)				1
Grandidierella elongata Chevreux, 1926	1		1	
Lembos websteri Spence Bate, 1857	1			
Microdeutopus algicola Della Valle, 1893	1			
Microdeutopus anomalus (Rathke, 1843)	1	1		

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Microdeutopus chelifer (Spence Bate & Westwood, 1862)	1	1		
Microdeutopus damnoniensis (Spence Bate, 1857)	1	1		
Microdeutopus gryllotalpa A. Costa, 1853	1			
Microdeutopus obtusatus Myers, 1973	1			
Microdeutopus stationis Della Valle, 1893		1		
Microdeutopus versiculatus (Spence Bate, 1857)	1	1	1	
Archaeoscinidae K. H. Barnard, 1930				
Archaeoscina steenstrupi (Spence Bate, 1857)	1			1
Argissidae Walker, 1904				
Argissa hamatipes (Norman, 1869)	1		1	
Aristiidae Lowry & Stoddart, 1997				
Perrierella audouiniana (Spence Bate, 1857)	1		1	
Atylidae Lilljeborg, 1865				
Nototropis falcatus (Metzger, 1871)	1			
Nototropis guttatus (A. Costa in Hope, 1851)	1	1	1	1
Nototropis swammerdamei (H. Milne Edwards, 1830)	1	1	1	
Nototropis vedlomensis (Spence Bate & Westwood, 1862)	1			
Bathyporeiidae d'Udekem d'Acoz, 2011				
Bathyporeia chevreuxi d'Udekem d'Acoz & Vader, 2005	1		1	
Bathyporeia elegans Watkin, 1938	1	1		
Bathyporeia elkaimi d'Udekem d'Acoz & Menioui, 2004	1			
Bathyporeia guilliamsoniana (Spence Bate, 1857)	1	1	1	
Bathyporeia ledoyeri d'Udekem d'Acoz & Menioui, 2004	1			
Bathyporeia microceras d'Udekem d'Acoz & Menioui, 2004	1			
Bathyporeia nana Toumond, 1966	1			
Bathyporeia pelagica (Spence Bate, 1857)	1	1	1	
Bathyporeia pilosa Lindström, 1855	1			
Bathyporeia watkini d'Udekem d'Acoz, Echchaoui & Menioui, 2005	1			
Bogidiellidae Hertzog, 1936				
Bogidiella madeirae Stock, 1994		1		
Cabogidiella littoralis Stock & Vonk, 1992				1
Stygogidiella atlantica (Sánchez, 1991)		1		
Xystriogidiella spathulata (Stock & Rondé-Broekhuizen, 1987)		1		
Brachyscelidae Stephensen, 1923				
Brachyscelus crusculum Spence Bate, 1861	1	1		1
Brachyscelus globiceps (Claus, 1879)				1
Brachyscelus macrocephalus Stephensen, 1925		1		1
Brachyscelus rapax (Claus, 1871)				1
Calliopiidae G.O. Sars, 1893				
Apherusa alacris Krapp-Schickel, 1969	1	1		
Apherusa bispinosa (Spence Bate, 1857)	1	1	1	
Apherusa chiereghinii Giordani Soika, 1950		1		

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Apherusa jurinei (H. Milne Edwards, 1830)	1			
Apherusa mediterranea Chevreux, 1911	1	1		
Apherusa ovalipes Norman & Scott, 1906	1	1	1	
Apherusa vexatrix Krapp-Schickel, 1979		1		
Stenopleura atlantica Stebbing, 1888	1	1	1	1
Caprellidae Leach, 1814				
Aeginina longicornis (Krøyer, 1843)			1	
Caprella acanthifera Leach, 1814	1	1		
Caprella cavediniae Krapp-Schickel & Vader, 1998		1		
Caprella danilevskii Czerniavsky, 1868	1	1		
Caprella dilatata Krøyer, 1843	1			
Caprella equilibra Say, 1818	1	1	1	
Caprella grandimana Mayer, 1882	1	1		
Caprella hirsuta Mayer, 1890	1			
Caprella innocens Mayer, 1903	1			
Caprella liparotensis Haller, 1879	1	1		
Caprella penantis Leach, 1814	1	1	1	
Caprella scaura Templeton, 1836		1		
Caprella takeuchii Guerra-García, Sánchez-Moyano & García-Gómez, 2001	1			
Caprella wirtzi Krapp-Schiekel & Takeuchi, 2000				1
Liropus gracilis Chevreux, 1920	1		1	
Mantacaprella macaronensis Vázquez-Luis, Guerra-García, Carvalho & Png-Gonzalez, 2013		1		1
Paracaprella pusilla Mayer, 1890	1		1	
Pariambus typicus (Krøyer, 1845)		1		
Phtisica marina Slabber, 1769	1	1	1	1
Pseudolirius kroyeri (Haller, 1879)	1			
Pseudoprotella inermis Chevreux, 1920	1			
Pseudoprotella phasma (Montagu, 1804)	1	1	1	
Cebocaridae Lowry & Stoddart, 2011				
Crybelocephalus birsteini Thurston, 1976		1		
Metacyphocaris helgae Tattersall, 1906		1		
Colomastigidae Chevreux, 1899				
Colomastix pusilla Grube, 1861		1		
Corophiidae Leach, 1814				
Apocorophium acutum (Chevreux, 1908)	1	1		
Corophium orientale Schellenberg, 1928	1			
Corophium volutator (Pallas, 1766)	1			
Leptocheirus guttatus (Grube, 1864)				1
Leptocheirus hirsutimanus (Spence Bate & Westwood, 1862)	1			
Leptocheirus mariae Karaman, 1973		1		
Leptocheirus pectinatus (Norman, 1869)	1	1	1	

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Leptocheirus pilosus Zaddach, 1844	1	1		
Medicorophium minimum (Schiecke, 1978)		1		
Medicorophium runcicorne (Della Valle, 1893)	1		1	
Monocorophium acherusicum (A. Costa, 1853)	1	1	1	
Monocorophium insidiosum (Crawford, 1937)	1			
Monocorophium sextonae (Crawford, 1937)	1	1		
Cressidae Stebbing, 1899				
Cressa mediterranea Ruffo, 1979		1		
Cyclocaridae Lowry & Stoddart, 2011				
Cyclocaris tahitensis Stebbing, 1888				1
Cyphocarididae Lowry & Stoddart, 1997				
Cyphocaris anonyx Boeck, 1871	1			1
Cyphocaris challengeri Stebbing, 1888	1	1		1
Cyproideidae J.L. Barnard, 1974				
Peltocoxa damnoniensis (Stebbing, 1885)		1		
Peltocoxa gibbosa (Schiecke, 1977)	1			
Peltocoxa marioni Catta, 1875	1		1	
Peltocoxa mediterranea Schiecke, 1977	1	1		
Cystisomatidae Willemöes-Suhm, 1875				
Cystisoma fabricii Stebbing, 1888	1	1		
Cystisoma latipes (Stephensen, 1918)		1		
Cystisoma spinosus (Fabricius, 1775)		1		
Dairellidae Bovallius, 1887				
Dairella californica (Bovallius, 1885)		1		
Dexaminidae Leach, 1814				
Dexamine spiniventris (A. Costa, 1853)	1			
Dexamine spinosa (Montagu, 1813)	1	1	1	
Guernea (Guernea) coalita (Norman, 1868)	1	1		
Tritaeta chelata Chevreux, 1925			1	
Tritaeta gibbosa (Spence Bate & Westwood, 1862)		1	1	
Dogielinotidae Gurjanova, 1953				
Parhyale plumicornis (Heller, 1866)	1			
Eriopisidae Lowry & Myers, 2013				
Psammogammarus initialis Stock & Sanchez, 1987		1		
Psammogammarus spinosus Stock & Vonk, 1992				1
Psammogammarus stocki Vonk, 1990		1		
Victoriopisa atlantica Stock & Platvoet, 1981			1	
Eupronoidae Zeidler, 2016				
Eupronoe armata Claus, 1879		1		1
Eupronoe laticarpa Stephensen, 1925	1	1		1
Eupronoe maculata Claus, 1879	1	1		1
Eupronoe minuta Claus, 1879	1	1		1

