Title/Name of the area: MCA

Presented by

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Abstract

MCA (Mainland Canyons Area) EBSA is compounded by a total of 11 canyons, 4 seamounts and one archipelago, and this area includes one OSPAR Marine Protected Area, one Protected Area, one UNESCO Biosphere Reserve, one Natura 2000 Site of Community Interest and 5 Natura 2000 Special Protection Areas for wild birds. The EBSA is divided by 3 sections, North MCA (32786 Km^2), Center MCA (48048 Km^2) and South MCA (29099 Km^2). The structures in the EBSA are hotspots of marine life and in general they represent areas of an enhanced productivity, especially when compared with nearby areas. This EBSA has a total area of 109933 km^2 with identified structures depths ranging from 50m (head of Nazaré canyon) to ~5000m (bottom of Nazaré canyon). The area presents particular features which make it eligible as an EBSA when assessed against the EBSA scientific criteria. All structures included in the MCA EBSA fulfill four or more out of the seven EBSA scientific criteria. A total of 3411 species are listed to the area, with 776 specifically recorded for different EBSA structures. From the total of species recorded 11% are protected under international or regional law. The EBSA is totally under Portuguese national jurisdiction, with its structures located on territorial waters and on the Portuguese Economic Exclusive Zone (EEZ).

Introduction

The MCA EBSA includes a total of 11 canyons, 4 seamounts and one archipelago (Figure 1). The EBSA is divided into three parts: MCA North (Figure 2) comprising 3 seamounts (Vasco da Gama, Vigo, Porto) and 2 canyons (Porto and Aveiro), MCA Center (Figure 3) comprising one seamount (Fontanelas), one archipelago (Berlengas) and 4 canyons (Nazaré, Lisboa, Cascais, Setúbal) and MCA South (Figure 4) with 5 canyons (São Vicente, Sagres, Lagos, Faro, Portimão). There are numerous coastal protected areas inside this EBSA, which were designated under different multilateral agreements, national legislation or European Union Directives, with some of them overlapping partially ou totally. As an example Archipelago of Berlengas is a protected area (Reserva Natural das Berlengas) – Decree-Law No. 264/81, of 3 September, and it overlapps with the SCI (Site of Community Interest) Arquipélago das Berlengas - PTCON0006, designated under EU Habitats Diretive, with the SPA (Special Protection Area) Ilhas Berlengas - PTZPE0009, designated under EU Birds Directive, with the

UNESCO Berlengas Biosphere Reserve, with OSPAR Berlengas Marine Protected Area and with the Council of Europe Berlenga Biogenetic Reserve.

The Portuguese mainland shelf is relatively wide (~50 km) and flat, characterized by an L-shaped continental shelf and a steep slope-edge. Its edge is well defined by the 200 m isobath. The shelf width varies along the coastline, from around 40 km wide off the northern coast to 10 km wide (south of Lisbon), increasing slightly to the southwest and southern coasts (Weaver *et al.*, 2000; Relvas *et al.*, 2007).

The continental margin has been characterized as a glacially influenced margin, dominated by canyon and channel processes (Weaver *et al.*, 2000; Relvas *et al.*, 2007). The margin has some of Europe largest submarine canyon systems (e.g. Nazare canyon and Setubal Canyon) (Guerreiro *et al.*, 2014; Moura *et al.*, 2017). The present-day configuration of the margin is the result of tectonic events during the Messinian/early Pliocene in combination with subsequent Quaternary glacio-eustatic changes. Three sectors, separated by modern submarine canyons (several kilometres wide, few kilometres in relief), have been differentiated, which are from north to south: the Porto, Lisbon and Alentejo continental margins (Alves *et al.*, 2003; Garcia *et al.*, 2015).

The Portuguese coast is situated in the North Atlantic Upwelling System of the western coast of the Iberian Peninsula (Prego *et al.*, 2007). The wind and the current system present a strong seasonal variability, with the summer and the winter patterns being easily distinguished. From March to April the winds are typically north-westerly and by May they become predominantly northerly, with the wind stresses near the coast (Reis and Gonçalves, 1988). Due to the wind direction and stresses, a surface divergence and geostrophic budget is setup near the coast corresponding of the upwelling of deep cold water, spreading and advected offshore, pushing the warmer water far from the coast (Lopes *et al.*, 2014; Sauvaget *et al.*, 2000). This event favors nutrient input towards the surface waters, enhancing phytoplankton growth and primary productivity (Prego *et al.*, 2007).

Tidal currents change direction periodically with time, describing an elliptical hodograph usually aligned along bathymetric contours in the ocean interior. Tidal energy tends to dissipate, and hence, to exert a stronger effect on continental slopes within submarine canyons and adjacent areas (e.g., Shepard, 1976; Shepard *et al.*, 1979; Viana *et al.*, 1998; Kunze *et al.*, 2002; Garrett, 2003; Shanmugam, 2012; Gómez-Ballesteros *et al.*, 2014; Gong *et al.*, 2013). Shanmugam (2012) has proposed that barotropic tidal currents affect land- or shelf-incising canyons connected to estuaries or rivers. Baroclinic tide currents affect slope-incising canyons but do not clearly connect to major rivers or estuary systems. Inversion of bottom current directions due to tidal influence occurs outside these canyons (Kennett, 1982; Stow *et al.*, 2013a).

Submarine canyons

The submarine canyons are major geomorphic features of continental margins, with more than 9000 large canyons covering 11.2% of continental slopes globally (Harris *et al.*, 2014), with an estimated accumulated axis length of over 25,000 km (Huang *et al.*, 2014). Canyons are characterized by steep and complex topography (Shepard and Dill, 1966; Lastras *et al.*, 2007; Harris and Whiteway, 2011) that influences current patterns (Shepard *et al.*, 1979; Xu, 2011) and provides a heterogeneous set of habitats, from rocky walls and outcrops to soft sediment (De Leo *et al.*, 2014). These geomorphologic features act as preferential particle-transport routes from the productive coastal zone down continental slopes to the more stable deep seafloor (Allen & Durrieu de Madron, 2009; Puig *et al.*, 2014).

