5.5. Biodiversity and biogeography of decapods crustaceans in the Canary Current Large Marine Ecosystem

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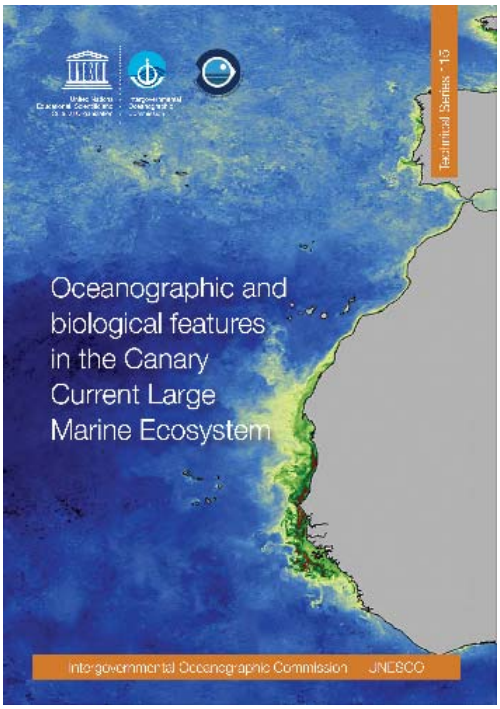

The report *Oceanographic and biological features in the Canary Current Large Marine Ecosystem* and its separate parts are available on-line at: http://www.unesco.org/new/en/ioc/ts115.

The bibliography of the entire publication is listed in alphabetical order on pages 351-379. The bibliography cited in this particular article was extracted from the full bibliography and is listed in alphabetical order at the end of this offprint, in unnumbered pages.

ABSTRACT
Decapods constitute the dominant benthic group in the Canary Current Large Marine Ecosystem (CCLME). An inventory of the decapod species in this area was made based on the information compiled from surveys and biological collections of the Instituto Español de Oceanografía. A total number of 228 species belonging to 54 families were registered. Brachyura, with 87 different species was the most diversified taxa, followed by Caridea and Anomura with 61 and 33 species, respectively. The high diversity of this group in the CCLME is favoured by the presence of typically temperate species in the North (Morocco-Western Sahara), subtropical-temperate species from Morocco to Mauritania, and typically tropical species in the South (Guinea-Bissau–Guinea). The diversity in the most temperate and northern zone was higher than in the most tropical and southern zone, with exceptionally high values in Mauritania mainly explained by its special biogeographic and oceanographic conditions. Some decapod species have been exploited by both artisanal and industrial fisheries for decades, providing significant incomes to the coastal states. However, the intense shrimp fishing activities have some negative effects like the overexploitation of certain stocks and the impact on benthic communities by disturbing their physical structures and habitats.

Keywords: Decapods diversity · Biogeography · Temperate species · Tropical species · Fisheries · Canary Current Large Marine Ecosystem · Northwest Africa

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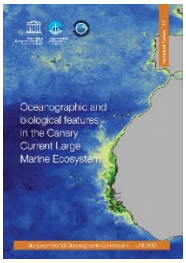

BIODIVERSITY AND BIOGEOGRAPHY OF DECAPOD CRUSTACEANS IN THE CANARY CURRENT LARGE MARINE ECOSYSTEM

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5.5.1. INTRODUCTION

Crustaceans constitute one of the most morphologically diverse taxonomic groups on the planet (Martin and Davis, 2001). Among them, decapods are the most studied taxon, mainly on account of the commercial interest of some species and their great diversity. Decapods are mainly composed of marine species that live in waters depths ranging from shallow to deeper than 5000 m. The importance of this group lies in several factors such as the great biomass they represent, their significant role in marine food webs and the commercial interest of many decapod species.

The main morphologic types of Decapoda (the word means “ten legs”) include: (i) shrimps and prawns (Dendrobranchiata -Penaeidae- and families Caridea, Stenopodidea and Axiidea), (ii) crabs (Brachyura), (iii) lobsters (infraorders Astacidea and Achelata) and (iv) squat lobsters and hermit crabs (Anomura).

A number of expeditions have been carried out in West African waters since the 19th century with the aim of studying their marine environment and fauna, which involved the first studies on crustaceans including part of the entire Canary Current Large Marine Ecosystem (CCLME) region. This is the case of the *Travailleur* and *Talisman* expeditions in the 19th century (Milne-Edwards and Bouvier, 1892, 1900), and the worldwide voyage of the HMS *Challenger* (Bate, 1888). In the 20th century, the expeditions *Mercator* (1935-1936 and 1938), *Atlantide* (1945 and 1946) and *Calypso* (1956) contributed to a better knowledge of different decapod groups in West Africa (Capart, 1951; Holthuis, 1951; Crosnier and Forest, 1965, 1966; Miyake and Baba, 1970; Saint Laurent and Le Loeuff, 1979). Some crustacean species from Moroccan Atlantic waters, Western Sahara and Mauritania were collected during the cruises on board the R/V *Meteor* in 1967, 1970, 1971 and 1975 (Türkay, 1975, 1976), the R/V *Thalassa* in 1962 (Maurin, 1963), 1968 and 1971 and the R/V *Atlor VII* in 1975 (Anadón, 1981). A significant number of organisms were collected during the CAPCAN expeditions to the Canarian-Caboverdian region (1976-1986) and the MAURITANIA expedition to the Bank d’Arguin (1988) (Fransen, 1991). The material collected in all these expeditions and surveys provided faunal inventories and species descriptions in the CCLME area.

More recently, the surveys carried out by the Instituto Español de Oceanografía (IEO) from 2002 to 2010, on board the R/V *Vizconde de Eza* in several Exclusive Economic Zones (EEZs) of the CCLME region provided excellent material for studying the taxonomy and ecology of decapods in the area. In addition, the analysis of the material collected in the last CCLME Ecosystem surveys conducted on board the R/V *Dr. Fridtjof Nansen* in 2011 and 2012, which is currently under study, will undoubtedly be a valuable tool in furthering knowledge of the crustacean biodiversity in the whole area.