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Parapronoe campbelli Stebbing, 1888	1	1		1
Parapronoe crustulum Claus, 1879	1	1		1
Parapronoe parva Claus, 1879		1		
Eurytheneidae Stoddart & Lowry, 2004				
Eurythenes gryllus (Lichtenstein in Mandt, 1822)	1	1		1
Eusiridae Stebbing, 1888				
Cleonardo neuvillei Chevreux, 1908		1		
Eusiropsis riisei Stebbing, 1897		1		1
Eusirus longipes Boeck, 1861	1			
Rhachotropis grimaldii (Chevreux, 1887)			1	
Rhachotropis rostrata Bonnier, 1896	1			
Gammaridae Latreille, 1802				
Gammarus aequicauda (Martynov, 1931)	1			
Gammarus chevreuxi Sexton, 1913	1			
Gammarus insensibilis Stock, 1966	1			
Gammarus locusta (Linnaeus, 1758)	1	1		
Gammarus nox Stock, 1995		1		
Gammarus subtypicus Stock, 1966	1			
Marinogammarus marinus (Leach, 1816)	1			
Pectenogammarus olivii (H. Milne Edwards, 1830)	1	1		
Hadziidae S. Karaman, 1943				
Dulzura lobata Stock & Vonk, 1991				1
Hadzia acutus (Andres, 1978)		1		
Haustoriidae Stebbing, 1906				
Haustorius arenarius (Slabber, 1769)	1			
Hornelliidae d'Udekem d'Acoz, 2010				
Hornellia (Metaceradocus) perdentatus Chevreux, 1925			1	
Hyalidae Bulyčeva, 1957				
Apohyale media (Dana, 1853)		1		
Apohyale perieri (Lucas, 1846)	1	1	1	
Apohyale prevostii (H. Milne Edwards, 1830)	1	1	1	
Apohyale stebbingi (Chevreux, 1888)	1	1		
Hyale macrodactyla Stebbing, 1899			1	
Hyale pontica Rathke, 1836	1	1		
Parhyale aquilina (Costa, 1857)		1		
Parhyale hawaiensis (Dana, 1853)		1		
Parhyale inyacka (K.H. Barnard, 1916)			1	
Parhyale multispinosa Stock, 1987		1		
Protohyale (Boreohyale) camptonyx (Heller, 1866)	1	1		
Protohyale (Protohyale) grimaldii (Chevreux, 1891)		1		
Protohyale (Protohyale) schmidtii (Heller, 1866)	1	1	1	
Ptilohyale barnardi (Chevreux, 1926)			1	

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Serejohyale ramalhoi (Reid, 1939)		1		
Serejohyale spinidactylus (Chevreux, 1926)		1	1	
Hyperiidae Dana, 1852				
Hyperoche medusarum (Kröyer, 1838)		1		
Hyperoche picta Bovallius, 1889	1	1		
Hyperiopsidae Bovallius, 1886				
Hyperiopsis voringi G.O. Sars, 1885		1		
Ingolfiellidae Hansen, 1903				
Ingolfiella canariensis Vonk & Sànchez, 1991		1		
Ingolfiella similis Rondé-Broekhuizen & Stock, 1987		1		
Ingolfiella unguiculata Stock, 1992		1		
Iphimediidae Boeck, 1871				
Iphimedia minuta G.O. Sars, 1883			1	
Iphimedia obesa Rathke, 1843		1	1	
Isaeidae Dana, 1852				
Pareurystheus dentatus (Holmes, 1908)	1		1	1
Ischyroceridae Stebbing, 1899				
Bonnierella abyssi (Chevreux, 1887)			1	
Centraloecetes dellavallei (Stebbing, 1899)			1	
Centraloecetes kroyeranus (Spence Bate, 1857)		1	1	
Centraloecetes neapolitanus (Schiecke, 1978)	1			
Centraloecetes striatus (Myers & McGrath, 1979)	1			
Ericthonius brasiliensis (Dana, 1853)	1	1	1	1
Ericthonius difformis H. Milne Edwards, 1830		1		
Ericthonius punctatus (Spence Bate, 1857)	1	1	1	
Jassa falcata (Montagu, 1808)	1	1	1	
Jassa herdmani (Walker, 1893)		1		
Jassa marmorata Holmes, 1905	1	1		
Jassa pusilla (G.O. Sars, 1894)			1	
Microjassa cumbrensis (Stebbing & Robertson, 1891)		1		
Neoischyrocerus inexpectatus (Ruffo, 1959)		1		
Parajassa pelagica (Leach, 1814)	1			
Plumulojassa ocia (Spence Bate & Westwood, 1862)	1			
Siphonoecetes sabatieri Rouville, 1894	1			
Kamakidae Myers & Lowry, 2003				
Cerapopsis longipes Della Valle, 1893		1		1
Cerapopsis takamado Menioui & Myers, 2001	1			
Kuriidae J.L. Barnard, 1964				
Micropythia carinata (Spence Bate, 1863)	1	1		
Lanceolidae Bovallius, 1887				
Lanceola clausii Bovallius, 1885	1	1		
Lanceola loveni Bovallius, 1885		1		

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Lanceola pacifica Stebbing, 1888	1	1		
Lanceola sayana Bovallius, 1885		1		
Scypholanceola aestiva (Stebbing, 1888)	1	1		
Lestrigonidae Zeidler, 2004				
Hyperietta luzoni (Stebbing, 1888)	1	1		1
Hyperietta parviceps Bowman, 1973				1
Hyperietta stebbingi Bowman, 1973				1
Hyperietta stephenseni Bowman, 1973		1		1
Hyperietta vosseleri (Stebbing, 1904)	1	1		1
Hyperioides longipes Chevreux, 1900	1	1		1
Hyperionyx macrodactylus (Stephensen, 1924)				1
Lestrigonus bengalensis Giles, 1888	1	1		1
Lestrigonus latissimus (Bovallius, 1889)		1		1
Lestrigonus macrophthalmus (Vosseler, 1901)		1		1
Lestrigonus schizogeneios (Stebbing, 1888)	1	1		1
Phronimopsis spinifera Claus, 1879		1	1	1
Themistella fusca (Dana, 1853)		1		1
Leucothoidae Dana, 1852				
Leucothoe brunonis Krapp-Schickel & Menioui, 2005	1			
Leucothoe euryonyx Walker, 1901	1		1	
Leucothoe incisa Robertson, 1892	1	1		
Leucothoe lilljeborgi Boeck, 1861	1			
Leucothoe occulta Krapp-Schickel, 1975	1			
Leucothoe procera Spence Bate, 1857	1			
Leucothoe richiardii Lessona, 1865			1	
Leucothoe spinicarpa (Abildgaard, 1789)	1	1	1	1
Leucothoe spinulosa Chevreux, 1919			1	
Liljeborgiidae Stebbing, 1899				
Idunella picta (Norman, 1889)			1	
Idunella sketi Karaman, 1980		1		1
Liljeborgia inermis Chevreux, 1920			1	1
Liljeborgia pallida (Spence Bate, 1857)		1	1	
Sextonia longirostris Chevreux, 1920	1			
Lycaeidae Claus, 1879				
Lycaea bovallii Chevreux, 1900		1		1
Lycaea pachypoda (Claus, 1879)		1		1
Lycaea pulex Marion, 1874	1	1		
Lycaea vincentii Stebbing, 1888		1		1
Simorhynchotus antennarius (Claus, 1871)		1		1
Lycaeopsidae Chevreux, 1913				
Lycaeopsis themistoides Claus, 1879	1	1		1
Lycaeopsis zamboangae (Stebbing, 1888)	1	1		1