The submarine canyons are described by a deep and steep incisions on the seafloor of continental shelves and slopes that act both as temporary stores of sediment and carbon (van Weering *et al.*, 2001, 2002; Weaver *et al.*, 2004; Canals *et al.*, 2004; Oliveira *et al.*, 2007). These structures can favor the transport of large amounts of sediment from the land to the deep sea, driven by dense-water cascading and gravity-driven sediment flow events (Shepard & Dill, 1966; Gardner, 1989; Canals *et al.*, 2006; de Stigter *et al.*, 2007). The thermohaline stratification of the water column is strong, with the probability of the flow in the upper mixed layer decouple from the underlying water levels, which interact with the rims of the canyon. In such a scenario, the current flowing above the canyon head tends to follow its path, ignoring the bottom topography, while the flow below the rim is deflected by the canyon (e.g., Palanques *et al.*, 2005; Oliveira *et al.*, 2007). This current flow can also induce the formation and focussing of internal waves (e.g., Garcia *et al.*, 2008; Hall & Carter, 2011).

On many continental margins, cross-shelf exchanges of water and particulate matter are inhibited by the presence of density fronts and associated slope currents flowing parallel to the isobaths (e.g., Font *et al.*, 1988; Allen & Durrieu de Madron, 2009). Submarine canyons intercept the path of these currents, inducing a new dynamic balance, eventually enhancing non-geostrophic motions, and shelf-slope exchanges (Huthnance, 1995). Near the seafloor, alignment of the current with the direction of the canyon axis is commonly observed (Shepard *et al.*, 1979; Puig *et al.*, 2000). The adjustments of the current to the canyon topography produce vortex stretching and vertical motions (Klinck, 1996; Hickey, 1997). These modifications of the currents may result in local upwelling, thus stimulates primary production (Ryan *et al.*, 2005). Additionally, closed-circulation cells and downwelling may develop over canyons, enhancing the capacity of the canyon to trap particles transported by long-shore currents (Granata *et al.*, 1999; Palanques *et al.*, 2005; Allen & Durrieu de Madron, 2009).

Long incised valleys expose the older underlying rocks, their morphology resembles their on land equivalents with an amphitheatre like head with several tributaries, more or less sinuous axis (thalweg) and steep sides (Valadares, 2012), they are often associated with sand-rich turbidites and are thus investigated as modern analogues for deepwater hydrocarbon reservoirs (Wynn *et al.*, 2000; Stow & Mayall, 2000; Kenyon *et al.*, 2002). Canyons incisions into the shelf edge offer preferential pathways for dense shelf-water cascades (Canals *et al.*, 2006, 2009; Allen & Durrieu de Madron, 2009). Canyons are important routes for the transport of organic matter from surface waters and continental shelf areas to the deep sea basins (Granata *et al.*, 1999; Durrieu de Madron *et al.*, 2000; Palanques *et al.*, 2005; Canals *et al.*, 2006; Pasqual *et al.*, 2010). These segments are considered to be preferential pathways for shelf-slope exchanges. Suspended sediment concentrations inside submarine canyons are many times higher than concentrations present at comparable locations on the adjacent open slope areas (Baker, 1976; Schmidt *et al.*, 2001; van Weering *et al.*, 2002; Puig *et al.*, 2003; Stigter *et al.*, 2007).

The "unusual" physical/oceanographic conditions inside canyons can be caused by topographic effects such as accelerated currents and dense-water cascades, which increase suspended particulate concentrations and transport organic matter from coastal zones to deeper regions of the margin (Bosley *et al.*, 2004; Genin, 2004; Canals *et al.*, 2006). This intermittent process affects biogeochemical cycles by re-suspending sediment and transporting significant volumes of minerals and organic matter (Fohrmann *et al.*, 1998; Hill *et al.*, 1998; Puig *et al.*, 2013). In conclusion the canyons are responsible for a major part of mass transfers between the coastal zone and the deep oceanic domain, affecting the oceanic circulation pattern, as well as the distribution of the bottom sedimentary deposits in the shelf nearby (Guerreiro *et al.*, 2009). There is increasing evidence that submarine canyons play important ecological roles in the functioning of deep-sea ecosystems (Amaro *et al.*, 2016; Thurber *et al.*, 2014) and contribute significantly to regional biodiversity and primary/secondary production along the continental margin (Gili *et al.*, 1999, 2000; Sardà *et al.*, 2009; Ingels *et al.*, 2009; Vetter *et al.*, 2010; De Leo *et al.*, 2010).

Canyons can enhance habitat heterogeneity and affect faunal communities in a variety of ways: (1) by channeling currents and promoting topographically induced upwelling (Klinck, 1996; Hickey, 1997), (2) by entraining particulate organic matter (Vetter, 1994; Vetter & Dayton, 1998; Harrold *et al.*, 1998; Company *et al.*, 2008; Rowe *et al.*, 2008; De Leo *et al.*, 2010, 2012), (3) by transporting shelf sediments to slopes in episodic turbidity currents or mass wasting events (de Stigter *et al.*, 2007; Oliveira *et al.*, 2007; Arzola *et al.*, 2008), (4) by acting as topographic features that funnel and concentrate diel vertical migrators (Greene *et al.*, 1988; Lavoie *et al.*, 2000; Genin, 2004), and (5) by providing enhanced seafloor habitat heterogeneity (Brodeur, 2001; Yoklavich *et al.*, 2000; Uiblein *et al.*, 2003; Vetter *et al.*, 2010; De Leo *et al.*, 2012).

Seamounts

The MCA EBSA registers the presence of 4 seamount structures. The seamounts are defined as isolated topographic features of the seabed that have a limited lateral extent and rise more than 1000 m from abyssal depths (Menard, 1964). Large seamounts are usually originate as volcanoes and primarily associated with the intraplate hotspots and mid-ocean ridges (Staudigel *et al.*, 2010). Generally, seamounts topography may act as an element which turns the structures into high complexity sites. Due to their more or less isolated location, these structures can be an obstacle to the free circulation of the oceans. This gives rise to different kinds of phenomena and disturbances, including an increase in the speed of sea currents, upwellings, turbulence, Taylor cones, eddies, and even jets in the zones where the seamounts interact with ocean currents (Richardson *et al.*, 2000; Kunze & Smith, 2004; White *et al.*, 2007; Pakhorukov, 2008).

