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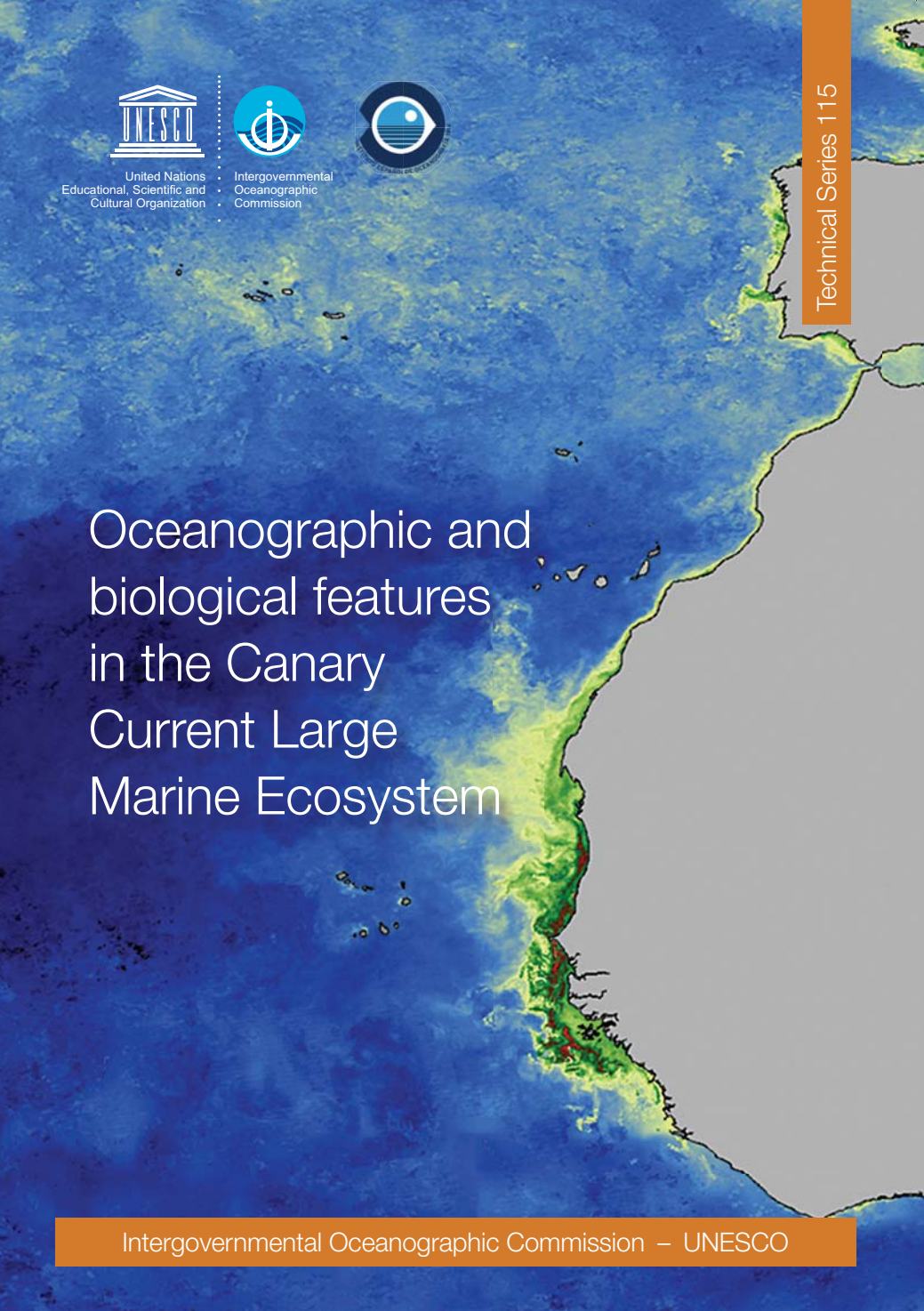
Oceanographic and biological features in the Canary Current Large Marine Ecosystem



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Technical Series 115

Oceanographic and biological features in the Canary Current Large Marine Ecosystem

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(IOC/2015/TS/115)

5.4. CEPHALOPODS IN THE CANARY CURRENT LARGE MARINE ECOSYSTEM

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5.4.1. INTRODUCTION

The Canary Current Large Marine Ecosystem (CCLME) ranks third in the world in terms of primary productivity and has one of the highest fisheries production of any African large marine ecosystem with an annual production ranging from 2 to 3 million t (Déniz-González et al., 2014). The CCLME cephalopods are characterized by high abundance, biomass and diversity. In the case of Mauritanian waters a total of 132 species and 39 families have been identified (Rocha et al., submitted). These results concur with the maximum diversity of cephalopods observed in the tropics and subtropics by Nesis (2003). Many species present in CCLME waters have a worldwide distribution or have been previously reported in Atlantic waters (Roper et al., 1984; Nesis, 1987; Mangold, 1998; Jereb and Roper, 2005; Jereb and Roper, 2010; Jereb et al., 2013; Guerra et al., 2014). In this region, species of the families Ommastrephidae, Loliginidae, Octopodidae and Sepiidae represent the main cephalopod resources with high commercial value (Boyle and Rodhouse, 2005), which explains why in this region we find one of the largest cephalopod fisheries in the Eastern Atlantic (Faure et al., 2000; FAO, 2014c).