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Lysianassidae Dana, 1849				
Lysianassa caesarea Ruffo, 1987	1	1	1	
Lysianassa ceratina (Walker, 1889)		1	1	
Lysianassa costae H. Milne Edwards, 1830	1			
Lysianassa pilicornis Heller, 1866				1
Lysianassa plumosa Boeck, 1871	1		1	
Lysianassina longicornis (Lucas, 1846)		1		
Socarnes erythrophthalmus Robertson, 1892			1	
Socarnes filicornis (Heller, 1866)	1		1	
Socarnopsis obesa Chevreux, 1919			1	
Maeridae Krapp-Schickel, 2008				
Animoceradocus semiserratus (Spence Bate & Westwood, 1862)		1		
Ceradocus (Ceradocus) orchestiipes A. Costa, 1853			1	1
Elasmopus antennatus (Stout, 1913)	1	1		
Elasmopus brasiliensis (Dana, 1853)	1			1
Elasmopus canarius Krapp-Schickel & Ruffo, 1990		1		
Elasmopus pectenicrus (Spence Bate, 1863)	1	1		
Elasmopus pocillimanus (Spence Bate, 1863)	1			1
Elasmopus rapax A. Costa, 1853	1	1	1	
Elasmopus vachoni Mateus & Mateus, 1966	1	1		
Maera edwardsi Chevreux, 1920	1	1	1	1
Maera grossimana (Montagu, 1808)		1	1	1
Maera hirondellei Chevreux, 1900				1
Maeropsis perrieri Chevreux, 1920	1		1	
Othomaera knudseni (Reid, 1951)	1			
Othomaera othonis (H. Milne Edwards, 1830)	1		1	
Quadrimaera ascensionis (K.H. Barnard, 1932)		1		
Quadrimaera inaequipes (A. Costa in Hope, 1851)	1	1		1
Megaluropidae Thomas & Barnard, 1986				
Megaluropus agilis Hoek, 1889		1		
Melitidae Bousfield, 1973				
Abludomelita aculeata (Chevreux, 1911)	1			
Abludomelita obtusata (Montagu, 1813)	1		1	
Abludomelita richardi (Chevreux, 1900)		1		
Dulichiella fresnelii (Audouin, 1826)				1
Melita coroninii Heller, 1866	1			
Melita hergensis Reid, 1939	1			
Melita palmata (Montagu, 1804)	1	1	1	
Verdeia grandimana (Chevreux, 1908)				1
Melphidippidae Stebbing, 1899				
Melphidippella macra (Norman, 1869)			1	
Microphasmidae Stephensen & Pirlot, 1931				

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Microphasma agassizi Woltereck, 1909	1	1		
Microprotopidae Myers & Lowry, 2003				
Microprotopus longimanus Chevreux, 1887		1		
Mimonectidae Bovallius, 1885				
Mimonectes gaussi (Woltereck, 1904)	1	1		
Mimonectes loveni Bovallius, 1885	1	1		1
Mimonectes spandlii Bovallius, 1885	1			
Mimonectes sphaericus Bovallius, 1885		1		1
Nuuanuidae Lowry & Myers, 2013				
Gammarella fucicola (Leach, 1814)	1	1	1	
Oedicerotidae Lilljeborg, 1865				
Kroyera carinata Spence Bate, 1857	1	1		
Perioculodes longimanus (Spence Bate & Westwood, 1868)	1		1	
Pontocrates altamarinus (Spence Bate & Westwood, 1862)	1		1	
Pontocrates arenarius (Spence Bate, 1858)	1	1		
Synchelidium maculatum Stebbing, 1906	1			
Westwoodilla caecula (Spence Bate, 1857)	1			
Westwoodilla rectirostris (Della Valle, 1893)	1		1	
Oxycephalidae Dana, 1852				
Calamorhynchus pellucidus Streets, 1878	1	1		1
Glossocephalus milneedwardsi Bovallius, 1887	1	1		
Leptocotis tenuirostris (Claus, 1871)		1		1
Oxycephalus clausi Bovallius, 1887	1	1		1
Oxycephalus longiceps Claus, 1879		1		
Oxycephalus piscator H. Milne Edwards, 1830	1	1		1
Rhabdosoma brevicaudatum Stebbing, 1888	1	1		
Rhabdosoma whitei Spence Bate, 1863		1		
Streetsia challengeri Stebbing, 1888	1	1		1
Streetsia porcella (Claus, 1879)		1		1
Paraphronimidae Bovallius, 1887				
Paraphronima crassipes Claus, 1879	1	1		1
Paraphronima gracilis Claus, 1879	1	1		1
Parargissidae Lowry & Myers, 2017				
Parargissa nasuta Chevreux, 1908				1
Parascelidae Bovallius, 1887				
Parascelus edwardsi Claus, 1879		1		1
Parascelus parvus Claus, 1879		1		
Schizoscelus ornatus Claus, 1879		1		
Thyropus sphaeroma (Claus, 1879)		1		1
Pardaliscidae Boeck, 1871				
Halice aculeata Chevreux, 1912	1	1		
Halice macronyx (Stebbing, 1888)		1		

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Halicoides discoveryi Thurston, 1976		1		
Nicippe tumida Bruzelius, 1859	1		1	
Spelaeoconicippe buchi (Andres, 1975)		1		
Phliantidae Stebbing, 1899				
Pereionotus testudo (Montagu, 1808)	1	1		
Photidae Boeck, 1871				
Gammaropsis anomala (Chevreux, 1926)			1	
Gammaropsis dentata Chevreux, 1900	1	1		
Gammaropsis maculata (Johnston, 1828)	1	1	1	1
Gammaropsis minuta (Chevreux, 1926)			1	
Gammaropsis ostroumowi (Sowinsky, 1898)		1	1	
Gammaropsis sophiae (Boeck, 1861)	1	1	1	
Gammaropsis ulrici Krapp-Schickel & Myers, 1979		1		
*Latigammaropsis atlantica (*Stebbing, 1888)	1	1	1	1
Megamphopus cornutus Norman, 1869		1	1	
Megamphopus longicornis Chevreux, 1911		1		
Megamphopus longidactyla Chevreux, 1926			1	
Photis antennata Chevreux, 1926	1		1	
Photis longicarpa Chevreux, 1926			1	
Photis longicaudata (Spence Bate & Westwood, 1862)	1	1	1	
Photis obesa Chevreux, 1926			1	
Photis reinhardi Krøyer, 1842		1		
Podoceropsis angulosa Chevreux, 1920			1	
Phoxocephalidae G.O. Sars, 1891				
Basuto stimpsoni (Stebbing, 1908)			1	
Harpinia antennaria Meinert, 1890	1	1		
Harpinia crenulata (Boeck, 1871)		1		
Harpinia pectinata G.O. Sars, 1891	1		1	
Harpinia propinqva G.O. Sars, 1891	1			
Joubinella ciliata Chevreux, 1908		1		
Metaphoxus fultoni (Scott, 1890)	1			
Metaphoxus simplex (Spence Bate, 1858)	1			
Pseudharpinia brevirostris (Chevreux, 1919)	1		1	
Pseudharpinia latipes (Norman, 1900)	1			
Phronimidae Rafinesque, 1815				
Phronima atlantica Guérin-Méneville, 1836	1	1		1
Phronima colletti Bovallius, 1887	1	1		1
Phronima curvipes Vosseler, 1901	1			1
Phronima pacifica Streets, 1877		1		1
Phronima sedentaria (Forskål, 1775)	1	1	1	1
Phronima solitaria Guérin-Méneville, 1844	1	1		
Phronima stebbingi Vosseler, 1901		1		1