Seamounts are hotspots of marine life (*e.g.* Rogers, 1994; Gubbay, 2003; Morato & Pauly, 2004; Pitcher *et al.,* 2007, 2010; Mendonça *et al.,* 2012), and in general represent areas of enhanced productivity in comparison with nearby abyssal areas. In most cases, around the seamounts there is an extensive anticyclonic eddy associated with the lifting of nutrients from the rich deep water, giving rise to high concentrations of nitrates and chlorophyll in shallow waters (Coelho & Santos, 2003), which encourages the development of a wealth of flora and fauna on the structures, leading to exposed hard substrates and improved food conditions for epibenthic suspension feeders (*e.g.* Cartes *et al.*, 2007 a), b); Genin & Dower, 2007) such as cold water corals or deep water sponges (*e.g.* Samadi *et al.,* 2007; Sánchez *et al.,* 2008), tunas (*e.g.* Yasui, 1986; Morato *et al.,* 2010, Ressurreição & Giacomello, 2013), marine mammals (*e.g.* Cañadas *et al.,* 2002; Correia *et al.,* 2015), and other organisms which apparently feed on prey aggregations (*e.g.* Boehler & Sasaki, 1988; Porteiro & Sutton, 2007; Tabachnick & Menchenina, 2007). Seamounts are biologically distinctive habitats of the open ocean exhibiting a number of unique features (Rogers, 1994; Probert, 1999; Morato & Clark, 2007). These structures can host very distinctive biological communities that are different to the communities on nearby soft sediment dominated abyssal plain, and these particular places may attract pelagic fish including larger, commercially valuable vertebrate (*Beryx splendens*) and invertebrate (*Charonia lampas*) species and other marine species like top predators such as the shark (*Prionace glauca*), and reptile species as loggerhead sea turtles (*Caretta caretta*) and protected marine mammals (*Balaenoptera borealis*) (see *e.g.* Holland & Grubbs, 2007, Kaschner, 2007, Santos *et al.*, 2007).

Benthic biological communities on seamounts are highly vulnerable to human activities. Many benthic species are long-lived and slow-growing, and not resilient to human impacts (Convention on Biological Diversity, 2008). Seamounts are locations for a broad range of current-topography interactions and biophysical coupling, with implications for both phyto and zooplankton. Seamounts appear to support relatively large planktonic and higher consumer biomass when compared to surrounding ocean waters, particularly in oligotrophic oceans. It has been a widely held view that *in situ* enhancement of primary production fuels this phenomenon, but this has recently been challenged (Genin & Dower, 2007).

Productivity in oceanic settings depends on light and nutrient availability, while overall production is the result of productivity and accumulation of the phytoplankton. At a seamount, either a seamount-generated, vertical nutrient flux has to be shallow enough to reach the euphotic zone and the ensuing productivity retained over the seamount long enough to allow transfer to higher trophic levels, or the seamount must rely on allochthonous inputs of organic material to provide a trophic subsidy to resident populations (Clark *et al.,* 2010 a), b)).

The MCA EBSA (Figure 1) includes 11 canyons, 4 seamounts and an archipelago that fulfill at least four EBSA Criteria. There are differences in the number of information available for each structure included in the EBSA (Table 1).

Table 1 – Resume of the MCA structures, EBSA scientific criteria fulfilled by each structure (Crit 1 (Uniqueness or rarity), 2 (Special importance for life-history stages of species, 3 (Importance for threatened, endangered or declining species and/or habitats), 4 (Vulnerability, fragility, sensitivity, or slow recovery), 5 (Biological productivity), 6 (Biological diversity) and 7 (Naturalness). Nº sps – total number of species in each structure. Nº refs - total number of references in each structure.

Structures	**Crit 1**	**Crit 2**	**Crit 3**	**Crit 4**	**Crit 5**	**Crit 6**	**Crit 7**	**Nº sps**	**Nº refs**
North MCA									
Aveiro canyon	√	√	√	√	√	√		159	39
Porto canyon	√	√	√	√	√	√		44	39
Porto seamount	√	√	√	√	√	√		13	54
Vasco da Gama seamount	√	√	√	√	√	√	√	17	51
Vigo seamount	√	√	√	√	√	√	√	4	69
Center MCA									
Berlengas archipelago	√	√	√	√	√	√	√	458	180
Cascais canyon	√	√	√	√	√	√		75	44
Fontanelas seamount	√	√	√	√	√	√	√	13	6
Lisboa canyon	√	√	√	√	√	√		65	37
Nazaré canyon	√	√	√	√	√	√		154	143
Setúbal canyon	√	√	√	√	√	√		123	81
South MCA									
Faro canyon	√	√	√	√	√	√		13	6
Lagos canyon	√	√	√	√	√	√		12	23
Portimão canyon	√	√	√	√	√	√		37	51
Sagres canyon	√	√	√	√	√	√		14	4
São Vicente canyon	√	√	√	√	√	√		71	23
General MCA								3174	350

The MCA EBSA is located next to the mainland area (see Figure 1). The EBSA is divided in 3 sections, North MCA, Center MCA and South MCA.

MCA North (Figure 2)

Located in the northern part of the mainland Portuguese coastal shelf (between the Minho river mouth and Mondego cape). The shelf break occurs at about 150m depth. Two important canyons (Porto and Aveiro canyons) indent the shelf break at different latitudes.

Shelf-break canyons such as Porto and Aveiro canyons (NW off Portugal) have been classified as minor submarine valleys, since they cut the shelf-break away from the littoral processes (Cascalho & Fradique, 2007; Guerreiro *et al.*, 2009). One of the big features in MCA EBSA North is Galicia Bank, a 200x150 km area within which the seafloor shoals to about 600 m water depth. Galicia Bank is characterized by two isolated seamounts on its southern edge (Vasco da Gama and Vigo) and is separated from northwestern Iberia by a broad submarine valley (Whitmarsh *et al.*, 1998; Maestro *et al.*, 2015).

Vasco da Gama / Vigo / Porto seamounts

To the northwest of the Iberia Abyssal Plain area there are 3 seamounts - Vigo, Vasco da Gama, and Porto. In the area the continental rise is relatively wide, ~100 km, and including these three submarine mounts, the easternmost Porto seamount and the more distal Vigo and Vasco da Gama seamount. The Dom Carlos Valley between the seamounts forms a prominent fault bounded depression into which the sediment transported by the Porto and Aveiro submarine canyons is mainly funnelled (Mougenot *et al.*, 1984; Mougenot, 1988; Milkert *et al.*, 1996; Alves *et al.*, 2003).

Galicia Bank is characterized by two isolated seamounts on its southern edge (Vasco da Gama and Vigo) and is separated from northwestern Iberia by a broad submarine valley. The Galicia Bank has an area of 200x150 km within which the seafloor shoals to about 600 m water depth (Whitmarsh *et al.*, 1998; Wilson *et al.*, 2001).

Porto and Vigo Seamounts are made up of the same geological formations and had a similar structural history since their uplift as continental fault blocks in the Late Cretaceous to Middle Eocene period. Ravines that dissect the presumably lithified scarps bounding the seamounts may be relict features but still appear to control sediment input to gulley and channel systems in the surrounding topography. Sedimentary ridges associated with the seamounts represent anomalously thick sequences of post-Eocene material and probably result from interaction of downslope sedimentary processes and contour-following boundary currents (Mougenot *et al.*, 1984; Alves *et al.*, 2006; Gruetzner *et al.*, 2016).