This work presents a brief review of cephalopod fauna found in CCLME waters in terms of biodiversity, ecology and fisheries.

5.4.2. SPECIES BIODIVERSITY

A recent study (Rocha et al., submitted) shows a high diversity of cephalopod species in the CCLME area. This marine ecosystem presents 139 cephalopod species (Table 5.4.1), including high commercial value groups (Ommastrephids, Loliginids, Octopods and Sepiids).

Sepiids are mainly coastal species associated with the continental shelf and slope up to 500 m depth (Jereb and Roper, 2005). Eight sepiid species have been cited in the area (Table 5.4.1). The most abundant and commercially important sepiid species is *Sepia officinalis* (Nigmatullin, personal communication), although other species such as *S. bertheloti*, *S. elegans*, *S. hierredda* and *S. orbignyana* are also abundant in CCLME coastal waters (Nesis, 1987; Jereb and Roper, 2005; Rocha et al., submitted).

A total of 14 sepiolid species can be observed in this area (Jered and Roper, 2005; Rocha et al., submitted). Of limited commercial interest, probably the most abundant species in the area correspond to *Sepietta oweniana*, *S. neglecta* and *Sepiola rondeletii*.

The unique species of the family Spirulidae, the mesopelagic *Spirula spirula*, is also present in the area (Jereb and Roper, 2005).

Table 5.4.1. CCLME cephalopods checklist with data about their habitat, bathymetry and fishery potential. Abisal (A), Benthic (Be), Demersal (D), Neritic (N), Pelagic (P): Epipelagic (E), Mesopelagic (M), Bathypelagic (Ba), Not determined (?).

Species	Habitat	Deep range (m)	Fishery potential
ORDER: SEPIOIDEA Naef, 1916			
SUBORDER: SEPIIDA Keferstein, 1866			
Family SEPIIDAE Keferstein, 1866			
Sepia angulata Roeleveld, 1972	N	?	?
Sepia bertheloti d'Orbigny, 1835	N	20-160	YES
Sepia elegans Blainville, 1827	N-D	0-500	YES
Sepia elobyana Adam, 1941	N	?	?
Sepia hierredda Rang, 1835	N	0-50	YES
Sepia officinalis Linnaeus, 1758	N	0-200	YES
Sepia orbignyana Férussac in d'Orbigny, 1826	N-D	15-570	YES
Sepiella ornata (Rang, 1837)	N	0-100	YES
SUBORDER SEPIOLIDA Fioroni, 1981			
Family SEPIOLIDAE Leach, 1817			
Subfamily SEPIOLINAE Appellöf, 1898			
Rondeletiola minor (Naef, 1912)	N-D	80-500	YES
Sepiola atlantica Orbigny. 1839-1842	N	0-100	NO
Sepiola knudseni Adam, 1983	N	32-90	?
Sepiola rondeleti Leach, 1834	N-D	0-450	NO
Sepietta neglecta Naef, 1916	N	25-475	YES
Sepietta oweniana (Orbigny, 1839-1841)	N-P(E-M)	0-1000	YES
Sepietta petersi (Steenstrup, 1887)	N	20-350?	?
Subfamily ROSSIINAE Appellöf, 1898			
Austrorossia mastigophora (Chun, 1915)	N	0-640	?
Neorossia caroli (Joubin, 1902)	N-D	40-1750	YES?
Rossia macrosoma (Delle Chiaie, 1830)	N-D	32-900	YES
Subfamily HETEROTEUTHINAE Appellöf, 1898			
Heteroteuthis dagamensis Robson, 1924	?	?	?
Heteroteuthis dispar (Rüppell, 1844)	N-P(M)-Be	0-1600	NO
Stoloteuthis leucoptera (Verrill, 1878)	N-D	160-700	?
Family IDIOSEPIIDAE Appellöf, 1898			
Idiosepius minimus (Orbigny, 1835)	N	0-80	NO
ORDER SPIRULIDA Stolley, 1919			
Family SPIRULIDAE Owen, 1836			
Spirula spirula (Linnaeus, 1758)	P(M)	0-700	NO
ORDER MYOPSIDA Naef, 1916			
Family LOLIGINIDAE Lesueur, 1821			
Afrololigo mercatoris (Adam, 1941)	N	0-50	YES
Alloteuthis africana Adam 1950	N	20-100	YES
Alloteuthis media (Linnaeus, 1758)	N	0-200	YES
Alloteuthis subulata (Lamarck, 1798)	N-D	0-500	YES
Loligo forbesii Steenstrup, 1856	N-D	0-1000	YES
Loligo vulgaris Lamarck, 1798	N-D	0-500	YES
ORDER OEGOPSIDA Orbigny, 1845			
Family ANCISTROCHEIRIDAE Pfeffer, 1912			
Ancistrocheirus lesueurii (d'Orbigny, 1842)	P(E-M)	0-700	YES
Family ARCHITEUTHIDAE Pfeffer, 1900			
Architeuthis dux Steenstrup, 1857	P(M)	200-1000	NO