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Phronimella elongata (Claus, 1862)	1	1		1
Phrosinidae Dana, 1852				
Anchylomera blossevillei H. Milne Edwards, 1830	1	1		1
Phrosina semilunata Risso, 1822	1	1		1
Primno brevidens Bowman, 1978				1
Primno latreillei Stebbing, 1888				1
Primno macropa Guérin-Méneville, 1836	1	1		
Platyscelidae Spence Bate, 1862				
Hemityphis tenuimanus Claus, 1879	1			
Paratyphis maculatus Claus, 1879	1	1		1
Paratyphis parvus Claus, 1887		1		1
Paratyphis promontori Stebbing, 1888	1	1		
Platyscelus armatus (Claus, 1879)	1	1		
Platyscelus crustulatus (Claus, 1879)				1
Platyscelus ovoides (Risso, 1816)	1	1		
Platyscelus serratulus Stebbing, 1888	1	1		
Tetrathyrus forcipatus Claus, 1879	1	1		1
Pleustidae Buchholz, 1874				
Mesopleustes abyssorum (Stebbing, 1888)	1			
Stenopleustes latipes (M. Sars, 1858)	1		1	
Podoceridae Leach, 1814				
Laetmatophilus armatus (Norman, 1869)	1	1	1	
Laetmatophilus purus Stebbing, 1888	1		1	
Laetmatophilus tuberculatus Bruzelius, 1859		1		
Podocerus senegalensis Chevreux, 1926			1	
Podocerus variegatus Leach, 1814	1	1		
Pontogeneiidae Stebbing, 1906				
Dautzenbergia dentata (Chevreux, 1920)		1		
Dautzenbergia grandimana (Chevreux, 1887)			1	
Dautzenbergia megacheir (Walker, 1897)		1		
Eusiroides dellavallei Chevreux, 1899	1	1		
Eusiroides sarsi Chevreux, 1900		1	1	1
Pontogeneia minuta Chevreux, 1908				1
Pronoidae Dana, 1852				
Pronoe capito Guérin-Méneville, 1836	1	1		1
Pseudoniphargidae Karaman, 1993				
Pseudoniphargus cupicola Stock, 1988		1		
Pseudoniphargus littoralis Stock & Abreu, 1993		1		
Pseudoniphargus macrurus Stock & Abreu, 1993		1		
Pseudoniphargus multidens Stock, 1988		1		
Pseudoniphargus porticola Stock, 1988		1		
Pseudoniphargus portosancti Stock & Abreu, 1993		1		

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Pseudoniphargus salinus Stock, 1988		1		
Scinidae Stebbing, 1888				
Acanthoscina acanthodes (Stebbing, 1895)	1	1		
Ctenoscina brevicaudata Wagler, 1926		1		
Ctenoscina macrocarpa (Chevreux, 1905)		1		
Scina borealis (G.O. Sars, 1883)	1	1		1
Scina crassicornis (Fabricius, 1775)	1	1		1
Scina curvidactyla Chevreux, 1914	1	1		
Scina damasi Pirlot, 1929	1	1		1
Scina excisa Wagler, 1926		1		
Scina incerta Chevreux, 1900	1			
Scina inermis Chevreux, 1919	1			
Scina lamperti Vosseler, 1901		1		
Scina latifrons Wagler, 1926				1
Scina lepisma Chun, 1889	1	1		
Scina marginata (Bovallius, 1885)	1	1		
Scina megameros Chevreux, 1919		1		
Scina oedicarpus Stebbing, 1895		1		
Scina pacifica (Bovallius, 1887)	1			
Scina pusilla Chevreux, 1919		1		
Scina rattrayi Stebbing, 1895	1	1	1	1
Scina rattrayi keilhacki Wagler, 1926				1
Scina similis Stebbing, 1895	1	1		1
Scina stebbingi Chevreux, 1919		1		1
Scina stenopus Stebbing, 1895	1	1		
Scina submarginata Tattersall, 1906	1	1		1
Scina tullbergi (Bovallius, 1885)		1		1
Scina uncipes Stebbing, 1895		1		
Scina vosseleri Tattersall, 1906	1	1		
Scina wagleri atlantis Thurston, 1976		1		1
Scina wolterecki Wagler, 1926		1		
Spinoscina spinosa (Chevreux, 1914)	1	1		
Scopelocheiridae Lowry & Stoddart, 1997				
Paracallisoma alberti Chevreux, 1903		1		
Stegocephalidae Dana, 1852				
Andaniexis abyssi (Boeck, 1871)			1	
Parandania boecki (Stebbing, 1888)		1		1
Stenothoidae Boeck, 1871				
Metopa propinqva G.O. Sars, 1892		1		
Stenothoe dollfusi Chevreux, 1887		1		
Stenothoe marina (Spence Bate, 1857)	1	1	1	
Stenothoe monoculoides (Montagu, 1813)	1	1	1	

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Stenothoe tergestina (Nebeski, 1881)	1	1	1	
Stenula latipes (Chevreux & Fage, 1925)	1			
Wollastenothoe minuta Gouillieux & Navarro-Mayoral in Navarro-Mayoral *et al*., 2024		1		
Synopiidae Dana, 1853				
Synopia scheeleana Bovallius, 1886				1
Syrrhoe affinis Chevreux, 1908	1		1	
Talitridae Rafinesque, 1815				
Africorchestia spinifera (Mateus, 1962)	1			
Britorchestia brito (Stebbing, 1891)	1			
Canariorchestia chevreuxi (de Guerne, 1887)		1		
Gazia ancheidos (K.H. Barnard, 1916)		1		
Orchestia gammarellus (Pallas, 1766)	1	1		
Orchestia mediterranea A. Costa, 1853	1	1		
Platorchestia platensis (Krøyer, 1845)	1	1		
Talitrus saltator (Montagu, 1808)	1	1		
Thamneidae Zeidler, 2016				
Thamneus rostratus Bovallius, 1887	1	1		
Trischizostomatidae Lilljeborg, 1865				
Trischizostoma longirostre Chevreux, 1919			1	1
Tryphanidae Boeck, 1871				
Tryphana malmii Boeck, 1871	1	1		1
Tryphosidae Lowry & Stoddart, 1997				
Abyssorchomene chevreuxi (Stebbing, 1906)	1			1
Hippomedon denticulatus (Spence Bate, 1857)	1			
Hippomedon robustus G.O. Sars, 1895	1		1	
Lepidepecreum crenulatum Chevreux, 1925	1		1	
Lepidepecreum crypticum Ruffo & Schiecke, 1977	1			
Lepidepecreum longicorne (Spence Bate & Westwood, 1861)	1	1		
Lepidepecreum typhlops Bonnier, 1896	1		1	
Orchomene humilis (A. Costa, 1853)			1	
Pseudorchomene plebs (Hurley, 1965)				1
Tryphosa crenata Chevreux & Fage, 1925)			1	
Tryphosella minima (Chevreux, 1911)	1			
Tryphosites alleni Sexton, 1911			1	
Tryphosites longipes (Spence Bate & Westwood, 1861)		1		
Unciolidae Myers & Lowry, 2003				
Unciola tenuipes Chevreux, 1920			1	
Uristidae Hurley, 1963				
Anonyx sarsi Steele & Brunel, 1968		1		
Ichnopus spinicornis Boeck, 1861	1			
Stephonyx biscayensis (Chevreux, 1908)	1		1	

Continued

Table 1 continued

Families & Species	Zones			
	NWA	CAN – MAD	SEN	CV
Stephonyx talismani (Chevreux, 1919)	1		1	
Tmetonyx nardonis (Heller, 1867)	1			
Urothoidae Bousfield, 1978				
Urothoe atlantica Bellan-Santini & Menioui, 2004	1			
Urothoe elegans Spence Bate, 1857	1		1	
Urothoe grimaldii Chevreux, 1895	1		1	
Urothoe marina (Spence Bate, 1857)	1	1		
Urothoe poseidonis Reibish, 1905	1		1	
Urothoe pulchella (A. Costa, 1853)	1	1	1	
Vibiliidae Dana, 1852				
Vibilia armata Bovallius, 1887	1	1		1
Vibilia australis Stebbing, 1888		1		
Vibilia borealis Spence Bate & Westwood, 1868	1	1		
Vibilia chuni Behning & Woltereck, 1912	1			
Vibilia cultripes Vosseler, 1901	1	1		
Vibilia jeangerardii Lucas, 1846	1	1		
Vibilia propinqua Stebbing, 1888	1	1		1
Vibilia pyripes Bovallius, 1887		1		
Vibilia stebbingi Behning & Woltereck, 1912		1		
Vibilia viatrix Bovallius, 1887	1	1		1
Vibilioides alberti Chevreux, 1905		1		
Total of species	**297**	**302**	**152**	**122**

When only taking account of the 334 benthic species from the continental shelf, 204 species are listed for NWA, 167 for CAN-MAD, 136 for SEN and only 34 for CV, region where pelagic species are dominant (88 species).

The 509 species recorded in the four regions of the Macaronesian Archipelagos and the north-west African coasts belong to 90 families.

The most diversified family is the Ampeliscidae Krøyer, 1842 (32 species), the Scinidae Stebbing, 1888 (29 species), the Caprellidae Leach, 1814 (22 species). Then, five other families are each represented by 16 species or more: Photidae Boeck, 1871, Maeridae Krapp-Schickel, 2008 and Ischryroceridae Stebbing, 1899 (17 species), Aoridae Stebbing, 1899 and Hyalidae Bulyčeva, 1957 (16 species).