Porto canyon

The Porto submarine canyon is located at about 25 km W off Póvoa de Varzim, deeper than 110m. This canyon has also more than 100 km length towards the Iberian Abyssal Plain and its morphology is related with the occurrence of mass movements, with no apparent relation to the present day watercourses (Vanney & Mougenot, 1981; Rodrigues, 2001; Guerreiro *et al.*, 2007). The Porto submarine canyon is cut deeply into this steep surface (Rodrigues *et al.*, 1991).

At about 20-30 km W off the Douro estuary, at the Porto canyon's head, stands the Douro Muddy Deposit, mainly built of silty-clay particles driven from the Douro river in periods of high river discharge, transported mainly suspension during storm events, when the downwelling regime combines with poleward currents resulting in a fine particles transport towards NW (Drago *et al.*, 1999; Vitorino *et al.*, 2002). The bottom sedimentary cover is characterized by the presence of two important muddy deposits with general N-S orientation, located in the mid-shelf off the Minho and Douro rivers (Oliveira *et al.*, 2002; Guerreiro *et al.*, 2009). The normal wave regime is able to promote bottom sediment remobilization mostly in the inner and middle shelf region (Vitorino *et al.*, 2002).

In the head of the Porto submarine canyon, rocks from the Mesozoic (Upper Cretaceous) can be found (Rodrigues *et al.*, 1991). According to Drago *et al.*, (1999) this is a sedimentary active zone, tectonically depressed and partially protected by hard rocky outcrops of different scales (e.g. Beiral de Viana formations) being, therefore, highly efficient as a fine sediment trap.

Aveiro canyon

The Aveiro canyon cuts the shelf-break, presenting an "amphitheater" outline, with the head carved in biogenic and detritic limestone formations from Neogenic and Eocenic (Kenyon *et al.*, 2000; Rodrigues, 2004). The canyon begins at about 30 km W off the coast, deeper than 110 m depth, has a wide transversal profile with a half-circle upper sector of about 10 km diameter. It shows no apparent relation to present-day watercourses and meets the Porto canyon at the Valle-Inclan Depression, before reaching the Iberian Abyssal Plain (Rodrigues, 2001). This sector of the Portuguese margin is much more flat and wide, registering smooth gradients (about 0.3%) locally interrupted by Mesozoic and Cenozoic rocky outcrops (Terrinha *et al.*, 2003; Guerreiro *et al.*, 2007).

The Aveiro canyon zone is, in general, coarse and homogeneous, dominated by sand (at all depths) and gravel (at 60 m and 150 m depth). At 300 m and 400 m, the silty-clay fraction increases on this sector. Deeper than 480 m clay fraction achieves locally relevance, with percentage values of about 45% (Guerreiro *et al.*, 2007).

The canyon has a carbonates dominance, may be due to the lack of significant sediment sources, both in the continent and surrounding shelf. The shelf-break of the Aveiro canyon is located in a width and coarse part of the continental shelf (Abrantes *et al.*, 1994; Peliz *et al.*, 2005: Abrantes & Rocha, 2007) where the existent rock outcrops seem to be less efficient in creating local favorable settling of fine grained sediments. Additionally, the Vouga river cannot be considered as an important sediment source, since it discharges into the Aveiro lagoon. According to Abrantes *et al.*, (2004) the Ria de Aveiro acts as a trap of fine-grained sediments, both advected from the coastal ocean, eroded from the lagoon system, as well as transported by the rivers.

In Aveiro canyon, due to the interaction of the poleward slope flow with the canyon's topography and with the southwards upwelling, this sector is known to promote recurrent filament activity (Haynes *et al.*, 1993) and generating an anticyclonic eddy in the canyon's mouth (Peliz *et al.*, 2002).

MCA Center (Figure 3)

Nazaré canyon

Nazaré canyon is the largest submarine canyon of Europe and one of the largest of the World, it is also the longest submarine canyon on the western Iberian margin, extending over 270 km from a water depth of about 50 m near the Portuguese coast to 5000 m at the edge of the Iberian Abyssal Plain (Vanney &

Mougenot, 1990). The Nazaré fault, with an ENE-WSW alignment, is a late Variscan structure, which maintained its activity during the Meso-Cenozoic period (Moreira, 1985; Ribeiro *et al.*, 1990).

Nazaré Canyon can be divided into three parts on the basis of its morphology (Lastras *et al.*, 2009). The upper part, narrow and steep sided, extending from the canyon head to the shelf break (50–2000 m water depth). The middle part extends from the shelf break to the point where the narrow canyon opens in to abroad flat-floored channel on the lower slope (2000–4050m water depth). It is a morphologically complex region with an overall v-shaped cross- section modified by gullies, terraces and an incised axial channel (Arzola *et al.*, 2008). And finally the lower part of canyon begins where the v-shaped valley abruptly broadens to a 3 km wide flat-bottomed channel at 4050 m water depth. This channel extends for a further 100 km downslope, slowly becoming wider to a maximum of about 7.5 km at the edge of the Iberian Abyssal Plain (Masson *et al.*, 2011).

The upper part of Nazaré Canyon is a sharp V-shaped valley that descends from the shoreline. The middle part of the canyon is a broad meandering valley, incised into the middle slope and descending from 2700 to 4000 m depth over 50 km. The main valley has terraced slopes and a V-shaped axial channel (Duarte *et al.*, 2000; Oliveira *et al.*, 2007).

In terms of sediment transport, the canyon is highly active, in particular during winter, because upwelling events may prevent sediment export during summer (Pusceddu *et al.*, 2010). Although the canyon does not connect to a river, the proximity of the head to the shore contributes to its effectiveness to capture sediment transported along the shelf (Duarte *et al.*, 2000; de Stigter *et al.*, 2007; Oliveira *et al.*, 2007). Present day sediment input is dominated by capture of sediment transported along the continental shelf (Oliveira *et al.*, 2007) and the high sedimentation rates are related to enhanced nepheloid layer activity especially at the upper section of the canyon (de Stigter *et al.*, 2007; Arzola *et al.*, 2008; Tyler *et al.*, 2009).