Species	Habitat	Deep range (m)	Fishery potential
Family BATHYTEUTHIDAE Pfeffer, 1900			
Bathyteuthis abyssicola Hoyle, 1885	P(M-B)	200-1400	NO
Family BRACHIOTEUTHIDAE Pfeffer, 1908			
Brachioteuthis behnii (Steenstrup, 1882)	P(E-M)	50-1000	NO
Brachioteuthis picta Chun, 1910	P	0-3000	NO
Brachioteuthis riisei (Steenstrup, 1882)	P(E-M)	0-1000	NO
Family CHIROTEUTHIDAE Gray, 1849			
Chiroteuthis joubini Voss, 1967	P	?	NO
Chiroteuthis veranyi (Ferussac, 1834)	P	0-1800	NO
Grimalditeuthis bonplandi (Verany, 1839)	P(M-Ba)	200-1000	NO
Planctoteuthis danae (Joubin, 1930)	P	?	NO
Planctoteuthis exophthalmica (Chun, 1908)	P	?	NO
Family CHTENOPTERYGIDAE Grimpe, 1922			
Chtenopteryx canariensis Salcedo-Vargas and Guerrero-Kommritz, 2000	P(M)	200-1000	NO
Chtenopteryx sicula (Verany, 1851)	P(M)	200-1000	NO
Family CRANCHIIDAE Prosch, 1847			
Subfamily CRANCHIINAE Pfeffer, 1912			
Cranchia scabra Leach, 1817	P(M-B)	200-2000	NO
Leachia atlantica (Degner, 1925)	P(E-M)	50-1000	NO
Liocranchia reinhardti (Steenstrup, 1856)	P	50-1200	NO
Subfamily TAONIINAE Pfeffer, 1912			
Bathothauma lyromma Chun, 1906	P	0-2000	NO
Egea inermis Joubin, 1933	P	0-2000	NO
Galiteuthis armata Joubin, 1898	P	0-2500	NO
Helicocranchia joubini (Voss, 1962)	P	100-2000	NO
Helicocranchia pfefferi Massy, 1907	P	0-2000	NO
Liguriella podophthalma Issel, 1908	P	0-1500	NO
Megalocranchia oceanica (Voss, 1960)	P	50-2000	NO
Sandalops melancholicus Chun, 1906	P	0-2000	NO
Taonius pavo (Lesueur, 1821)	P	150-2000	NO
Teuthowenia maculata (Leach, 1817)	P	25-2000	NO
Family CYCLOTEUTHIDAE Naef, 1923			
Cycloteuthis akimushkini Filippova, 1968	P(M)	200-1000	NO
Cycloteuthis sirventi Joubin, 1919	P(M)	200-1000	NO
Discoteuthis discus Young and Roper, 1969	P(M)	200-1000	NO
Discoteuthis laciniosa Young and Roper, 1969	P(M)	200-1000	NO
Family ENOPLOTEUTHIDAE Pfeffer,			
Abralia siedleckyi Lipinski, 1983	P(E-M)	0-600	NO
Abralia veranyi (Rüppel, 1844)	P(E-M)	0-600	NO
Abraliopsis atlantica Nesis, 1982	P(E-M)	0-600	NO
Abraliopsis morissi (Verany, 1839)	P(E-M)	0-600	NO
Enoploteuthis anapsis Roper, 1964	P(E)	0-200	?
Enoploteuthis leptura (Leach, 1817)	P(E)	0-200	YES
Family HISTIOTEUTHIDAE Verrill, 1881			
Histioteuthis arcturi (Robson, 1948)	P(E-M)	0-1000	NO
Histioteuthis bonnellii (Ferussac, 1834)	P(M-Ba)	500-2000	NO
Histioteuthis celetaria (Voss, 1960)	P(E-M)	40-1000	NO
Histioteuthis corona (Voss and Voss, 1962)	P	100-1500	NO
Histioteuthis meleagroteuthis (Chun, 1910)	P	0-2000	NO
Histioteuthis reversa (Verrill, 1880)	P	0-1000	NO
Family JOUBINITEUTHIDAE Naef, 1922			
Joubiniteuthis portieri (Joubin, 1916)	P(M-Ba)	300-2500	NO
Family LEPIDOTEUTHIDAE Pfeffer, 1912			
Lepidoteuthis grimaldii Joubin, 1895	P	100-2000	NO
Family LYCOTEUTHIDAE Pfeffer, 1908			
Subfamily LYCOTEUTHINAE Pfeffer, 1908			
Selenoteuthis scintillans Voss, 1959	P(E-M)	0-600	NO
Subfamily LAMPADIOTEUTHINAE Berry, 1916			
Lampadioteuthis megaleia Berry, 1916	P(E-M)	0-300	NO
Family MAGNAPINNIDAE Vecchione and Young, 1998			
Magnapinna talismani (Fisher and Joubin, 1907)	P	0-3000?	NO