There are certain studies concerning fisheries and biological aspects of some crustacean species (i.e. Maurin and Bonnet, 1969; Crosnier and De Bondy, 1967; Lhomme, 1978, 1979a, b; Bast et al., 1984; Lhomme and Garcia, 1984; Cervantes and Goñi, 1985; García, 1988; Cervantes et al., 1992; Sobrino and

García, 1991, 1992a, 1992b, 1994; Caveriviere and Rabarison Andriamirado, 1997; Laë et al., 2004; Thiaw et al., 2009). Only a few recent works have analysed ecological aspects of the decapod community structure in certain CCLME areas (Muñoz et al., 2012; García-Isarch et al., submitted). Aside from these studies, the literature about decapod crustaceans in the CCLME is rather dispersed and mainly focused on faunal lists and taxonomic aspects of certain species. There is a large number of studies concerning single species or genera. More generally, it is worth mentioning the excellent works carried out in the region by Crosnier and Forest (1973) on deep shrimps (Caridea and Penaidea) and Capart (1951), Monod (1956) and Manning and Holthuis (1981) on Brachyuran crabs. In addition, some excellent taxonomic reviews include West African records such as Zariquiey (1968) for decapods in general; Macpherson (1988) for Lithodidae; Pérez-Farfante and Kensley (1997) for penaeoid shrimps; Holthuis (1991) for lobsters; Galil (2000) for Polychelid lobsters; and McLauguin (2003) for hermit crabs, among others.

In the CCLME, decapod species have been targeted by both artisanal (local) and industrial fisheries. Foreign industrial shrimper fleets have been established in the area since the decade of the 60s, first freely and, since the implementation of the Convention on the Law of the Sea (UNCLOS, 1982), through agreements between the different administrations involved. Later, most CCLME countries developed their own industrial fisheries. The exploitation of these resources has provided significant economic incomes to the coastal States.

The purpose of this article is to present a global overview of the biodiversity of crustaceans in the CCLME region considering the latest information available, supported by an extensive literature review.

5.5.2. METHODS

The main data sources considered for the study of decapod diversity in the CCLME region were:

- IEO surveys. These were carried out in waters off Morocco (2004 and 2005) and Western Sahara (2006), Mauritania (2007, 2008 and 2009) and Guinea-Bissau (2008) on board the R/V *Vizconde de Eza*. Samples were taken by means of bottom trawls, at depths ranging from 229 m to 1861 m (Morocco-Western Sahara), 81 to 1825 m (Mauritania) and 20 to 1000 m (Guinea-Bissau). Decapods taken in each haul were sorted and keyed as specifically as possible to the lowest taxonomic level, counted and weighed. In order to check and complete the species identification, specimens of all the species caught were preserved and transported to the laboratory, where they have already been exhaustively reviewed in the case of Mauritania (García-Isarch et al., submitted) and Guinea-Bissau (Muñoz et al., 2012).

- Decapod specimens deposited in the Collection of Decapod and Stomatopod Crustaceans of the Cádiz Oceanographic Centre (Colección de Crustáceos Decápodos y Estomatópodos del Centro Oceanográfico de Cádiz, CCDE-IEOCD) from the IEO. This collection contains a great number of specimens from West Africa, mainly provided by the IEO and CCLME surveys, together with the IEO programmes of scientific observations on board the shrimper fleet in Mauritania and Guinea Bissau.

- Other sources: IEO databases of commercial fisheries developed in the region.

These data were used to produce a faunal list of the decapods in the area. The island fauna of the CCLME (the Canary Islands and Cape Verde Islands) remained beyond the scope of this study, on account of the lack of data. Considering the different type of sources, only a qualitative analysis was performed, based on

the presence/absence of each species in the CCLME countries. Given the geographical situation of Senegal and The Gambia, both countries were considered the same area.

The sampling coverage level was not the same for all the countries. The areas better sampled and studied were Mauritania and Guinea-Bissau (Muñoz et al., 2012; García-Isarch et al., submitted). The information from Morocco and Western Sahara was quite comprehensive (Ramos et al., 2005; Hernández-González et al., 2006; Hernández-González, 2007), although an in-depth analysis is still needed for a better knowledge of the biodiversity in these waters. However, the data from Senegal, The Gambia and Guinea came only from the material deposited in the CCDE-IEOCD collection, meaning that it does not represent the real diversity in the area. Because of the small number of specimens listed from Guinea, we analysed the decapod fauna of this country together with that of Guinea-Bissau, considering that species occurring in both EEZs were unlikely to be very different, because of the vicinity and similar characteristics of the two areas. Estimations of the species richness by area and by taxonomic group were made using this information.

Taking into account the limitations of our data (not all the areas and depths are similarly represented), the literature available was reviewed to confirm the geographical range of certain species.

5.5.3. RESULTS AND DISCUSSION

5.5.3.1. Species composition and diversity

A total number of 228 decapod species belonging to 54 families are reported in this work for the CCLME. Table 5.5.1 shows the taxonomic list by area (Morocco-Western Sahara, Mauritania, Senegal-The Gambia, Guinea-Bissau-Guinea), indicating the origin of the record (IEO survey, CCDE-IEOCD collection or other sources). Geographical positions of the specimens deposited in the CCDE-IEOCD collection are shown in Figure 5.5.1.

Brachyura, with 87 different species, was the most diversified taxa, followed by Caridea and Anomura with 61 and 33 species, respectively. The most important families in terms of species richness were the Inachidae spider crabs (20 species), followed by the Macropipidae crabs (17 species), the Oplophoridae deep sea shrimps (16), the Pandalidae shrimps (15) and the Penaeidae shrimps (10). Other diverse families were Crangonidae and Pasiphaeidae (8 species each) and the Diogenidae and Paguridae hermit crabs (7 species each). The remaining 45 families were represented by fewer than 6 species each (Figure 5.5.2).

Quantitative data have only been analysed in Mauritania and Guinea-Bissau so far. These analyses revealed quite similar decapod diversities in both areas (H’ = 3.22 in Mauritania and H’ = 3.30 in Guinea-Bissau; H’= Shannon diversity index) (Muñoz et al., 2012; García-Isarch et al., submitted), although samples were obtained at different depth ranges. When comparing the number of species registered in the current study, Morocco-Western Sahara and Mauritania showed the greatest species richness (137 and 134 species, respectively), followed by Guinea-Bissau-Guinea (119 species).