A differential mineralogical sedimentation: less mature, and coarser sediments from the Nazaré canyon are related with the canyon's proximity to sediment source (both from the continent and Berlengas' granites) and the canyon's highly energetic dynamic; more mature and fine sediments from Porto canyon reflect the lower energy of the outer-shelf and the higher distance from to the continent. Nazaré canyon registered the higher values of K-feldspar (Guerreiro *et al.*, 2009)

Under the influence of tidal currents, fine-grained particles suspended from bottom sediments are captured in the upper canyon and actively transported downwards to the abyssal plain (Stigter *et al.*, 2007). Other physical forces promoting active sediment transport are episodic (intermittent) gravity flows (Van Weering et *al.*, 2002; Stigter et *al.*, 2007).

Berlengas archipelago

The Berlengas archipelago is located on the Portuguese coast, at approximately 10 km west of the town of Peniche. The largest island of the archipelago is the granitic skerry called Berlenga Island that reaches an altitude of 88 m, with a maximum length of 1,5 km and a total area of 78,8 ha. Two groups of smaller islets called Estelas and Farilhões are also part of the archipelago. The archipelago achieved the status of protected area as, a natural reserve, in 1981 by the Portuguese government and since then it was designated with different classifications under several multilateral agreements and European Union Directives.

The geographical location gives singular characteristics to the archipelago, which enhanced the interest of ecological studies, because it is located in a zone with a temperate maritime climate and is influenced by seasonal coastal upwelling controlled by the atmospheric circulation associated with the Azores anticyclone. Persistent northerlies (upwelling favourable) are observed in summer (June to September) (Peliz *et al.*, 2002; Álvarez-Salgado *et al.*, 2003). However, it is during the non-upwelling season (late winter-spring) that a large amount of meroplankton species are observed over the shelf (Santos *et al.*, 2004). Concerning coastal circulation, other important aspects are the Portugal Current flowing off the continental slope westward of 10ºW (Saunders, 1982), the Iberian Poleward Current that flows over the slope (Haynes & Barton, 1991) and the Western Iberia Buoyant Plume (WIBP) (Peliz *et al.*, 2002). Moreover, it is located at the top of the escarpment of the Nazaré Canyon, one of the most worldwide important submarine canyons in the transition zone between the Mediterranean and European subregions. This location contributes to the remarkable productivity and diversity of marine species and habitats and to a landscape unique in the region. Previous studies have investigated the distribution and composition of zooplankton along the Berlenga shelf area (Pardal & Azeiteiro, 2001).

The Berlenga Marine Protected Area (MPA) is about 102 km^2 which surrounds seabirds nesting habitats and an important place of passage for migratory birds (Queiroga *et al.*, 2008), with a Special Protection Area (SPA) for Wild Birds and integrated in the Natura 2000.

Fontanelas seamount

The Fontanelas seamount is located 100 km west of Ericeira and it belongs to a series of magnetic anomalies occurring in the Estremadura Spur, between the Sintra igneous complex and the Tore seamount. The depth of the seamout varies between 1250m and 1600m) (Miranda, 2010; Neres *et al.*, 2014).

Cascais canyon

The Cascais canyon is the shortest, the steepest and the most central of the central Portuguese canyons. It starts in the shelf at depths of ~175m and runs to the abyssal plain, at more than 4600m depth. This complex canyon in the vicinity the mouth of Tagus estuary has a sinuous trajectory of 90km in an open valley, and then continues 62km more as a single broader channel (Lastras *et al*,. 2009).

The lower section of Cascais Canyon starts at about 4500 m water depth where the slope of the margin decreases abruptly. Here, the canyon widens considerably into a U-shaped, flatbottomed and less incised canyon as it opens onto the Tagus Abyssal Plain. The canyon mouth is dominated by pervasive grooving and comet marks on the flat floor (Lastras *et al.*, 2009), which are oriented parallel to the lower canyon axis and are thought to be caused by erosional flows exiting the canyon (Stigter *et al.*, 2011; Garcia *et al.*, 2015).

The Cascais Canyon is situated north to Setúbal canyon (Figura 1) and is not connected to any river flow. The organic matter input is thought to be mainly from Tagus River, though some quantities of sediment and associated materials may be transported from the continental shelf. The canyon acted as the major conduit of sediment from the continental shelf to the abyssal plain at the time of the Lisbon earthquake in 1755 (Amaro *et al.*, 2009; Lastras *et al.*, 2009).

Lisboa and Setúbal canyon

The Lisboa and Setúbal Canyons are located in an area of complex topography and coastal configuration. The Lisboa and Setúbal canyons are conduits with southwards (Lisboa) and westerly (Setúbal) course directions, and their heads are located on the shelf at around 80 and 120 m near the mouth of the Tagus and Sado rivers, respectively (Mougenot, 1988; Alves *et al.*, 2003; Lastras *et al.*, 2009; Jesus *et al.*, 2012).

The head of the Setúbal tributary is located at ~90 m water depth after cutting 40 km into the shelf, and lies close to the Sado River mouth. The head of the Lisbon tributary extends northward toward the head of Cascais Canyon and the mouth of the Tagus River (Lastras *et al.*, 2009; Jesus *et al.*, 2012).

The canyon forms a deep incision across the shelf and runs down to the Tagus Abyssal Plain at 4800m depth. The upper course of the system consists of two branches: the 47 km long Setúbal branch runs in westward direction, its head located 20 km SSW of the Sado river mouth and 6 km W of the nearest coastline. The 38 km long Lisbon branch runs in southward direction, its head located on the shelf at 13km SSW of the Tagus river mouth and 5 km W of the nearest coastline. The location and orientation of the two canyon branches coincide with the Tagus and Grândola fault zones on land (Alves *et al.*, 2003; Lastras *et al.*, 2009), suggesting that emplacement of the canyon system was at least partly structurally controlled. Where the two branches join, their axis has a depth of 2000 m. Both branches have a steep-V-shaped section, with a narrow, flat canyon floor enclosed between high gullied walls and local rocky escarpments. Small terraces are locally present along the canyon axis. The middle course of the canyon, from the confluence of the two branches at 2000 m depth to the canyon mouth at 4200 m, is 70 km long. It follows a sinuous course in WSW direction. A relatively flat floor of a few hundred meters wide is present along most of the middle course, alternating with some narrower V-shaped stretches. Terraces are present along the gullied walls. At 4200 m the canyon widens to a broad flat-bottomed valley which forms the lower course of the canyon. It descends for 58 km in WNW direction, until at 4800 m depth it opens into the Tagus Abyssal Plain (Lastras *et al.*, 2009; de Stigter *et al.*, 2011). This slope is crossed by the Sines cores transect (Terrinha *et al.*, 2003; Jesus *et al.*, 2012).