Species	Habitat	Deep range (m)	Fishery potential
Family MASTIGOTEUTHIDAE Verrill, 1881			
Mastigoteuthis agassizii Verrill, 1881	P(M)	700-1000	NO
Mastigoteuthis atlantica Joubin, 1933	P(M)	600-1000	NO
Mastigoteuthis danae (Joubin, 1933)	P(M)	600-1000	NO
Mastigoteuthis flammea Chun, 1910	P-A	100-3500	NO
Mastigoteuthis hjorti Chun, 1913	P(M)	600-1000	NO
Mastigoteuthis magna Joubin, 1913	P(M)	600-1000	NO
Family NEOTEUTHIDAE Naef, 1921			
Neoteuthis thielei Naef, 1921	P(E-M)	100-2000	NO
Family OCTOPOTEUTHIDAE Berry, 1912			
Octopoteuthis danae Joubin, 1931	P(E)	50-100?	NO?
Octopoteuthis megaptera (Verrill, 1885)	P(M-Ba)	200-2000	NO?
Octopoteuthis rugosa Clarke, 1980	P(M)	200-800	NO?
Octopoteuthis sicula Rüppell, 1844	P(M-Ba)	200-2000	NO?
Taningia danae Joubin, 1931	P	0-1300	YES
Family OMMASTREPHIDAE Steenstrup, 1857			
Subfamily ILLICINAE Posselt, 1891			
Illex coindetii (Verany, 1839)	N-D	0-1000	YES
Subfamily OMMASTREPHINAE Posselt, 1891			
Hyaloteuthis pelagica (Bosc, 1802)	P(E-M)	0-800	YES
Ommastrephes bartramii (Lesueur, 1821)	P	0-1500	YES
Ornithoteuthis antillarum Adam, 1957	P	0-1500	YES
Sthenoteuthis pteropus (Steenstrup, 1855)	P	0-1200	YES
Subfamily TODARODINAE Adam, 1960			
Todaropsis eblanae (Ball, 1841)	N-D	20-850	YES
Todarodes sagittatus (Lamarck, 1798)	P(E-M)	0-1000	YES
Family ONYCHOTEUTHIDAE Gray, 1849			
Ancistroteuthis lichtensteini (Férussac, 1835)	P	0-1300	YES
Onychoteuthis banksii (Leach, 1817)	P-A	0-4000	YES
Onykia carriboea Lesueur, 1821	P	0-?	?
Walvisteuthis virilis Nesis and Nikitina, 1986	P(E-M)	0-500	NO
Family PHOLYDOTEUTHIDAE Voss, 1956			
Pholidoteuthis massyae (Pfeffer, 1912)	P(M-Ba)	200-1500	NO?
Family PYROTEUTHIDAE Pfeffer, 1912			
Pterygioteuthis gemmata Chun, 1908	P(E-M)	150-600	NO
Pterygioteuthis giardi Fischer, 1896	P(E-M)	0-500	NO
Pyroteuthis margaritifera (Rüppel, 1844)	P(E-M)	50-800	NO
Family THYSANOTEUTHIDAE Keferstein, 1866			
Thysanoteuthis rhombus Troschel, 1857	P(E-M)	100-800	YES
ORDER OCTOPODA Leach, 1818			
SUBORDER CIRRATA Grimpe, 1916			
Family CIRROTEUTHIDAE Keferstein, 1866			
Cirrothauma magna Hoyle, 1885	P(Ba)-A	1300-3359	NO
Cirrothauma murrayi Chun, 1911	P(Ba)-A	2400-4850	NO
Family OPISTHOTEUTHIDAE Verrill, 1896			
Opisthoteuthis agassizii Verrill, 1883	P(M-Ba)	227-2000	NO
Opisthoteuthis calypso Villanueva, Collins, Sánchez and Voss, 2002	P(M-Ba)	365-2208	NO
Opisthoteuthis grimaldii (Joubin, 1903)	P(Ba)	1135-2287	NO
Opisthoteuthis massyae (Grimpe, 1920)	P(Ba)	1226-1450	NO
Family GRIMPOTEUTHIDAE O'Shea, 1999			
Grimpoteuthis megaptera (Verrill, 1885)	A	4592	NO
Grimpoteuthis wuelkeri (Grimpe, 1920)	P(Ba)	1550-2056	NO
SUBORDER INCIRRATA Grimpe 1916			
Family ALLOPOSIDAE Verrill, 1881a			
Haliphron atlanticus Steenstrup, 1861	P-A	0-6787	NO
Family ARGONAUTIDAE Tryon, 1879			
Argonauta argo Linnaeus, 1758	P(E-M)	0-300	NO
Argonauta hians Lightfoot, 1786	P(E-M)	0-300	NO