Eight families comprise between 10 and 15 species, 34 families between 3 and 9 species, while 13 families account for 2 species and 27 families (30%) account for only one species (Fig. 2).

Cluster analysis

The first analyses, including all species from the four regions studied here, show a separation between the CV and SEN faunas, while the other three regions are separated at a similarity level of 30%. The SEN is separated from the CAN-MAD and NWA at 40 %, and these two latter regions are themselves separated at 60% (Fig. 3). Cluster analysis shows that each region displays a unique and particular amphipod diversity, with a high similarity between NWA and CAN-MAD amphipod faunas compared with SEN and CV. The second analyses include only the benthic species, showing the same pattern as above but with a greater separation of the CV fauna from the three others (Fig. 4).

Discussion

State of the inventory and comments

The amphipod checklist accounts for 509 species, which is a higher number than the 454 species in the inventory recently established for the five countries bordering the southern Mediterranean Sea (Bakalem *et al*., 2024). However, there is a lack of data for pelagic species in the southern Mediterranean Sea, except along the Egyptian coast, while deep-sea amphipods are only

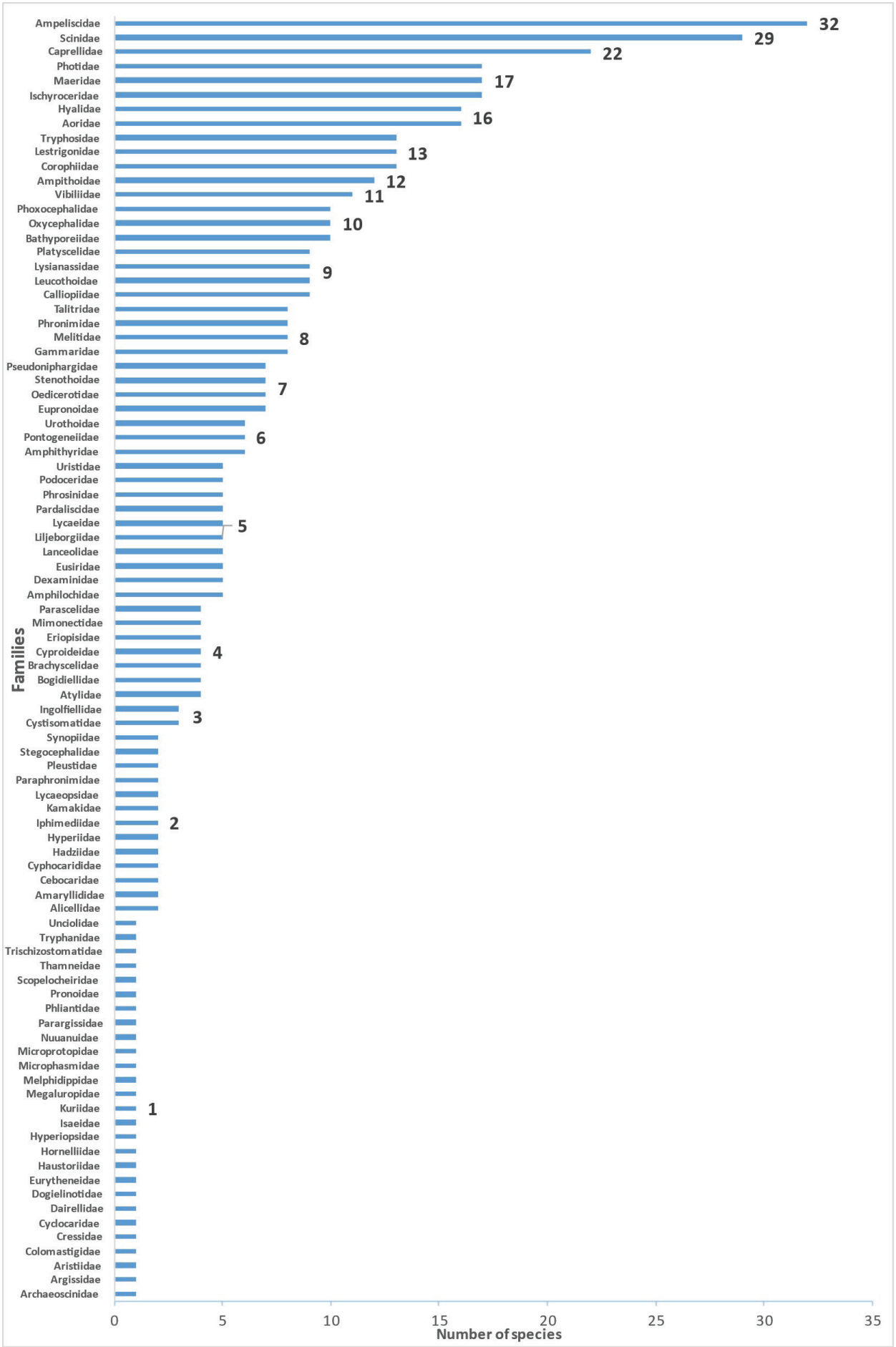

Fig. 2: Numbers of species among the 90 families reported in the 2024 amphipod checklist for the four regions Macaronesian Archipelagos and African coasts.

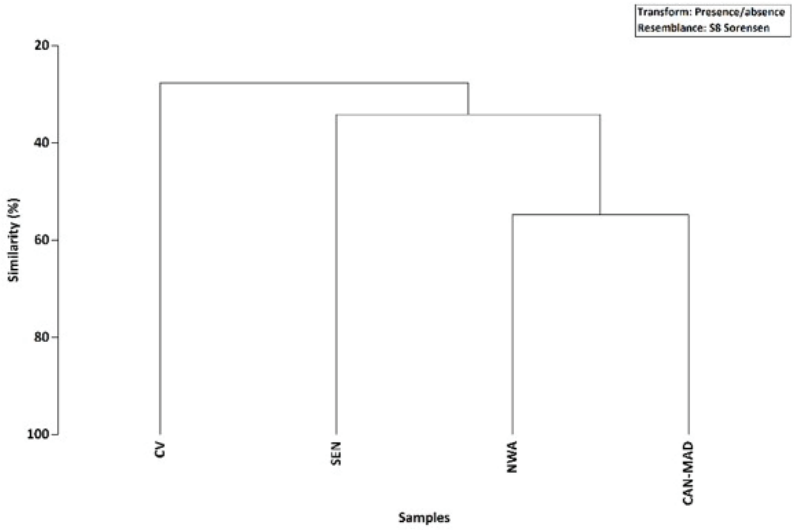

Fig. 3: Results of cluster analysis (Sørensen similarity) on all amphipod species in the four regions of the Macaronesian Archipelagos and north-west African coasts. See Figure 1 for location of the regions.

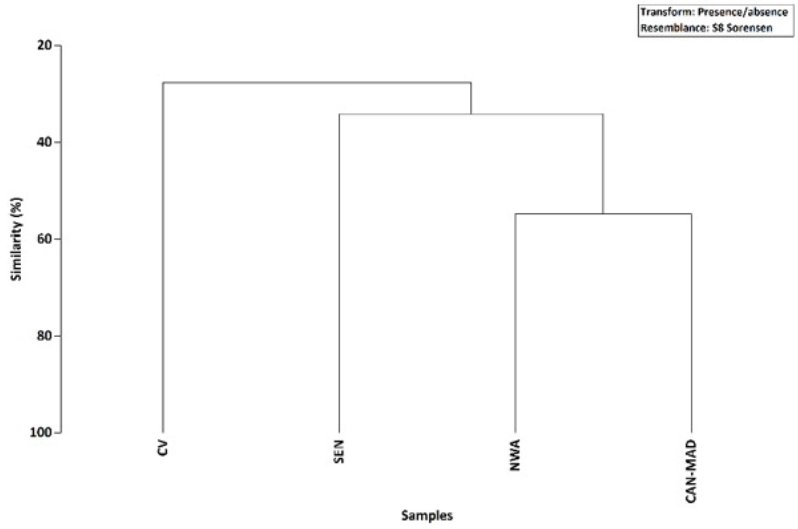

Fig. 4: Results of cluster analysis (Sørensen similarity) on benthic amphipod species recorded on the continental/insular shelf in the four regions of the Macaronesian Archipelagos and north-west African coasts. See Figure 1 for location of the regions.

known from a campaign off the Algerian coast (Bakalem *et al*., 2024). Moreover, our checklist supersedes the checklists of Bachelet *et al*., (2003) for amphipods from the southern Bay of Biscay (319 species) and Dauvin (2022) for the English Channel (269 species).