The Lisboa Canyon’s V-shaped channel follows a sinuous course down slope in a southerly direction. From the canyon head, at 100m depth, down to the junction with the Setúbal Canyon, at 1900 m, the channel has a length of 30 km. Below the junction point, the canyon continues in WSW direction for another 80 km to the foot of the continental slope at a depth of 4500 m (de Stigter *et al.*, 2004).

MCA South (Figure 4)

São Vicente canyon /Sagres canyon

The São Vicente and Sagres submarine canyon lies in the transition between the South Portuguese and the Western Portuguese margins.

The Sagres canyon had a 26 km long and 30 km wide (Llave *et al.*, 2007).

The São Vicente sheeted drifts head sector starts at the edge of the continental shelf, at 70 m below sea level, and extends until it reaches the Horseshoe Abyssal Plain at depths of 5000 meters below sea level. It measures more than 120 km in length (it is the largest of the South Portuguese canyons) and reach up to 20 km in width (Terrinha *et al.*, 2009, Valadares, 2012). The canyon is shaped as a wide, 120 km long corridor following a NE–SW orientation.

The canyon has a general staircase-like shape with the upper and lower parts trending NE-SW and the middle sector with an NNE-SSW direction aligned with the Odemira–Ávila fault, connecting the Alentejo margin to the Horseshoe Abyssal Plain (Alves *et al.*, 2003; Terrinha *et al.*, 2009; Valadares *et al.*, 2009). Located approximately 12 km offshore mainland Portugal, the São Vicente canyon head lies very close to the shore, at depths shallower than 70 m and runs towards the Horseshoe Abyssal Plain at an approximate depth of 4900 m (Valadares *et al.*, 2009; 2012).

This submarine canyon differs from the other canyons by the width of its valley which follows a graben. To the south the continental shelf is very narrow and disappears below the sediment progradation of Neogene beds (Kenyon *et al.*, 2001).

Lagos canyon

The head of Lagos canyon head is located at 760 m water depth and partly separates the Portimao Drift and the Lagos Drift. Two bends affects the canyon orientation. It has a NNE-SSW orientation for less than 10 km, and then runs westward and finishes with a NNE-SSW orientation before joining the Lagos deep valley and finally merges with the Horseshoe Abyssal Plain (Mulder *et al.*, 2006; Marchès *et al.*, 2007; Garcia *et al.*, 2015). The eastern side is steep whereas the western side of the canyon is smoother and characterized by terraces probably formed by instabilities along this flank (Mulder *et al.*, 2006; Marchès *et al.*, 2010; Leynaud *et al.*, 2017).

The Lagos canyon extends over 60 km, drains towards the SW and its morphology changes from the upper to the lower parts. In its upper part the canyon displays a wider thalweg with a smaller inner channel carved close to the SE wall. The heights of the flanks vary from 200 m (incising the contourites deposits) to 800 m (closer to the continental slope). The lower segment is separated from the upper by a major constriction point and there the incision reaches 1 km with slopes of more than 10º on the flanks that display an asymmetrical V shaped transverse profile (Valadares, 2012)

Portimão canyon

The mid-slope terrace of the Algarve Margin is dissected by the Portimãao Canyon. The Portimão canyon is a prominent and large canyon, starting at about 120 m water depth, presenting a slight sinuosity in proximal area, as well as gullied flanks and failure scars (Mulder *et al.*, 2006; Garcia *et al.*, 2015). The location and size of the canyon are related to deep faults (Vanney & Mougenot, 1981; Marchès *et al.*, 2007).

The canyon has a length of 50 km, striking in an N-S direction~~,~~. The canyon presents a V-shape with steep walls affected by several slide scars (slope reaches more than 30º in several places) and a sinuous path till its bottom reaches 1400 m deep. Upper-middle slope is linked to the Alvarez-Cabral Moat (Mulder *et al.*, 2009; Valadares, 2012). The head of the Portimão canyon crosses the border of the continental shelf, which, in this region, is relatively wide (about 30 km) and gently slopes until its edge (Vanney & Mougenot, 1981; Ambar *et al.*, 1999). The lower part of this canyon constitutes a complex system subdivided into two main branches oriented to the north and to the northwest and another one pointing southeastwards (Bower *et al.*, 2002).

The Portimão canyon has an important effect on the formation of the filaments, eddies and internal waves that transport the Mediterranean waters to long distances into the Atlantic Ocean (Serra & Ambar, 2002; Serra *et al.*, 2005; Garcia-Lafuente *et al.*, 2006; Ambar *et al.*, 2008; Cherubin *et al.*, 2000; Bruno *et al.*, 2006; Garcia *et al.*, 2015).

Faro canyon

The Faro canyon is originated on the southern slope of the Albufeira Drift. The canyon is bordered eastward by the Bartolomeu Dias Drift, and merges sharply with the Portimão Valley (Mulder *et al.*, 2006). The canyon has N–S orientation. It appears at 940 m water depth and spreads over 20 km with a width of 5 km, a minimal depth of 260 m, and is rectilinear in form (Mulder *et al.*, 2006; Marchès *et al.*, 2007; Marchès *et al.*, 2010)

Its location seems to be related to the Albufeira Fault. Erosion is not active in the present-day as evidenced by its relatively smooth flanks, and the canyon seems to be progressively in filled by sediment load (Mulder *et al.*, 2006; Marchès *et al.*, 2007; Garcia *et al.*, 2015).

In general, the canyons have been described as “keystone structures” (Vetter *et al.*, 2010). An increasing amount of data provides evidence of how canyons can act benefiting and supporting fisheries (Yoklavich *et al.*, 2000; Company *et al.*, 2012), and enhance carbon sequestration and storage (Epping *et al.*, 2002; Canals *et al.*, 2006; Masson *et al.*, 2010). Canyon habitats also provide nursery (Sardà & Cartes, 1994; Hoff, 2010; Fernandez-Arcaya *et al.*, 2013) and refuge sites for other marine life (Tyler *et al.*, 2009; De Leo *et al.*, 2010; Vetter *et al.*, 2010; Morris *et al.*, 2013), including vulnerable marine ecosystems and essential fish-habitats such as cold-water corals and sponge fields (Schlacher *et al.*, 2007; Huvenne *et al.*, 2011; Davies *et al.*, 2014). Canyons also provide habitat for spawning females of pelagic and benthic species of commercial interest (Farrugio, 2012). Other faunal components of marine ecosystems, including mammals and marine birds, also use canyons, for example, as feeding grounds (Abelló *et al.*, 2003; Garcia & Thomsen, 2008; Roditi-Elasar *et al.*, 2013; Moors-Murphy, 2014).