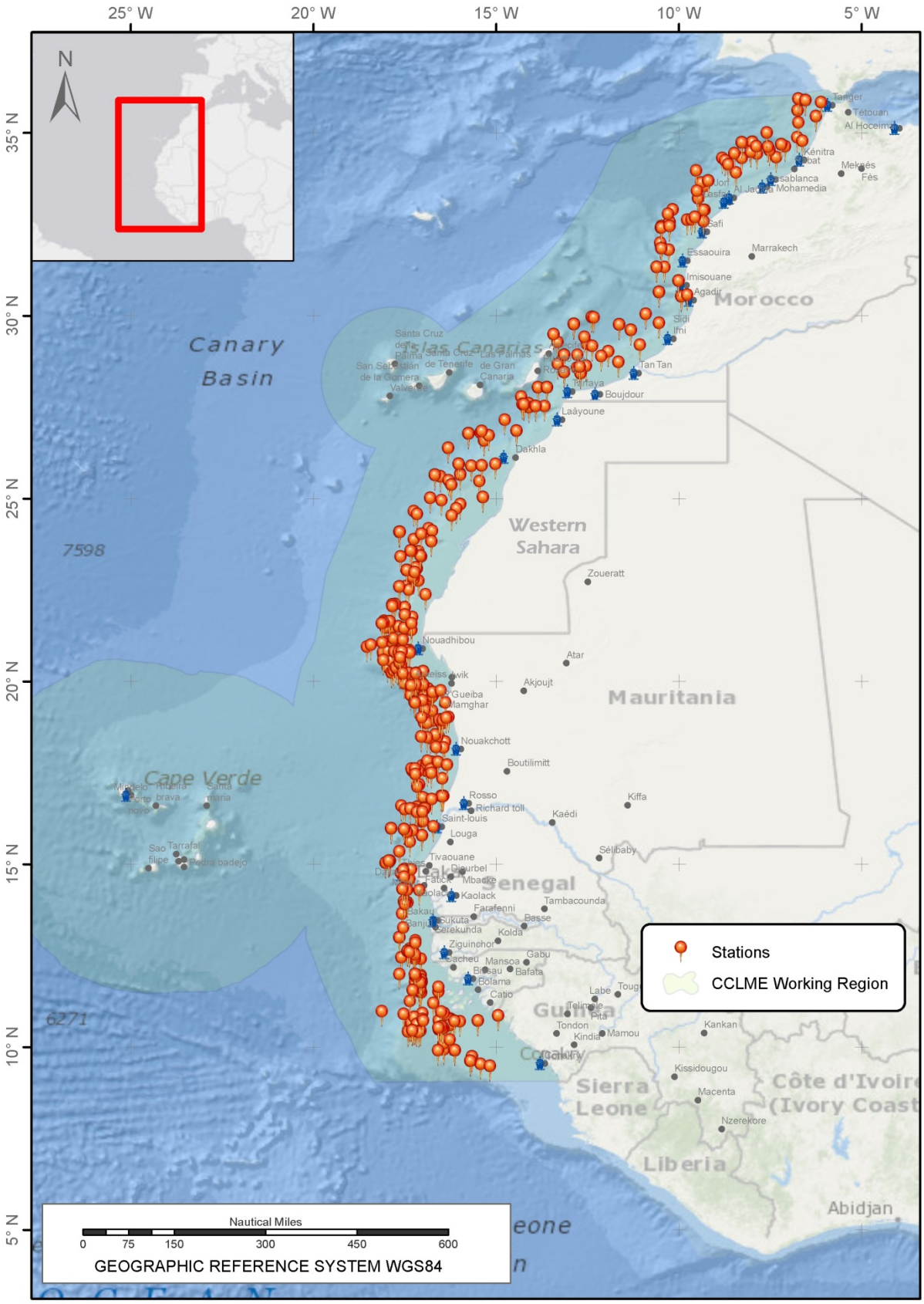

Figure 5.5.1. Geographical situation of the decapod specimens records from the CCLME deposited in the Collection of Decapod and Stomatopod Crustaceans of the Cádiz Oceanographic Centre - in Spanish *Colección de Crustáceos Decápodos y Estomatópodos del Centro Oceanográfico de Cádiz* (CCDE-IEOCD).

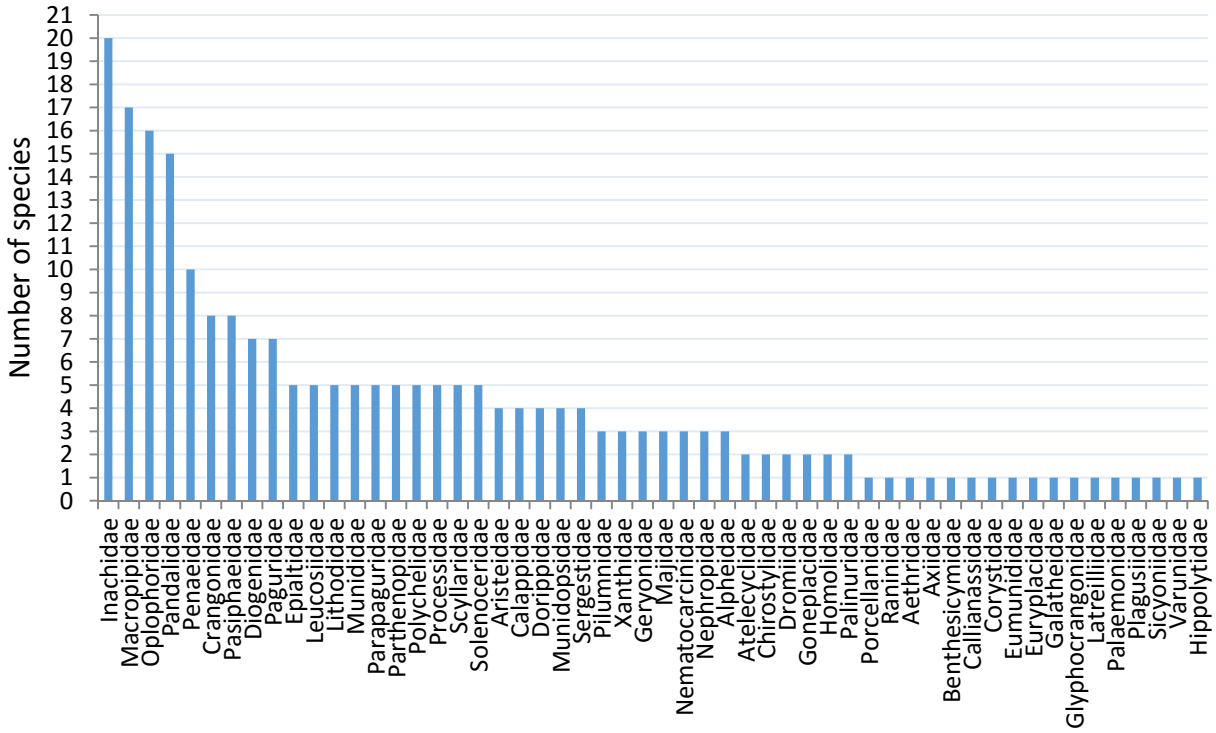

Figure 5.5.2. Species richness by decapod family in the CCLME.