Species	Habitat	Deep range (m)	Fishery potential
Family TREMOCTOPODIDAE Tryon, 1879			
Tremoctopus gelatus Thomas, 1977	P(E-M)	0-250	NO
Tremoctopus violaceus Delle Chiaie, 1830	P(E-M)	0-250	NO
Family AMPHITRETIDAE HOYLE, 1886			
Amphitretus pelagicus thielei Robson, 1930	P(E-M)	100-2000	NO
Family OCTOPODIDAE Orbigny, 1840			
Subfamily OCTOPODINAE Grimpe, 1921			
Amphioctopus burryi Voss, 1950	Be	200-400	?
Benthoctopus pseudonymus (Grimpe, 1922)	Be	1600	?
Callistoctopus macropus (Risso, 1826)	Be	0-200	YES
Macrotritopus defilippi (Verany, 1851)	Be	0-200	?
Octopus vulgaris Cuvier, 1797	Be	0-250	YES
Pteroctopus tetracirrhus (Delle Chiaje, 1830)	Be	25-720	YES
Scaeurgus unicirrhus (Delle Chiaje, 1830)	Be	50-500	?
Subfamily ELEDONINAE Grimpe, 1921			
Eledone caparti Adam, 1950	Be	64-150	?
Subfamily BATHYPOLYPODINAE Robson, 1928			
Bathypolypus arcticus (Prosch, 1849)	Be	37-1210	?
Bathypolypus biardii (Verrill, 1873)	Be	20-1545	?
Bathypolypus ergasticus (Fischer and Fischer, 1892)	Be	450-1400	?
Bathypolypus sponsalis (Fischer and Fischer, 1892)	Be	930-1250	?
Bathypolypus valdiviae (Thiele, in Chun, 1915)	Be	200-1000	?
Subfamily GRANELEDONINAE Voss, 1988			
Graneledone verrucosa (Verril, 1881)	Be	850-2300	?
Familia Enteroctopodidae Strugnell et al., 2014			
Muusoctopus fuscus (Taki, 1964)	Be	600-1000	?
Muusoctopus januarii (Hoyle, 1885)	Be	350-750	?
Family OCYTHOIDAE Gray, 1849			
Ocythoe tuberculata Rafinesque, 1814	P(E)	0-200	YES
Family BOLITAENINAE Chun, 1911			
Bolitaena pygmaea (Verrill, 1884)	P	100-1400	NO
Japetella diaphana Hoyle, 1885	P(M)	200-1000	NO
Family VITRELEDONELLIDAE Robson, 1932			
Vitreledonella richardi Joubin, 1918	P(E-M)	0-1000	NO
ORDER VAMPYROMORPHIDA Pickford, 1939			
Family VAMPYROTEUTHIDAE Thiele, in Chun, 1915			
Vampyroteuthis infernalis Chun, 1903	P(M-Ba)	600-1200	NO

Six loliginid squids can be found in coastal waters (Table 5.4.1). Of special importance is *Loligo vulgaris*, one of the most common neritic squids on the northeastern Atlantic and Mediterranean coast. This species lives in the continental shelf and upper slope waters, at up to 500 m depth (Worms, 1983; Jereb and Roper, 2010). In African waters, *L. vulgaris* is distributed over the inner continental shelf, between 50 and 150 m depth, associated with the Mauritanian and Canary currents (Arkhipkin and Laptikhovsky, 2006). Other significant loliginids are *Alloteuthis africana* and *A. subulata*. According to Arkhipkin and Laptikhovsky (2006), from the north to the south, *A. subulata* is distributed over the Mauritanian-Senegalese continental shelf and is gradually replaced by *A. africana* in tropical African waters.

Oegopsid squids represent the most abundant group with 75 species (Table 5.4.1). Most of them correspond to continental slope and oceanic species. Probably the ommastrephids represent the most important group in the area with 7 species. Among these species three seem to be more significant, and we will describe them below. *Todarodes sagittatus* is an oceanic species distributed in the Eastern Atlantic Ocean that inhabits this region from the outer continental shelf to the upper slope, at depths ranging from 65 m to 1800 m (Nigmatullin et al., 2002; Arkhipkin and Laptikhovsky, 2006; Rocha et al., submitted). *Illex coindetii* is a demersal species widely distributed on the continental shelf and upper slope of both eastern

and western coastlines of the Atlantic Ocean (Roper et al., 1998; Sánchez et al., 1998; Jereb and Roper, 2010; González and Guerra, 2013). Its presence in CCLME waters is associated with the continental shelf and upper slope waters, concurring with the findings of Arkhipkin and Laptikhovsky (2006). *Todaropsis eblanae* is a species present in the Eastern Atlantic Ocean (Jereb and Roper 2010). This species presents significant abundance levels associated with the continental shelf and upper slope waters (Arkhipkin and Laptikhovsky, 2006; Rocha et al., submitted). Other species, such as enoploteuthid squids, are relatively abundant in slope waters, although their biomass is not significant because of their small size (Nesis, 1987; Rocha et al., submitted).