In terms of biodiversity, the continental margins are considered major reservoirs of marine biodiversity and productivity (Sanders & Hessler, 1969; Rex, 1983; Snelgrove *et al.*, 1992; Levin *et al.*, 2001; Brandt *et al.*, 2007). The patterns of benthic community structure and productivity have been studied in relatively few submarine canyons (e.g. Vetter 1994; Vetter & Dayton 1999; Hargrave *et al.*, 2004; Schlacher *et al.*, 2007). Habitat diversity and specific abiotic characteristics enhance the occurrence of high levels of biodiversity (Vetter & Dayton, 1998; McClain and Barry, 2010; Company *et al.*, 2012; De Leo *et al.*, 2014). Some findings suggest that increased habitat heterogeneity in canyons is responsible for enhancing benthic biodiversity and creating biomass hotspots (Rowe *et al.*, 1982; Vetter 1994; Vetter *et al.*, 2010). Enhanced local fishery production in canyons, when contrasted to regular slope environments, has also been reported and attributed to the channelling and concentrating of detrital organic matter and pelagic animal populations (Yoklavich *et al.*, 2000; Brodeur, 2001; Company *et al.*, 2008).

The MCA EBSA also encompasses seamounts. Seamounts have a presence of epipelagic fishes with important functions for migratory species such as tuna (*e.g. Thunnus thynnus* and *Thunnus albacares*) and habitats that are associated with the species spawning function and recruitment of fish (belonging to the Serranidae, and Carangidae families), benthopelagic and respective communities (including fish species captured for commercial purposes habitats, such as eye glass orange (*Orange roughy*) (Morato & Clark, 2007; OSPAR, 2010). In this set of habitats some endangered and / or declining species can also be found, such as the whale *Balaenoptera musculus*, turtles *Dermochelys coriacea* and *Caretta caretta* (protected under the European Union Habitats Directive, the Bern Convention, Bonn Convention, CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) and OSPAR Convention), and elasmobranch *Hoplostethus atlanticus*, *Centroscymnus coelolepis*, *Centrophorus granulosus* and *Centrophorus squamosus* (protected under the OSPAR Convention) (Morato *et al.*, 2008; Santos *et al.*, 2012).

Seamounts are also important to birds and Cory's shearwater (*Calonectris diomedea*) breeding in the Azores has been shown to forage over the region of the Mid-Atlantic Ridge (Magalhães *et al.*, 2008).

Both structures, seamounts and canyons, can host high biodiversity. This EBSA structures have a relatively high number of studies (see table 1). A total of 3411 species are listed to the area as a whole, and 776 were specifically recorded for the different EBSA structures (see feature description of the proposed area).

Location

The MCA EBSA is located on Portugal mainland margin (Figure 1) and is compounded by 3 polygons - North MCA (Figure 2), Center MCA (Figure 3), and South MCA (Figure 4), defined by a total of 14 points plus shoreline, see Table 2. This EBSA has a total area of 109933 km^2 divided by 3 sections, North MCA (32786 Km^2), Center MCA (48048 Km^2) and South MCA (29099 Km^2). The datum used is World Geodetic System 1984 (WGS84).

Table 2 – Geographic coordinates in two different formats: Decimal degrees and Degrees, Minutes and Seconds, corresponding to the vertices of the polygon that defines the MCA EBSA.

Vertices	Latitude	Longitude	Latitude	Longitude
North MCA				
1	41,69948°	-12,12692°	41°40'24.57"N	8°49'38.31"W
2	41,67349°	-8,82731°	40°10'51.93"N	8°54'28.96"W
3	40,18109°	-8,90804°	41° 3'30.24"N	11°56'10.82"W
4	41,0584°	-11,93634°	41°41'58.12"N	12° 7'36.92"W
Center MCA				
1	39,884°	-8,97°	39°53'0.82"N	8°58'11.36"W
2	37,941°	-8,889°	37°56'27.02"N	8°53'20.52"W
3	37,935°	-11,176°	37°56'7.12"N	11°10'34.30"W
4	38,789°	-11,864°	38°47'18.68"N	11°51'51.49"W
5	40,043°	-11,437°	40° 2'35.68"N	11°26'12.75"W
South MCA				
1	37,603°	-8,819°	37°36'9.73"N	8°49'7.50"W
2	37,163°	-7,4°	37° 9'47.29"N	7°23'58.80"W
3	36,094°	-7,403°	36° 5'38.70"N	7°24'10.60"W
4	36,091°	-10,102°	36° 5'28.79"N	10° 6'7.72"W
5	37,032°	-10,105°	37° 1'54.88"N	10° 6'18.18"W

The MCA EBSA includes 11 submarine canyons, 4 seamounts structures and a 1 archipelago. The EBSA is totally located under Portuguese national jurisdiction and all structures are on the Portuguese EEZ (seabed and water column).

Feature description of the proposed area

The knowledge of the MCA EBSA is based on the analysis of 350 scientific articles containing relevant information about the proposed area. Several structures are well known with a large number of geological and biological studies (*e.g.* Berlengas). There are 3174 species reported for the whole area and 776 specifically recorded for the structures (see table 1). The knowledge of each structure is not equal, for example the structure Nazaré canyon has 143 bibliographic references, while Sagres canyon has only 4 bibliographic references (table 1). In table 1 it is possible to evaluate how many EBSA scientific criteria each structure meet.