As mentioned before, data from Senegal-The Gambia are not comparable to those of the former countries, because they do not represent the decapods' real diversity. Despite the fact that species richness is supposed to be higher in tropical and subtropical regions as compared to temperate and cold regions (Abele, 1982), the decapod diversity in the most temperate and northern areas of the region (Morocco-Western Sahara and Mauritania) was higher than in the most tropical and southern areas (Guinea-Bissau-Guinea). However, it should be borne in mind that deeper waters were prospected in Morocco-Western Sahara and Mauritania, a fact that may have increased the number of species recorded. In any case, the great diversity of decapods in the temperate area of the CCLME is evident. García-Isarch et al. (submitted) showed the exceptionally high decapod diversity in Mauritania, compared with other temperate areas. This fact gives an idea of the special character of the CCLME, where there is great diversity not only in the tropical southern areas (as typically occurs), but also in more temperate northern waters, in relation to the special hydrographical conditions under the influence of the Canary Current.

It is worth mentioning that our list contains two species that are new to science: *Munidopsis anaramosae* (de Matos-Pita and Ramil, 2014) (Plate 5.5.1(6)) and *Paguristes candelae* (de Matos-Pita and Ramil, 2015) and that some of the observations increased the bathymetric and/or geographic range of certain species in Atlantic waters (Muñoz and García-Isarch, 2013; de Matos-Pita and Ramil, 2014, 2015, submitted; de Matos-Pita et al., submitted, García-Isarch et al., submitted).

5.5.3.2. Biogeographical considerations

In spite of the sampling limitations due to different coverage levels, depth ranges and gears used in different surveys, certain biogeographical considerations are concluded from the available data.

There are some species that are cited only in the northern area of the CCLME region in our work and that have not been reported in southern Morocco-Western Sahara waters or in the literature. This is the case of

the solenocerid shrimp *Hymenopenaeus debilis;* the crangonid *Crangon crangon,* the Processidae *Processa canaliculata, Processa edulis edulis, Processa elegantula,* and *Processa nouveli nouveli;* the Nephropidae *Homarus gammarus* and *Nephrops norvegicus;* the Anomura *Munida curvimana, Pagurus excavatus* and *Strobopagurus gracilipes;* and the Brachyura *Corystes cassivelaunus, Dromia personata, Macropodia tenuirostris, Geryon trispinosus, Liocarcinus depurator, Liocarcinus pusillus, Liocarcinus zariquieyi* and *Polybius henslowii.* Accordingly, Morocco-Western Sahara represents the southern distribution limit for these north-east Atlantic species, which can be considered typically temperate. Other species such as *Notostomus gibbosus* and *Capartiella longipes* found their northern geographical distribution in this area. Waters off the Western Sahara constitute a boundary of zoogeographic regions in West Africa, where species composition changed abruptly (Burukovski, 1998). This may be the transition zone of species belonging to the same genus, as is the case of Solenocera *(S. membranacea* in the North and *S. africana* in the South) and Aristeus (*A. antennatus* in the North and *A. varidens* in the South).

Some other species were recorded only in the waters from Morocco to Mauritania, being considered subtropical-temperate species. This is the case of the solenocerid *Hadropenaeus affinis;* the caridean shrimps *Sabinea hystrix* and *Nematocarcinus ensifer;* the lobster *Palinurus mauritanicus;* and the crabs *Inachus communissimus* and *Macropipus tuberculatus.* The reviewed literature does not report them south of Dakar in Senegal (15°N) or off Cape Verde. More specifically, some of the species in our study only recorded in Mauritania found their southern limit in these waters (i.e. *Ephyrina figueirai figueirai, Munidopsis curvirostra* or *Anapagurus laevis*). Conversely, Mauritania also constitutes the northern known distribution area of other reported species such as *Plesionika holthuisi*, *Neolithodes asperrimus, Inachus nanus, Macropodia hesperiae* and *Macropodia macrocheles.* As mentioned above, two new species were described in Mauritanian waters (*Munidopsis anaramosae* and *Paguristes candelae*) from specimens collected in the IEO surveys. Others, like *Neolithodes grimaldii, Paragiopagurus macroceros* and *Diogenes pugilator are newly recorded* in Mauritanian waters (Muñoz and García-Isarch, 2013; de Matos-Pita and Ramil, 2015). The literature review confirmed that the hippolytid *Lebbeus africanus* has been found only in Mauritanian waters, being a possible endemism. On the open shelf, the boundary between temperate and tropical species occurs around 21°N (Cape Blanc), where a frontal zone is located, due to a coastal upwelling occurrence that changes the characteristics of the water masses. In the case of species living on the shelf edge and continental slope, the northern boundary is situated in the northern part, around 26°N (Burukovski, 1998).

Among the species registered only in Senegal and/or Guinea-Bissau-Guinea, some of them can be considered typically tropical; these include *Penaeus monodon, Acanthephyra kingsleyi, Psathyrocaris infirma, Polycheles perarmatus, Ciliopagurus caparti, Diogenes ovatus, Petrochirus pustulatus* and *Ranilia constricta.* In the absence of a representative number of records from Senegal, the northern limit of these species in Senegalese or southern waters was confirmed with the literature review.

Some 50 species were considered to be distributed in the entire area of the CCLME studied (see Table 5.5.1 and Plate 5.5.2). However, this number may be much higher as the origin of the records reported in this work is limited to certain bathymetric ranges, areas and gear samplers. Most of these widely distributed species inhabit deep waters. At greater depths, physical-geographical characteristics of the water masses are much more homogeneous, which explains the presence of numerous species that are common to the tropical zone and the temperate northern area. In addition, the system of currents in the CCLME contributes to the distribution of many species from the edge of the shelf up to the equatorial zone (Crosnier and Forest, 1973).

Among the species cited, 55 are known only in West African waters, with greater or lesser geographical distribution. They can be considered to be endemisms in the area (see Table 5.5.1.).

It is worth mentioning the presence of the Asian tiger shrimp *Penaeus monodon,* which is an invader species in West Africa. It has been widely farmed outside of its native range in the Indo-West Pacific. Introductions in the late 1980s to West Africa have resulted in the rapid establishment of the species in the wild along the coasts from Senegal to northern Angola, as a result of escapes from aquaculture (Fuller et al., 2014). In our study, it has been registered in Guinea-Bissau.