Octopods probably represent the less known cephalopod group in the area with 34 species (Table 5.4.1). Shallow-water species are better-known than deep-water species. Of these, *Octopus vulgaris* is the most widely found and studied octopod species in the area (Hatanaka, 1979; Rocha et al., submitted). This is a shallow-water coastal benthic species that lives between the surface and 100 m depth, rarely deeper (Mangold, 1998; Boyle and Rodhouse, 2005). Other species, such as *Pteroptopus tetracirrhus,* are abundant in platform and continental slope waters (Jereb et al., 2013). New records of incirrate octopods of the genus *Muusoctopus* and *Bathypolypus* in Mauritanian waters (Rocha et al., submitted) add to the list of deep benthic cephalopods in the area. *Muusoctopus* species may be a common element of benthic octopod fauna on the CCLME continental slope, as these species can be caught in the region, but these may have been identified as *Benthoctopus* specimens. *Bathypolypus* species may be frequent in deep waters associated with the Canary Current and cold deep waters (Rocha et al., submitted).

Finally, the vampiroteuthid *Vampyroteuthis infernalis* is also reported and seems to be relatively frequent in these waters (Jereb et al., 2013; Rocha et al., submitted).

5.4.3. CEPHALOPOD ASSEMBLAGES AND ECOLOGY

The CCLME constitutes a transitional faunistic region in which tropical, subtropical and boreal species are mixed, probably associated with specific water masses (Arkhipkin and Laptikhovsky, 2006; Rocha et al., submitted).

Table 5.4.1 presents the habitat and distribution deep range of the species present in this region. The cephalopod assemblages in the CCLME area can be divided into three ecological groups in relation to the habitat: bottom, near-bottom and true pelagic species, integrating data about local species, wide distribution species permanently resident in the studied area, and periodical species which inhabit the adjoining waters (Nigmatullin, personal communication). Accordingly, several assemblages can be identified in the zone corresponding to the horizontal speciation and stratification pattern of cephalopod fauna recorded in the world's oceans (Nesis, 2003). Rocha et al. (submitted) identified two assemblages in Mauritanian waters. On the one hand, there is the Shelf Assemblage with two main species, *I. coindetii* and *T. eblanae*, corresponding to bottom-associated neritic species, usually living near the coast (Jereb and Roper, 2010). Other species of this assemblage are benthic or demersal shallow-water species, such as *O. vulgaris* or *S. elegans*, both living close to the coast (Jereb and Roper, 2005; Jereb et al., 2013). On the other hand, the Slope Assemblage is mainly composed of pelagic species such as *T. sagittatus*, which lives outside of continental shelf waters (Jereb and Roper, 2010). This more "pelagic" assemblage is composed of oceanic species and deep benthic and bathyal octopuses (Rocha et al., submitted).

Both assemblages can be divided according to their habitat in: Coastal, Slope, Pelagic and Deep Benthic assemblages (Plates 5.4.1 and 5.4.2). The Coastal Assemblage includes coastal shallow-water species such as *O. vulgaris* and sepiids near the coast and loliginids on the upper slope. The Slope Assemblage includes bottom-associated neritic species such as the ommastrephids *I. coindetii* and *T. eblanae*. The Pelagic Assemblage is composed of pelagic oceanic species such as *T. sagittatus* and *Opisthoteuthis agassizii*. Finally, the Deep Benthic Assemblage includes mainly benthic deep-water octopus species such as *Muusoctopus* and *Bathypolypus.*

The cephalopod fauna of the CCLME is composed of a mixture of tropical to temperate pelagic, demersal and benthic species living over the shelf and in open waters, and cold water benthic species living on the deep slope. Thus, the zone is a transitional area between different zoogeographic provinces, where different water masses from the North and South Atlantic Ocean are present (Nesis, 2003; Arkhipkin and Laptikhovsky, 2006).

5.4.4. CEPHALOPOD FISHERIES

The cephalopod resources in the CCLME represent one of the most substantial fisheries in the Atlantic region (FAO, 2014c), ranging from 80,000 t yr^{-1} to 200,000 t yr^{-1}. The bulk of the catches of cephalopods in the zone are presented in Figure 5.4.1. The level of global cephalopod catches has decreased sharply from a mean of 165,000 t to 91,000 t in the recent period. Most of these catches come from fishing grounds located off the African coast (Fig. 5.4.2). This level of catch is to be seen against catches in other CCLME countries like Guinea-Bissau (approximately 4,000 t in 2012) and Guinea (6,000 t, unpublished data). However, these data include few commercial catch data relating to squid, cuttlefish and octopus species. Most small-scale local fisheries on African coasts lack descriptive statistics making it impossible to identify the species caught. *Octopus vulgaris* is currently the main species exploited by artisanal and industrial fisheries in the coastal waters (Hatanaka, 1979; Balguerías et al., 2002; Jereb et al., 2013).