A total of 66 species (13% of total Amphipods) have been described from the four regions studied here, among them 21 coming from SEN, 17 from CAN-MAD, 17 from NWA and seven from CV, while four species were originally described from two regions (Table 2). Among the species new to science, Chevreux described 30 species (45%), then Stock (eight species), Reid (six species), and d'Udekem d'Acoz and Menioui (three species).

Table 3 reports the 59 endemic species recorded only in the four regions studied here. Most of them have been recorded only in the two archipelagos CAN-MAD and the region SEN. There are very few non-indigenous or possibly non-indigenous species in this part of the North-East Atlantic (Table 4), with four species from the Canary and Madeira Archipelagos and three species along the Moroccan coast. This is a very low number compared to the potential total of 105 species in this amphipod category for the world ocean (Marchini & Cardeccia, 2017), even though there is intense maritime traffic between Europe and the African continent as well as to the numerous islands of the region. Bakalem *et al*. (2024) reported 15 non-indigenous or possibly non-indigenous species for the five southern Mediterranean countries, while Dauvin (2022) indicated 12 that are non-indigenous species for the English Channel.

Comparison with other checklists of benthic amphipods from the Mediterranean Sea and neighbouring regions in the North-East Atlantic (Azores and Portugal-Spain-France)

The benthic amphipod checklists for the four Maca-

Table 2. List of the amphipod species described from material coming from the four zones of the Macaronesian Archipelagos and North-West Atlantic Africa (NWA: Northwest African coasts; CAN-MAD: Canary & Madeira Archipelagos; SEN: Senegalese & Mauritanian coasts and Cabo Verde).

Species	NWA	CAN-MAD	SEN	Cabo Verde
Ampelisca cavicoxa Reid, 1951			Senegal	
Ampelisca monoculata Dauvin & Bellan-Santini, 1985	Sahara			
Ampelisca pectenata Reid, 1951			Senegal	
Ampelisca senegalensis Chevreux, 1925			Senegal	
Ampelisca verga Reid, 1951			Senegal	
Ampithoe grubiformis Reid, 1951				+
Bathyporeia chevreuxi d'Udekem d'Acoz & Vader, 2005			Senegal	
Bathyporeia elkaimi d'Udekem d'Acoz & Menioui, 2004	Morocco			
Bathyporeia ledoyeri d'Udekem d'Acoz & Menioui 2004	Morocco			
Bathyporeia microceras d'Udekem d'Acoz & Menioui 2004	Morocco			
Bathyporeia watkini d'Udekem d'Acoz, Echchaoui & Menioui 2004	Morocco			
Bogidiella madeirae Stock, 1994		Madeira		
Cabogidiella littoralis Stock & Vonk, 1992				+
Caprella wirtzi Krapp-Schickel &Takeuchi, 2000				+
Cerapopsis takamado Menioui et Myers 2000	Morocco			
Crybelocephalus birsteini Thurston, 1976		Canarias		
Dautzenbergia dentata Chevreux, 1920		Canarias		
Dulzura lobata Stock & Vonk, 1991				+
Elasmopus canarius Krapp-Schickel & Ruffo, 1990		Canarias		
Gammaropsis minuta (Chevreux, 1926)			Senegal	
Gammarus nox Stock, 1995		Canarias-Madeira		
Globosolembos francanni (Reid, 1951)				+
Grandidierella elongata Chevreux, 1926	Sahara			
Hadzia acutus (Andres, 1978)		Canarias		
Halice aculeata Chevreux, 1912	Morocco	Madeira		
Halicoides discovery Thurston, 1976		Canarias		
Haploops proxima Chevreux, 1919	Morocco			
Hornellia (Metaceradocus) perdentatus Chevreux, 1925			Senegal	
Ingolfiella unguiculata Stock, 1992		Madeira		
Lepidepecreum crenulatum Chevreux, 1925	Sahara			
Leucothoe brunonis Krapp- Schickel & Menioui, 2005	Morocco			
Leucothoe spinulosa Chevreux, 1919			Mauritania	
Liljeborgia inermis Chevreux, 1920			Mauritania	
Liropus gracilis Chevreux, 1920	Morocco			
Maera edwardsi Chevreux, 1920		Canarias	Mauritania	+
Maeropsis perrieri Chevreux, 1920	Morocco			
Mantacaprella macaronensis Vázquez-Luis, Guerra-García, Carvalho & Png-González, 2013		Canarias		+
Megamphopus longidactyla Chevreux,1926			Senegal	
Mimonectes sphaericus Bovallius, 1885		Canarias		
Mimonectes spandlii Stephensen & Pirlot, 1931	Morocco			
Paracallisoma alberti Chevreux, 1903		Madeira		
Photis antennata Chevreux, 1926	Sahara			
Photis longicarpa Chevreux, 1926			Senegal	

Continued

Table 2 continued

Species	NWA	CAN-MAD	SEN	Cabo Verde
Photis obesa Chevreux, 1926			Senegal	
Podoceropsis angulosa Chevreux, 1920			Mauritania	
Podocerus senegalensis Chevreux, 1926			Senegal	
Pseudharpinia brevirostris (Chevreux, 1919)			Mauritania	
Psammogammarus initialis Stock & Sanchez, 1987		Canarias		
Psammogammarus spinosus Stock & Vonk, 1992				+
Psammogammarus stocki Vonk, 1990		Canarias		
Ptilohyale barnardi (Chevreux, 1926)			Senegal	
Scina damasi Pirlot, 1929	Morocco	Madeira		
Scina wagleri atlantis Thurston, 1976		Canarias		
Serejohyale ramalhoi (Reid, 1939)		Madeira		
Serejohyale spinidactylus (Chevreux, 1926)		Canarias	Senegal	
Socarnopsis obesa Chevreux, 1919			Mauritania	
Spelaeonicippe buchi (Andres, 1975)		Canarias		
Stephonyx talismani (Chevreux, 1919)	Morocco			
Syrrhoe affinis Chevreux, 1908	Morocco			
Trischizostoma longirostre Chevreux, 1919			Senegal	+
Tritaeta chelata Chevreux, 1925			Senegal	
Unciola tenuipes Chevreux, 1920			Mauritania	
Urothoe atlantica Bellan Santini & Menioui, 2005	Morocco			
Verdeia grandimana (Chevreux, 1908)				+
Victoriopisa atlantica Stock & Platvoet, 1981			Mauritania	
Wollastenothoe minuta Gouillieux & Navarro-Mayoral in Navarro-Mayoral *et al*., 2024		Canarias		

Table 3. Checklist of the endemic amphipod species in the four zones of the Macaronesian Archipelagos and North-West Atlantic Africa (NWA: Northwest African coasts; CAN-MAD: Canary & Madeira Archipelagos; SEN: Senegalese & Mauritanian coasts and Cabo Verde).