5.5.3.3. Commercial species

Coastal penaeids such as *Penaeus notialis* and *Penaeus kerathurus* have traditionally been exploited by the local artisanal fleets. The industrial fleets target both coastal shrimps and other species inhabiting deeper waters such as the penaeids *Parapenaeus longirostris* and the aristeids *Aristeus antennatus, Aristeus varidens, Aristaeopsis edwardsiana* or *Aristeomorpha foliacea* (Sobrino and García, 1991, 1992a, 1992b, 1994; FAO, 2012 b, c) (see Plate 5.5.2). Some crabs and lobsters also have great commercial interest (i.e: *Chaceon maritae, Palinurus mauritanicus*). The deep-water rose shrimp *P. longirostris* is the most important commercial species, being fished by industrial fleets in the whole of the region, with average annual catches of around 16,000 t during the period 1990-2012 (FAO b, c, in press). More than 60% of these catches occur in the Moroccan EEZ. The Southern rose shrimp *P. notialis,* with an average annual catch of around 5,000 t in the last 20 years (FAO b, c, in press), constitutes the second most important commercial species, being fished from Mauritania to Guinea. Most catches occur in Senegal-The Gambia (57%), where the species is mainly fished by the industrial fleet. These shrimp stocks are exploited by the coastal countries as well as by foreign fleets, which makes joint action necessary to assess their situation within a scientific framework, provided by the Fishery Committee for the Eastern Central Atlantic (CECAF), a regional fishery body dependent on the Food and Agriculture Organization of the United Nations (FAO). The latest assessments of the FAO/CECAF Working Groups on the Assessment of Demersal Resources were carried out in 2013 (Subgroup North, from Morocco to Senegal-Gambia), and in 2011 (Subgroup South, including Guinea-Bissau and Guinea). These assessments indicated a situation of overexploitation of the Moroccan stock of *P. longirostris* and the Senegal-The Gambia stock of *P. notialis,* while the remaining stocks assessed (*P. longirostris* and *P. notialis* stocks of Mauritania and *P. longirostris* of Guinea-Bissau) were considered not fully exploited. However, it should be kept in mind that abundances of these stocks suffer the typical cyclical fluctuations of short-living species, greatly depending on their annual recruitment and therefore on the environmental conditions.

The magnitude of the impact of trawl fishery on the marine ecosystems in the CCLME area is still unknown.

5.5.4. CONCLUSIONS AND RECOMMENDATIONS

This work constitutes a first contribution to the knowledge of decapod crustaceans in the CCLME region as a whole. The richness of this group in the area is fostered by the special hydrographical conditions of these waters where tropical and temperate species coexist. The detailed analysis of the samples obtained from the most recent surveys conducted in the area, still under study, will provide a better overview of the ecological communities in the region.

One of the main factors adversely affecting the crustacean populations in the CCLME region is the fishing pressure. Some of the species are directly targeted by specific fisheries, or they are captured as by-catch,

thus causing the overexploitation of some stocks, as is the case of the Moroccan stock of *Parapenaeus longirostris* and the Senegal-The Gambia stock of *Penaeus notialis* (FAO b, in press). In addition, there is an indirect impact produced by those fishing activities using certain gears (such as bottom trawls) that affect the benthic communities by disturbing the physical structures and habitats. Other anthropogenic factors such as pollution and eutrophication may affect crustacean populations, especially in shallow areas.

Crustaceans have a significant role in the marine ecosystem, especially in marine food webs, where they link high and low trophic levels (Cartes, 1998). It is therefore recommended first to follow the status and trends of these communities through faunal monitoring programmes in the area. Those especially vulnerable benthic habitats should be protected by specific conservation measures. Thus, protecting benthic habitats as a whole would involve the conservation of their decapod communities.

Another significant conservation measure to be adopted by the coastal countries should be the protection of overexploited stocks, following the recommendations established by the regional fishery organization in charge (FAO/CECAF).

Acknowledgements

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Table 5.5.1. Decapod taxonomic list by area of the CCLME region: Morocco EEZ (MOR), Mauritania EEZ (MAU), Senegal-The Gambia (SEGAM) and Guinea Bissau-Guinea (GUI), indicating the origin of the record (S=IEO survey, C=collection CCDE-IEOCD, OS=other sources), and endemisms (E). Species highlighted in grey are considered to be distributed along the entire CCLME region.

	Species		MWS	MAU	SEGAM	GUI
Suborder Dendrobranchiata						
Superfamily Penaeoidea						
Family ARISTEIDAE	*Aristaeopsis edwardsiana* (Johnson, 1868)		C-S	S	C	C-S
	Aristaeomorpha foliacea (Risso, 1827)		C-S	C-S		
	Aristeus antennatus (Risso, 1816)		S	C-S		S
	Aristeus varidens Holthius, 1952		S	C-S		C-S
Family BENTHESICYMIDAE	*Benthesicymus bartletti* Smith, 1882		S	C-S		S
Family PENAEIDAE	*Funchalia danae* Burkenroad, 1940		S	S	C	
	Funchalia villosa (Bouvier, 1905)		C-S			
	Holthuispenaeopsis atlantica (Balss, 1914)	E		C	C	C-S
	Penaeus kerathurus (Forskål, 1775)		C	C	OS	OS
	Penaeus monodon Fabricius, 1798					OS
	Penaeus notialis Pérez Farfante, 1967	E		C-S	C	C-S
	Metapenaeopsis miersi (Holthuis, 1952)	E		C-S		
	Parapenaeus longirostris (Lucas, 1846)		C-S	C-S	C	C-S
	Pelagopenaeus balboae (Faxon, 1893)			S	C	
	Penaeopsis serrata Spence Bate, 1881		C-S			
Family SICYONIIDAE	*Sicyonia galeata* Holthuis, 1952	E		C-S	C	C
Family SOLENOCERIDAE	*Hadropenaeus affinis* (Bouvier, 1906)		C	C		
	Hymenopenaeus chacei Crosnier & Forest, 1969	E	C-S	C-S	C	C
	Hymenopenaeus debilis Smith, 1882		C			
	Solenocera africana Stebbing, 1917	E		C-S	C	C
	Solenocera membranacea (Risso, 1816)		C-S	C		
Superfamily Sergestoidea						
Family SERGESTIDAE	*Eusergestes arcticus* (Krøyer, 1855)			S		
	Sergia grandis (Sund, 1920)			C-S		S
	Sergia robusta (Smith, 1882)		S	C-S		S
	Sergia talismani (Barnard, 1947)			C-S		C-S
Suborder Pleocyemata						
Infraorder Caridea						
Superfamily Alpheoidea						
Family ALPHEIDAE	*Alpheus talismani*			C		
	Alpheus sp.1					S
	Alpheus sp.2					S
Family HIPPOLYTIDAE	*Lebbeus africanus* Fransen, 1997			S		
Superfamily Crangonoidea						
Family CRANGONIDAE	*Aegaeon cataphractus* (Olivi, 1792)		C-S	C-S	C	C
	Aegaeon lacazei (Gourret, 1887)		C	C-S		C-S
	Crangon crangon (Linnaeus, 1758)		C			
	Metacrangon bellmarleyi (Stebbing, 1914)	E	S	C-S		S
	Parapontophilus gracilis gracilis (Smith, 1882)	E		C-S	C	
	Philocheras echinulatus (M. Sars, 1862)		C-S			
	Philocheras sculptus (Bell, 1847 [in Bell, 1844-1853])		C			
	Sabinea hystrix (A. Milne-Edwards, 1881)		S	S		
Family GLYPHOCRANGONIDAE	*Glyphocrangon longirostris* (Smith, 1882)		S	C-S		
Superfamily Nematocarcinoidea						
Family NEMATOCARCINIDAE	*Nematocarcinus africanus* Crosnier & Forest, 1973	E	S	C-S	C	C-S
	Nematocarcinus ensifer (Smith, 1882)		S	S		
	Nematocarcinus gracilipes Filhol, 1884		S	C		
Superfamily Oplophoroidea						
Family OPLOPHORIDAE	*Acanthephyra acanthitelsonis* Bate, 1888		S	S	C	S
	Acanthephyra acutifrons (Bate, 1888)		S			S
	Acanthephyra curtirostris Wood-Mason & Alcock, 1891		S	C-S		
	Acanthephyra eximia Smith, 1884		S	C-S		C-S
	Acanthephyra kingsleyi (Bate, 1888)	E				S