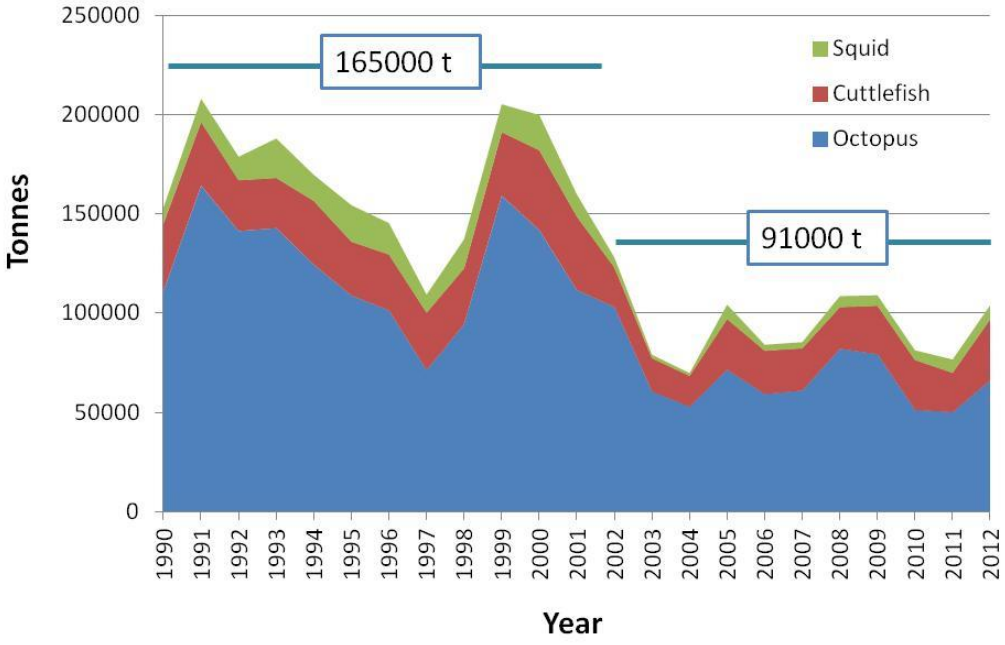

Figure 5.4.1. Cephalopod catches in the area of Morocco (Atlantic), Western Sahara, Mauritania, Senegal and Gambia (derived from CECAF statistics presented in FAO, in press c).

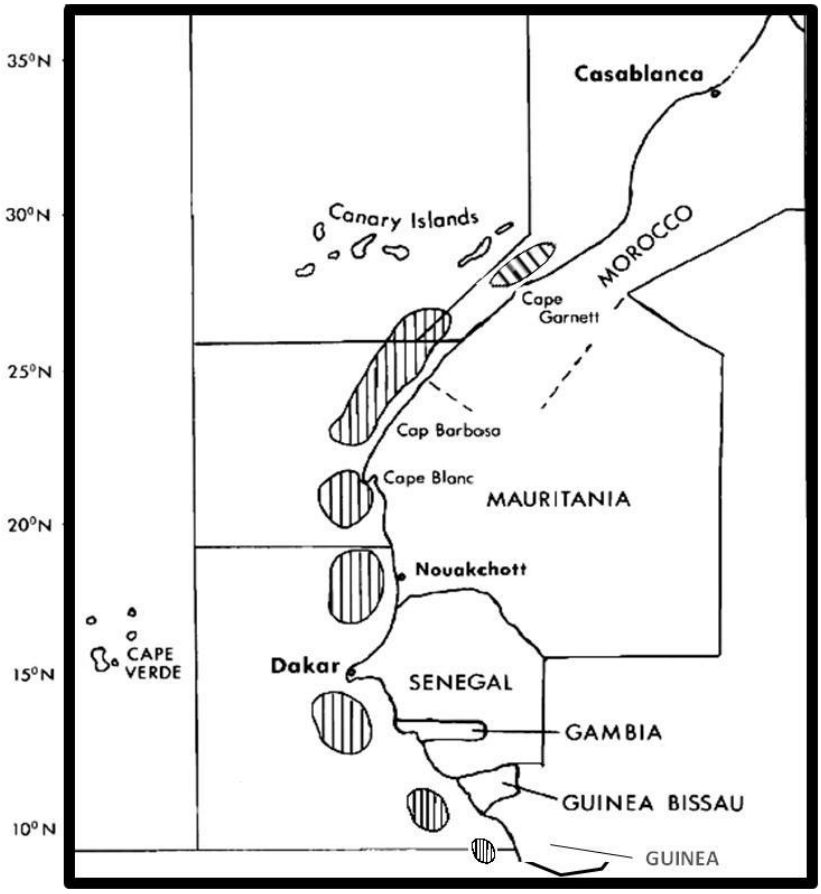

Figure 5.4.2. Main fishing grounds located off the African coast into the CCLME. Based on Grant et al., 1981.