Species	NWA	CAN-MAD	SEN	Cabo Verde
Ampelisca senegalensis Chevreux, 1925			Senegal	
Ampithoe grubiformis Reid, 1951				+
Bathyporeia chevreuxi d'Udekem d'Acoz & Vader, 2005	Morocco			
Bathyporeia ledoyeri d'Udekem d'Acoz & Menioui 2004	Morocco			
Bathyporeia microceras d'Udekem d'Acoz & Menioui 2004	Morocco			
Bathyporeia watkini d'Udekem d'Acoz, Echchaoui & Menioui 2004	Morocco			
Bogidiella madeirae Stock, 1994		Madeira		
Cabogidiella littoralis Stock & Vonk, 1992				+
Caprella wirtzi Krapp-Schickel &Takeuchi, 2000				+
Cerapopsis takamado Menioui et Myers 2000	Morocco			
Crybelocephalus birsteini Thurston, 1976		Canarias		
Dulzura lobata Stock & Vonk, 1991				+
Elasmopus canarius Krapp-Schickel & Ruffo, 1990		Canarias		
Gammaropsis minuta (Chevreux, 1926)			Senegal	
Gammarus nox Stock, 1995		Canarias, Madeira		
Hadzia acutus (Andres, 1978)		Canarias		

Continued

Table 3 continued

Species	NWA	CAN-MAD	SEN	Cabo Verde
Halice aculeata Chevreux, 1912	Morocco	Madeira		
Halicoides discovery Thurston, 1976		Canarias		
Hornellia (Metaceradocus) perdentatus Chevreux, 1925			Senegal	
Ingolfiella canariensis Vonk & Sánchez, 1991		Canarias		
Ingolfiella similis Rondé-Broekhuizen & Stock, 1987		Canarias		
Ingolfiella unguiculata Stock, 1992		Canarias, Madeira		
Leucothoe brunonis Krapp-Schickel & Menioui, 2005	Morocco			
Leucothoe spinulosa Chevreux, 1919			Mauritania	
Liropus gracilis Chevreux, 1920	Morocco			
Maera edwardsi Chevreux, 1920		Canarias	Mauritania	+
Maeropsis perrieri Chevreux, 1920	Morocco			
Mantacaprella macaronensis Vázquez-Luis, Guerra-García, Carvalho & Png-González, 2013		Canarias		+
Megamphopus longidactyla Chevreux, 1926			Senegal	
Parhyale multispinosa Stock, 1987		Canarias		
Photis antennata Chevreux, 1926	Sahara			
Photis longicarpa Chevreux, 1926			Senegal	
Photis obesa Chevreux, 1926			Senegal	
Podoceropsis angulosa Chevreux, 1920			Mauritania	
Podocerus senegalensis Chevreux, 1926			Senegal	
Psammogammarus initialis Stock & Sánchez, 1987		Canarias		
Psammogammarus spinosus Stock & Vonk, 1992				+
Psammogammarus stocki Vonk, 1990		Canarias		
Pseudharpinia brevirostris (Chevreux, 1919)			Mauritania	
Pseudoniphargus cupicola Stock, 1988		Canarias		
Pseudoniphargus multidens Stock, 1988		Canarias		
Pseudoniphargus porticola Stock, 1988		Canarias		
Pseudoniphargus salinus Stock, 1988		Canarias		
Ptilohyale barnardi (Chevreux, 1926)			Senegal	
Scina wagleri atlantis Thurston, 1976		Canarias		
Serejohyale ramalhoi (Reid, 1939)		Madeira		
Socarnopsis obesa Chevreux, 1919			Mauritania	
Spelaeonicippe buchi (Andres, 1975)		Canarias		
Stephonyx talismani (Chevreux, 1919)	Morocco			
Stygogidiella atlantica (Sánchez, 1991)		Canarias		
Stygogidiella uniramosa (Stock & Rondé-Broekhuizen, 1987)		Canarias		
Trischizostoma longirostre Chevreux, 1919			Senegal	+
Tritaeta chelata Chevreux, 1925			Senegal	
Unciola tenuipes Chevreux, 1920			Mauritania	
Urothoe atlantica Bellan Santini et Menioui, 2004	Morocco			
Verdeia grandimana (Chevreux, 1908)				+
Victoriopisa atlantica Stock & Platvoet, 1981			Mauritania	
Wollastenothoe minuta Gouillieux & Navarro-Mayoral in Navarro-Mayoral et al., 2024		Canarias		
Xystrriogidiella spathulata (Stock & Rondé-Broekhuizen, 1987)		Canarias		

Table 4. Checklist of the non-indigenous species or may be non-indigenous species of amphipods reported in the four zones of the Macaronesian Archipelagos and North-west Atlantic Africa.

Species	Status of the species	Establishment success of the species	Date of first record and source of the first signalisation					
			Canary Archipelago		Madeira Archipelago		Morocco	
Caprella scaura Templeton, 1836	Non-indigenous	Invasive	2009	Guerra-García *et al.,* 2011	2013	Ramalhosa & Canning-Clode, 2015		
Ericthonius punctatus (Spence Bate, 1857)	May be non-indigenous	Established			2018	Png-Gonzalez *et al*., 2021		
Jassa marmorata Holmes, 1905	May be non-indigenous	Established	2011	Riera *et al*., 2014			1984	Bitar, 1987
Monocorophium acherusicum (Costa, 1853)	Non-indigenous	Established	2005	Riera *et al*., 2014			1972	Elkaim, 1974
Platyscelus armatus (Claus, 1879)	Non-indigenous	Casual	2012	Mingorance *et al.,* 2014			1922	Pirlot, 1929

ronesian archipelagos and north-west African coasts are compared with data from three neighbouring regions.

The checklist of benthic amphipods of the Azores Archipelago (AZO) is established from the first inventory of amphipod species provided by Lopes *et al*. (1993) and supplementary data obtained subsequently (Wirtz, 1998; Guerra-García, 2004; Bamber & Robbins, 2009; Zeina *et al*., 2015; Andrade *et al*., 2021). The total number of species for the AZO shelf is 88. This low number is probably due to the development of a narrow insular shelf around the volcanic Azores archipelago. Lopes *et al.* (1993) reported a total of 122 species including numerous deep-sea amphipods mainly described by Edouard Chevreux during the expeditions of Prince Albert Ist of Monaco in this part of the North-Eastern Atlantic; Guerra-García (2004) reported three new species of deep-sea Caprellidea for the Azores Archipelago, making a total of 125 species for the Azores.

The present checklist reports 377 species of benthic amphipods from the Mediterranean coasts of Morocco and Algeria (MOR-ALG); this checklist was established from the recent study of Bakalem *et al*. (2024), combined with the historical data for Morocco (Menioui & Bayed, 1986; Menioui & Ruffo, 1988). This total is higher than that reported for Morocco (240 species) and Algeria (336 species), certain species being present in only one of the two countries. In this part of the Mediterranean Sea, the numbers of pelagic and deep-sea species are very low (Bakalem *et al*., 2024).

For the continental shelf extending from the Strait of Gibraltar to the North of the Bay of Biscay (BIS-IBE), the number of benthic amphipods reaches 315 species. The checklist was established for the whole Bay of Biscay from the lists of Dauvin & Bellan-Santini (2002, 2004) and Bachelet *et al.* (2003), with additional papers describing new species (Kaim-Malka, 2012; Tato *et al*., 2012; Gouillieux & Sorbe, 2015; Gouillieux, 2019) or new records mainly for non-indigenous species from this region (Jourde *et al*., 2013; Gouillieux *et al*., 2015, 2016; Gouillieux, 2017; Gouillieux & Massé, 2019; Gouillieux *et al*., 2020; Gouillieux & Droual, 2020). For the Iberian Atlantic coast, the checklist was established from the inventories of Marques & Bellan-Santini (1991) and Sampaio *et al.* (2016), as well as more local studies including lists of coastal benthic amphipods (van Maren, 1975; Rodrigues & Dauvin, 1985, 1987; Pardal *et al*., 2002; Lourido *et al*., 2008; Moreira *et al*., 2008; Carvalho *et al*., 2012; Plicanti *et al*., 2017; Dauvin *et al*., 2021; Gomes *et al*., 2022).

Including the four regions of our checklist, the total number of benthic species of the seven regions included in this comparison reaches 587 species. A total of 259 species (44%) are reported in only one of the studied regions. Only 7 species are recorded in CV and 10 in AZO. For NWA, SEN and CAN-MAD, the total numbers of species are 13, 25 and 30, respectively. The numbers are highest for MOR-ALG (100 species), where a large number of species have been reported that are endemic for the Mediterranean Sea (Bakalem *et al*., 2024). A total of 74 species have been recorded only once for the BIS-IBE, in a region where cold-temperate species are present (Bachelet *et al*., 2003; Dauvin, 2022).

A total of 203 species (35%) have been recorded in two or three regions, 52 (9%) in four regions, 30 (5%) in five regions, 26 (4%) in six regions, while only 5 species are present in all regions: *Aora typica*, *Ericthonius brasiliensis*, *Gammaropsis maculata*, *Leucothoe spinicarpa* and *Phtisica marina*.