	Species		MWS	MAU	SEGAM	GUI
	Acanthephyra pelagica (Risso, 1816)		S	C-S	C	C-S
	Acanthephyra purpurea (A. Milne-Edwards, 1881)		C-S			S
	Ephyrina figueirai figueirai Crosnier & Forest, 1973			C-S		
	Ephyrina ombango (Crosnier & Forest, 1973)					C-S
	Notostomus crosnieri Macpherson, 1984			S		C-S
	Notostomus gibbosus A. Milne-Edwards, 1881		S	S		
	Oplophorus spinosus (Brullé, 1839)		C-S	C-S		
	Systellaspis cristata (Faxon, 1893)		S	C-S		C
	Systellaspis debilis (A. Milne-Edwards, 1881)		C-S	C-S	C	C-S
	Systellaspis pellucida (Filhol, 1885)		C-S	S		C
Superfamily Palaemonoidea						
Family PALAEMONIDAE	*Palaemon serratus* (Pennant, 1777)		C			
Superfamily Pasiphaeoidea						
Family PASIPHAEIDAE	*Glyphus marsupialis* Filhol, 1884		S	C-S	C	C-S
	Parapasiphae sulcatifrons Smith, 1884		S	C-S		
	Pasiphaea multidentata Esmark, 1866		C-S	C-S		C-S
	Pasiphaea semispinosa Holthius, 1951	E		C-S	C	C-S
	Pasiphaea sivado (Risso, 1816)		S			S
	Pasiphaea tarda Krøyer, 1845		S	C-S		C-S
	Psathyrocaris fragilis Wood-Mason & Alcock, 1893		S	C-S	C	
	Psathyrocaris infirma (Alcock & Anderson, 1894)				C	C-S
Superfamily Pandaloidea						
Family PANDALIDAE	*Chlorotocus crassicornis* (A. Costa, 1871)		C			
	Heterocarpus ensifer A. Milne-Edwards, 1881		C-S	C-S	C	C-S
	Heterocarpus grimaldii A. Milne-Edwards & Bouvier, 1900		S	C-S		C-S
	Heterocarpus laevigatus (Bate, 1888)					S
	Plesionika acanthonotus (Smith, 1882)		C-S	C-S	C	C-S
	Plesionika antigai Zariquiey Alvarez, 1955		C			
	Plesionika brevipes (Crosnier & Forest, 1968)			C-S	C	
	Plesionika carinata Holthius, 1951	E	C-S	C-S	C	C-S
	Plesionika edwardsii (Brandt, 1851)		C-S	C-S		C-S
	Plesionika ensis (A. Milne-Edwards, 1881)		C-S	S	C	C-S
	Plesionika giglioli (Senna, 1903)		C			C-S
	Plesionika heterocarpus (A. Costa, 1871)		C-S	C-S	C	C-S
	Plesionika holthuisi (Crosnier & Forest, 1971)			C	C	S
	Plesionika martia (A. Milne-Edwards, 1883)		C-S	C-S	C	C-S
	Plesionika narval (Fabricius, 1787)		C	C-S	C	C-S
	Plesionika williamsi (Forest, 1963)		C-S		C	C-S
Superfamily Processoidea						
Family PROCESSIDAE	*Processa canaliculata* Leach, 1815 [in Leach, 1815-1875]		C			
	Processa edulis edulis (Risso, 1816)		C			
	Processa elegantula Nouvel & Holthuis, 1957		C			
	Processa intermedia Holthuis, 1951		C			
	Processa nouveli nouveli Al-Adhub & Williamson, 1975		C			
Infraorder Polychelida						
Superfamily Erynoidea						
Family POLYCHELIDAE	*Polycheles perarmatus* Holthuis, 1952					C
	Polycheles typhlops Heller, 1862		C-S	S		C-S
	Stereomastis nana (Smith, 1884)		S	C-S		
	Stereomastis sculpta (Smith, 1880)		S	C-S		C-S
	Stereomastis talismani (Bouvier, 1917)	E		C-S	C	
Infraorder Achelata						
Superfamily Palinuroidea						
Family PALINURIDAE	*Palinurus mauritanicus* Gruvel, 1911		C-S	C-S		
	Panulirus regius De Brito Capello, 1864	E			C	C
Family SCYLLARIDAE	*Acantharctus posteli* (Forest, 1963)			C	C	C-S
	Scyllarides latus (Latreille, 1803)					C-S
	Scyllarus arctus (Linnaeus, 1758)		C		C	C-S
	Scyllarus caparti Holthuis, 1952		C	C-S	C	C-S
	Scyllarus subarctus Crosnier, 1970	E	C	C-S	C	C-S