Fishing techniques for cephalopods used in the CCLME, especially along the African coast, are diverse. These species are fished for both artisanal and industrial fisheries, using trawl, traps, diving, jigging and other diverse fishing techniques (Table 5.4.2).

Table 5.4.2. Diversity of the gear used for fishing cephalopods in the CCLME.

Target species	Main fishing technique	Accessory fishing technique
Octopus	Trawl, Pot, Trap, Jig	Diving
Cuttlefish	Trap, Trawl	Jig
Squids	Trawl	

Loliginid and sepiid species constitute substantial resources exploited by coastal fisheries. *Loligo vulgaris* is fished throughout its distributional range by multispecific trawlers and small-scale fishing units. Other species, such as *A. africana* and *A. subulata,* are two small-sized loliginid species caught as bycatch by trawlers, but with no separate statistical data. *Sepia elegans* is the most abundant and commercially important sepiid species (Khromov et al., 1998; Jereb and Roper, 2005, 2010).

Ommastrephid squids probably represent the main potential resource for cephalopod pelagic and trawl fisheries in the area. Three species present great potential for fisheries in the zone. *Todarodes sagittatus* is a potential resource for more pelagic fisheries; it is intermittently fished in Norwegian waters, in the Mediterranean Sea and off the North African coast (Dunning and Wormuth, 1998; Nigmatullin et al., 2002; Jereb and Roper, 2010). *Illex coindetii* is a demersal species caught by bottom trawl and gillnet fleets as bycatch, accounting for a conspicuous fraction of the ommastrephid catches in Mediterranean and Atlantic waters (González et al., 1996; Sánchez et al., 1998; Jereb and Roper, 2010; González and Guerra, 2013). *Todaropsis eblanae* is taken mainly as bycatch in trawl and small-scale fisheries (González et al., 1996; Robin et al., 2002; Jereb and Roper, 2010). In the CCMLE waters this species can present significant abundance levels, also associated with the continental shelf and upper slope waters (Arkhipkin and Laptikhovsky, 2006; Rocha et al., submitted).

5.4.5. CONCLUSIONS

The CCLME waters exhibit a rich cephalopod fauna in comparison with other areas of the world's oceans. These waters are a transitional zone between different Atlantic zoogeographic provinces where tropical, temperate and cold water cephalopod species mix.

Several assemblages can be identified in the coastal, shelf, slope and deep waters. Coastal assemblages are dominated by sepiids, loliginids and shallow-water octopus, while more oceanic assemblages are largely dominated by ommastrephid and deep-water octopus species.

This area shows cephalopod resources that can maintain local and trawl fisheries for these resources, mainly for coastal octopus, neritic loliginids and more pelagic ommastrephids.

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Plate 5.4.1. Cephalopods species found in Coastal (1, 2, 3) and Slope (4, 5, 6) assemblages of CCLME Region. 1. *Octopus vulgaris* (© Ana Ramos); 2. *Sepia elegans* (© Lourdes Fernández); 3. *Sepia hierredda* (© José F González); 4. *Loligo vulgaris* (© Lourdes Fernández); 5. *Todaropsis eblanae* (© Lourdes Fernández) and 6. *Illex coindetii* (© Lourdes Fernández).

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Plate 5.4.2. Cephalopods species found in Pelagic (1, 2, 3) and Deep Benthic (4, 5, 6) assemblages of CCLME Region. 1. *Todarodes saggitatus* (© Lourdes Fernández); 2. *Opisthoteuthis agassizii* (© Ana Ramos); 3. *Galiteuthis armata* (© Ana Ramos); 4. *Muusoctopus januari* (© Ana Ramos); 5. *Bathypolypus ergasticus* (© Ana ramos) and 6. *Bathypolypus valdiviae* (© Ana Ramos).

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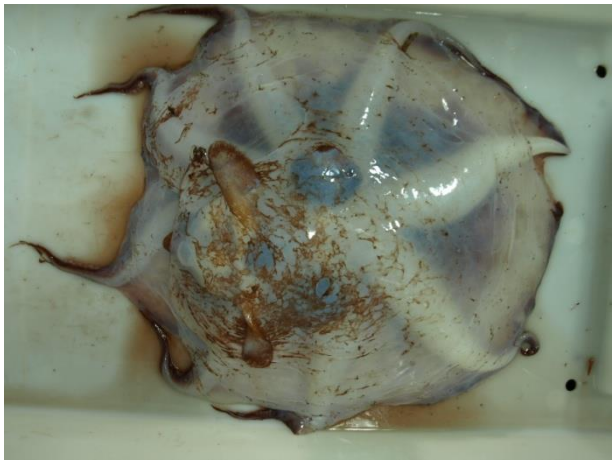

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