At a similarity level of 45%, the Cluster Analysis shows that the seven regions can be separated into four main groups (Fig. 5). CV (group a) is separated from the rest of the regions, while SEN (group b) is separated from all the others. The third group c gathers together the three regions NWA, MOR-ALG and BIS-IBE, while group d is made up of the CAN-MAD and AZO archipelagos. In summary, the amphipod fauna is distinguished by the

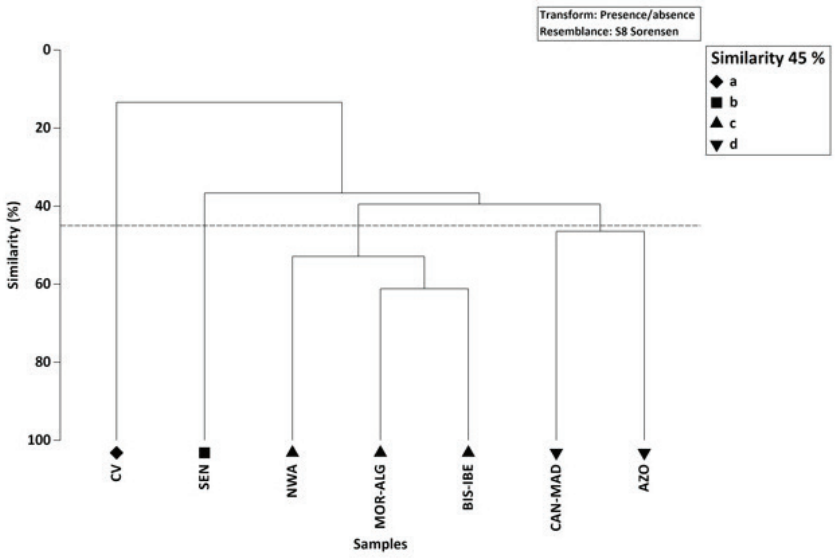

Fig. 5: Results of cluster analysis (Sørensen similarity) on benthic amphipod species (presence or absence) recorded on the continental shelf in seven regions of the North-East Atlantic plus the south-western Mediterranean Sea. See Figure 1 for location of the regions.

species diversity of the two southern regions SEN and CV. Moreover, a similar diversity is observed across the geographical continuum to the south, north and east of the Gibraltar Strait, as well as a high affinity with the amphipod diversity of the archipelagos lying offshore northwest Africa.

In their study of the biogeography of benthic marine amphipods of the Mediterranean Sea, Bellan-Santini & Ruffo (2003) stated that 38 % of the species were Mediterranean endemic species, while 59% were common to the Atlantic Ocean and the Mediterranean Sea, with a high affinity between both amphipod faunas. Based on a collection of soft-bottom crustaceans, Sampaio *et al.* (2016), showed that the Portuguese continental shelf offers favourable environmental conditions to support diverse benthic crustacean communities and confirmed that the Portuguese coast represents a transition zone with mixed Atlantic and Mediterranean faunas while also being exposed to noticeable North African and Macaronesian influences.

In their review of the benthos of the north-west Africa, Ramos *et al*. (2015) highlighted an important faunistic change between the tropical and temperate biota at the latitude of Cape Blanc, which is the limit between NWA and SEN. The benthos of Cabo Verde and the Canary Islands shows some specific features linked to their volcanic origin, insularity and oceanographic conditions.

More recently, Freitas *et al*. (2019) have reviewed the biogeographic region known as 'Macaronesia', including the Azores, Madeira, and the Selvagens, Canary and Cabo Verde archipelagos, using a multitaxon approach for a total of 3,737 marine species: 465 coastal fishes, 151 echinoderms, 1,312 gastropods, 177 brachyurans, 683 polychaetes and 949 macroalgae. These authors (*op. cit*.) show a complex situation including different patterns according to the type of organisms, and a clear separation of the Carbo Verde archipelago from the other Macaronesian islands due to the high number of endemic species in several marine phyla, particularly gastropod molluscs. When using the available checklist for the tropical West African shores (e.g., for fishes and macroalgae), their results support the inclusion of Cabo Verde as an independent marine ecoregion in the West African Transition province and separated from the Lusitanian Province, which includes the Azores, Madeira, Selvagens and Canary archipelagos. Therefore, Freitas *et al.* (2019) suggested redefining the Lusitanian biogeographical province, which could include the South European Atlantic Shelf, the Saharan Upwelling, the Azores and Webbnesia (i.e., Madeira, Selvagens and Canaries).

Vieira *et al*. (2021) has used mitochondrial DNA sequences to investigate the genetic differentiation between 28 populations from "Webbnesia" and adjacent coasts, based on 23 intertidal peracarid species including 13 amphipods. These populations display a notable genetic diversity and high endemicity, with 83% of the MOTUs (molecular operational taxonomic units) being restricted to these islands, particularly La Palma (Canaries) and Madeira. A clear differentiation can be observed in all the examined species between Webbnesia and the Iberian populations. The populations from the Azores and Morocco display specificities depending on the taxon. In their study, Vieira *et al.* (2021) found that both patterns were observed, i.e.: connections between the Azores and Webbnesia as well as between the Azores and the Iberian Peninsula. However, these data suggest a higher genetic proximity between the Moroccan and Iberian populations, contradicting other studies that relate the populations from Morocco with those from Macaronesia due to their vicinity.

Our Cluster Analysis on the benthic amphipods is supported by the biogeographical patterns identified in these previous studies. There is a net separation of the Cabo Verde and Senegal amphipod faunas from the rest of the

other north-eastern regions, as well as a similarity of amphipod faunas between the Azores and Webbnesia, and between the Atlantic-Mediterranean regions to the south, north and east of the Gibraltar Strait (see Fig. 5). Moreover, for this last group of regions, several contingents of species can be identified: Mediterranean endemic species in MOR-ALG, cold temperate species present only in the Bay of Biscay (BIS-IBE region) and some tropical species in the NWA region. In summary, the number of shared species in these three regions exceeds the number of species found in only one region, showing the same biogeographical pattern of the Amphipoda fauna as in the Lusitanian province as suggested by Freitas *et al.* (2019).

Need for future research

The present checklist of amphipods covers not only the continental shelf of north-west Africa but also the bathyal and abyssal waters. It includes pelagic and benthic amphipods recorded in this extended part of the North-East Atlantic. It is clear that the research effort is different in all of the four studied regions. The CV region has been intensively sampled for the zooplankton, resulting in a large number of pelagic amphipod species (88); it is the only one of four regions studied where this number is significantly higher than that of benthic amphipods (34).

Mainly due to the cruises of Prince Albert Ist of Monaco in this part of the north-eastern Atlantic, the deep-sea amphipod fauna is acceptably known. Most of the deeper amphipods collected during these cruises were studied by Edouard Chevreux, and among them numerous species new to science were described. Chevreux (1925) also studied the amphipods from Senegal and described new species for this area from material collected during the '*Voyage de la goélette "Melita" aux Canaries et au Sénégal (1889-1890)*'. The contribution of Reid (1951) on the Amphipoda (Gammaridea and Caprellidea) of the coast of tropical West Africa has also increased our knowledge on the amphipods of this region. Very few recent studies are available for the coasts of Senegal and Mauritania over the last 70 years.

Similarly, for the SEN region, there are very numerous scientific studies and reports on the Arguin bank, which is a Mauritanian National Park of international importance mainly for birds (Wijnsma *et al*., 1999; Araujo & Campredon, 2016). But, despite these publications, there are very few data on amphipod species and only the amphipod taxa are recorded.

Our knowledge of the amphipods is satisfactory for the two other regions (CAN-MAD and NWA), mainly concerning the Moroccan shallow waters and hard substrates of the Canaries Archipelago. In these regions, particular attention should be focused on artificial hard bottoms in harbours and other human infrastructures that could increase the number of indigenous and non-indigenous species responsible for biofouling.

Acknowledgements

The authors thank Jean-Philippe Pezy, CNRS, UMR 6143 M2C '*Morphodynamique Continentale et Côtière*' for the Primer analyses and Michael Carpenter for his help in improving the English of this typescript. The authors thank both reviewers for their very useful remarks and comments on the first version of the typescript.

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APPENDIX

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