	Species		MWS	MAU	SEGAM	GUI
Infraorder Astacidea						
Superfamily Nephropoidea						
Family NEPHROPIDAE	*Homarus gammarus (Linnaeus, 1758)*		OS			
	Nephrops norvegicus (Linnaeus, 1758)		C-S			
	Nephropsis atlantica Norman, 1882		S	C-S		C-S
Infraorder Axiidea						
Superfamily Axioidea						
Family AXIIDAE	*Calocarides* sp			S		
Superfamily Callianassoidea						
Family CALLIANASSIDAE	*Cheramus oblonga* (Le Loeuff & Intes, 1974)			S		
Infraorder Anomura						
Superfamily Chirostyloidea						
Family CHIROSTYLIDAE	*Gastroptychus formosus* (Filhol, 1884)					C
	Uroptychus concolor (A. Milne Edwards & Bouvier, 1894)					C-S
Family EUMUNIDIDAE	*Eumunida bella* de Saint Laurent & Macpherson, 1990	E		S		
Superfamily Galatheoidea						
Family GALATHEIDAE	*Galathea intermedia* Liljeborg, 1851		C			
Family MUNIDIDAE	*Munida curvimana* A. Milne Edwards & Bouvier, 1894		C			
	Munida guineae Miyake & Baba, 1970	E		S	C	C-S
	Munida intermedia A. Milne Edwards & Bouvier, 1899		C-S			
	Munida rutllanti Zariquiey Álvarez, 1952		C-S	C	C	C
	Munida speciosa von Martens, 1878			C-S	C	C-S
Family MUNIDOPSIDAE	*Munidopsis anaramosae* de Matos-Pita & Ramil, 2014			S		
	Munidopsis chunii Balss, 1913	E		S		
	Munidopsis curvirostra Whiteaves, 1874			S		
	Munidopsis serricornis (Lovén, 1852)			S		
Family PORCELLANIDAE	*Pisidia* sp.					S
Superfamily Paguroidea						
Family DIOGENIDAE	*Areopaguristes mauritanicus* (Bouvier, 1906)	E		S		
	Ciliopagurus caparti (Forest, 1952)	E				C
	Dardanus arrosor (Herbst, 1796)		C	S	C	C-S
	Diogenes ovatus Miers, 1881	E				C-S
	Diogenes pugilator (Roux, 1829)		C	S		
	Paguristes candelae de Matos-Pita & Ramil, 2015			S		
	Petrochirus pustulatus (H. Milne Edwards, 1848)	E				C-S
Family PAGURIDAE	*Anapagurus laevis* (Bell, 1846)			S		
	Pagurus alatus Fabricius, 1775		S	S		
	Pagurus cuanensis Bell, 1845			S		
	Pagurus excavatus (Herbst, 1791)		C			
	Pagurus forbesii Bell, 1846		C	C	C	
	Pagurus prideaux Leach, 1815			S		
	Spiropagurus elegans (Miers, 1881)		C			C-S
Family PARAPAGURIDAE	*Paragiopagurus macrocerus* (Forest, 1955)			S		
	Parapagurus nudus (A. Milne-Edwards, 1891)			S		
	Parapagurus pilosimanus Smith, 1879		S	S		C-S
	Parapaguridae indet.					S
	Strobopagurus gracilipes (A. Milne-Edwards, 1891		C			
Superfamily Lithodoidea						
Family LITHODIDAE	*Lithodes ferox* Filhol, 1885		S	C-S		C-S
	Neolithodes asperrimus Barnard, 1947	E		S		
	Neolithodes grimaldii (A. Milne-Edwards & Bouvier, 1894)			S		
	Paralomis cristulata Macpherson, 1988			S		C-S
	Paralomis erinacea Macpherson, 1988	E		C-S		S
Infraorder Brachyura						
Superfamily Aethroidea						
Family AETHRIDAE	*Sakaila africana* (Manning & Holthuis, 1981)	E			C	C-S
Superfamily Cancroidea						
Family ATELECYCLIDAE	*Atelecyclus rotundatus* (Olivi, 1792)		C			S
	Atelecyclus undecimdentatus (Herbst, 1783)		C	C		

	Species		MWS	MAU	SEGAM	GUI
Superfamily Calappoidea						
Family CALAPPIDAE	*Acanthocarpus brevispinis* Monod, 1946	E		C-S	C	C-S
	Calappa granulata (Linnaeus, 1758)		C-S			
	Calappa pelii Herklots, 1851	E	C	C-S		C-S
	Calappa rubroguttata (Herklots, 1851)	E			C	C-S
Superfamily Corystoidea						
Family CORYSTIDAE	*Corystes cassivelaunus* (Pennant, 1777)		C			
Superfamily Dorippoidea						
Family DORIPPIDAE	*Ethusa mascarone* (Herbst, 1785)		C-S			
	Ethusa sp.					S
	Medorippe lanata (Linnaeus, 1767)		C	C-S		C-S
	Phyllodorippe armata (Miers, 1881)	E			C	
Superfamily Dromioidea						
Family DROMIIDAE	*Dromia personata* (Linnaeus, 1758)		C			
	Sternodromia spinirostris (Miers, 1881)	E	C	C	C	C-S
Superfamily Goneplacoidea						
Family EURYPLACIDAE	*Machaerus oxyacantha* (Monod, 1956)	E			C	C
Family GONEPLACIDAE	*Goneplax barnardi* (Capart, 1951)	E		S	C	C-S
	Goneplax rhomboides (Linnaeus, 1758)		C	S		
Superfamily Grapsoidea						
Family PLAGUSIIDAE	*Euchirograpsus liguricus* H. Milne Edwards, 1853		C	S		
Family VARUNIDAE	*Asthenognathus atlanticus* Monod, 1933		C			
Superfamily Homoloidea						
Family HOMOLIDAE	*Homola barbata* (Fabricius, 1793)		C	C-S	C	C-S
	Paromola cuvieri (Risso, 1816)		C-S	C-S		S
Family LATREILLIIDAE	*Latreillia elegans* Roux, 1830		C-S			
Superfamily Majoidea						
Family EPIALTIDAE	*Apiomithrax bocagei* (Ozorio, 1887)	E				C
	Pisa armata (Latreille, 1803)		C	S		C-S
	Pisa calva (Forest & Guinot, 1966)	E				C-S
	Pisa carinimana Miers, 1879		C	C		
	Rochinia carpenteri (Wyville Thomson, 1873)		C-S			C-S
Family INACHIDAE	*Capartiella longipes* (Capart, 1951)	E	C			
	Dorhynchus thomsoni Thomson, 1873		C			
	Inachus aguiarii de Brito Capello, 1876		C	S		
	Inachus angolensis Capart, 1951	E		C-S	C	C
	Inachus communissimus Rizza, 1840		C	C		
	Inachus dorsettensis (Pennant, 1777)		C			
	Inachus leptochirus Leach, 1817		C	C-S		
	Inachus nanus Manning & Holthuis, 1981			S		
	Inachus thoracicus Roux, 1830		C			
	Inachus sp					S
	Macropodia doracis (Manning & Holthuis, 1981)	E				C-S
	Macropodia gilsoni (Capart, 1951)	E		C-S	C	
	Macropodia hesperiae Manning & Holthuis, 1981	E		S		
	Macropodia linaresi Forest & Zariquiey Alvarez, 1964		C			
	Macropodia longipes (A. Milne Edwards & Bouvier, 1899)		C	C-S		
	Macropodia macrocheles (A. Milne Edwards & Bouvier, 1898	E		S		
	Macropodia rostrata (Linnaeus, 1761)		C	C		S
	Macropodia spinulosa (Miers, 1881)	E			C	C-S
	Macropodia tenuirostris (Leach, 1814)		C			
	Stenorhynchus lanceolatus (Brullé, 1837)		C	C		C-S
Family MAJIDAE	*Eurynome aspera* (Pennant, 1777)			S		
	Maja crispata Risso, 1827		C			
	Maja squinado (Herbst, 1788)		C			
Superfamily Leucosioidea						
Family LEUCOSIIDAE	*Atlantophila cristata* (Miers, 1881)	E		C		C-S
	Ebalia nux A. Milne Edwards, 1883			S		
	Ilia spinosa (Miers, 1881)	E			C	C-S
	Merocryptus obsoletus (A. Milne-Edwards & Bouvier, 1898)	E				C-S
	Pseudomyra mbizi Capart, 1951	E		C-S	C	

	Species		MWS	MAU	SEGAM	GUI
Superfamily Parthenopoidea						
Family PARTHENOPIDAE	*Distolambrus maltzami* (Miers, 1881)			C		
	Parthenopoides massena (Roux, 1830)		C			C-S
	Solenolambrus noordendei (Capart, 1951)	E	C	S	C	
	Spinolambrus macrochelos (Herbst, 1790)		C			
	Spinolambrus notialis (Manning & Holthuis, 1981)	E		S		C-S
Superfamily Portunoidea						
Family GERYONIDAE	*Chaceon affinis* (A. Milne-Edwards & Bouvier, 1894)		S			C
	Chaceon maritae (Manning & Holthuis, 1981)	E	S	C-S	OS	S
	Geryon trispinosus		C			
Family MACROPIPIDAE	*Bathynectes maravigna* (Prestandrea, 1839)		C			C-S
	Bathynectes piperitus Manning & Holthuis, 1981	E		C-S	C	C
	Callinectes amnicola (Rochebrune, 1883)	E				C
	Callinectes marginatus (A. Milne-Edwards, 1861)	E		C		C-S
	Charybdis (Charybdis) hellerii (A. Milne-Edwards, 1867)					C
	Cronius ruber (Lamarck, 1818)					C-S
	Liocarcinus corrugatus (Pennant, 1777)		C	C		S
	Liocarcinus depurator (Linnaeus, 1758)		C			
	Liocarcinus marmoreus (Leach, 1814)		C			S
	Liocarcinus pusillus (Leach, 1816)		C			
	Liocarcinus vernalis (Risso, 1816)		C			
	Liocarcinus zariquieyi Gordon, 1968		C			
	Macropipus rugosus (Doflein, 1904)	E	C-S	C-S	C	C-S
	Macropipus tuberculatus (Roux, 1830)		C	C		
	Portunus (Portunus) hastatus (Linnaeus, 1767)		C			
	Polybius henslowii Leach, 1820		C-S			
	Sanquerus validus (Herklots, 1851)	E			C	S
Superfamily Raninoidea						
Family RANINIDAE	*Ranilia constricta* (A. Milne-Edwards, 1880)					C-S
Superfamily Xanthoidea						
Family PILUMNIDAE	*Pilumnus inermis* A. Milne-Edwards & Bouvier, 1894		C-S			
	Pilumnus spinifer H. Milne Edwards, 1834		C			
	Pilumnus stebbingi (Capart, 1951)	E				C-S
Family XANTHIDAE	*Monodaeus couchii* (Couch, 1851)		C	C		
	Monodaeus cristulatus Guinot & Macpherson, 1988			S		
	Paraxanthias eriphioides (A. Milne Edwards, 1867)					C-S
Number of species	**232**	**54**	**137**	**134**	**59**	**119**

Plate 5.5.1. Five decapod species widely distributed throughout the CCLME: 1. *Nematocarcunus africanus* (© José Francisco González Jiménez, IEO); 2. *Plesionika edwardsii* (© José Franscico González Jiménez, IEO); 3. *Dardanus arrosor* (© Lourdes Fernández Peralta, IEO); 4. *Stenorhynchus lanceolatus* (© Pablo Expósito Martínez, IEO); 5. *Scyllarus subarctus* (© Alberto García García, IEO). Species new to science reported in Mauritanian waters: 6. *Munidopsis anaramosae* (© Ana Ramos Martos, IEO).

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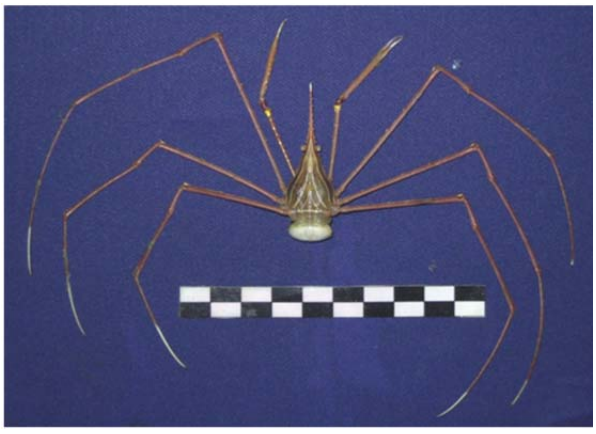

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Plate 5.5.2. Six decapod commercial species of the CCLME. 1. *Parapenaeus longirostris* (© Alberto García García, IEO); 2. *Penaeus notialis* (© Lourdes Fernández Peralta, IEO); 3. *Penaeus kerathurus* (© Lourdes Fernández Peralta, IEO); 4. *Aristaeopsis edwardsiana* (© Alberto García García, IEO); 5. *Aristeus varidens* (© José Francisco González Jiménez, IEO); 6. *Chaceon maritae* (© José Francisco González Jiménez, IEO).

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