Around 11% of the 3174 species identified in the EBSA are under some type of legal protection or threatened status from CITES, IUCN Red List, European Union Habitats and Birds Directives, FAO VMEs, Bern Convention and OSPAR Convention. In this area OSPAR identified as endangered or declining the deep water sharks *Centrophorus granulosus*, *Centroscymus coeleopsis*, *Centrophorus* *squamosus*, the commercial fish *Hoplostethus atlanticus*, three species of corals *Funiculina quadrangularis*, *Lophelia pertusa, Madrepora oculata,* sea urchin *Centrostephanus longispinus* and the turtles *Caretta caretta* and *Dermochelys coriacea*. Other examples of species with legal protection (CITES Appendix I) are the cetacean *Balaenoptera borealis*, *Balaenoptera musculus*, *Balaenoptera physalus*, *Megaptera novaeangliae*, *Physeter macrocephalus*, *Tursiops truncatus*, the turtles *Caretta caretta*, *Dermochelys coriacea*, *Eretmochelys imbricata* and *Lepidochelys kempii*, saw-fish *Pristis pristis*, (CITES Appendix II) sharks *Lamna nasus*, *Carcharodon carcharias*, *Cetorhinus maximus*, *Sphyrna zygaena*, the ray *Mobula mobular*, 45 corals *e.g. Antipathella subpinnata*, *Aulocyathus atlanticus*, *Caryophyllia ambrosia*, *Desmophyllum dianthus*, *Flabellum alabastrum*, *Flabellum angulare*, *Fungiacyathus fragilis*, *Lophelia pertusa*, *Madrepora oculata*, *Schizopathes affinis*, *Solenosmilia variabilis*, *Stauropathes arctica*, *Stephanocyathus moseleyanus*, fishes, *Hippocampus guttulatus* and *Hippocampus hippocampus*. The whale species *Balaenoptera physalus*, *Balaenoptera musculus*, *Balaenoptera borealis*, *Megaptera novaeangliae*, Sperm whale *Physeter macrocephalus*, the dolphins *Delphinus delphis* and *Tursiops truncatus*¸ turtles *Caretta caretta*, *Dermochelys coriacea*, crustacea *Scyllarides latus* and the sea urchin *Centrostephanus longispinus* are protected under the EU Habitats Directive. The whales *Balaenoptera physalus*, *Balaenoptera musculus*, *Balaenoptera borealis*, *Megaptera novaeangliae* and *Physeter macrocephalus*, turtles *Caretta caretta* and *Dermochelys coriacea*, anthozoa *Astroides calycularis*, crustacean *Homarus gammarus*, *Maja squinado*, *Pagurus bernhardus*, *Palinurus elephas*, *Scyllarides latus* and *Scyllarus arctus*, fish *Epinephelus marginatus*, *Pomatoschistus microps*, *Pomatoschistus minutos*, *Syngnathus abaster* and *Umbrina cirro* are protected by Annex II of the Bern Convention. There is also a presence of 109 species belonging to IUCN Red List as near threatened/ vulnerable/ endangered/ critically endangered e.g. 30 cetaceans (e.g. *Balaenoptera musculus* and *Balaenoptera borealis*), 6 turtles (e.g. *Caretta caretta* and *Dermochelys coriacea*), 1 coral *Eunicella verrucosa*, 1 crustacean *Palinurus elephas*, 37 sharks (e.g *Lamna nasus* and *Carcharhinus brachyurus*), 13 rays (e.g. *Dipturus batis* and *Gymnura altavela*), 15 fishes (e.g. *Epinephelus marginatus* and *Mola mola*), 5 tunas (e.g. *Thunnus alalunga* and *Thunnus thynnus*), 1 bird *Rissa tridactyla*. There are also 12 species of birds (e.g. *Oceanodroma castro* and *Calonectris borealis*) belonging to the Annex I of the European Union Birds Directive.

There are differences on the proportion of protected species, among the different groups of species. 12 % of the total species of cetacean and 30, 15% of Anthozoa are protected by the Annex II of CITES. All the bird species registered for MCA EBSA are protected by the EU Birds Directive and 86,67% belongs to the annex I and II. 23,39% of the Elasmobranchi are classified by the IUCN red list, with 36,17% NT (near threatened), 40,43% VUL (vulnerable), 17,02% EN (endangered), and 6.38% CR (critically endangered); 2,87% of Fish are classified by the IUCN red list, with 26,67% NT (near threatened), 53,33% VUL (vulnerable), 13,3% EN (endangered), and 6,67% CR (critically endangered).

The species in the EBSA that were studied belong to several phylum, subphylum, superclass, class, subclass or family (Figure 6). Of all the species described for the MCA EBSA there is a predominance of species belonging to the phylum Annelida, phylum Mollusca, Superclass Gnathostomata (Fish), class Bryozoa, subphylum Crustacea, class Anthozoa, subclasse Elasmobranchii (Figure 6).

The phylum Annelida is compounded almost totally, 94,8%, by species belonging to the class polychaeta. The second most abundant is the Phylum Mollusca (Figure 6) with species belonging to 5 different classes: Gastropoda (e.g. *Gibbula umbilicalis*), Bivalvia (e.g. *Crassostrea gigas*), Cephalopoda (e.g. *Loligo vulgaris*), Scaphopoda (e.g. *Cadulus subfusiformis*), Polyplacophora (e.g. *Callochiton calcatus*), a suborder Nudibranchia (e.g. *Flabellina affinis*) and order Opisthobranchia (e.g. *Aplysia fasciata*). The Crustacea subphylum (Figure 7) includes many different species from different order: Decapoda (e.g. *Scyllarides latus*), Amphipoda (e.g. *Ericthonius punctatus*), Isopoda (e.g. *Zonophryxus grimaldii*), Cumacea (e.g. *Paralamprops semiornatus*), Tanaidacea (e.g. *Apseudes latreillei*), Stomatopoda (e.g. *Pseudosquillisma oculata*); Subclass: Copepoda (e.g. *Temora longicornis*); Infraclass: Cirripedia (e.g. *Pollicipes pollicipes*); Family: Mysidae (e.g. *Diamysis bahirensis*), Caprellidae (e.g. *Caprella andreae*); Class: Ostracoda (e.g. *Munidopsis curvirostra*), Malacostraca (e.g. *Bathyporeia elkaimi*). The subclasse Elasmobranchii has a dominance of sharks with a percentage of 68,8.

Almost 4% of the total species belong to the Anthozoa class including species of scleractinians (e.g. *Leptopsammia Formosa*) and gorgonians (e.g. *Paramuricea clavata*). In the MCA EBSA (seamounts and canyons) the gorgonian species were reported to form dense gorgonian coral habitat-forming aggregations which may represent important feeding and sheltering grounds for seamount fishes and also potential shark nurseries (WWF, 2001; Etnoyer & Warrenchuk, 2007; OSPAR, 2011). Cold water, deep-sea, habitat forming corals can shelter higher megafauna in association to the corals than other habitats without corals community (Roberts *et al.*, 2006; Mortensen *et al.*, 2008, Rogers *et al.*, 2008). The MCA EBSA type of structures also harbour large aggregations of demersal or benthopelagic fish (Koslow, 1997; Morato & Pauly, 2004; Pitcher *et al.*, 2007; Morato *et al.*, 2009, 2010).

In terms of biodiversity the Berlengas archipelago presents high biodiversity, with 76 fish species currently reported in the reserve area (Rodrigues *et al.* 2008). This, allied with the favorable combination of bathymetric features and ocean and wind circulation (namely the Azorean anti-cyclone and the Portuguese continental shelf upwelling), characterizes the area as rich feeding and breeding grounds for several species, especially seabird species (Paiva *et al.*, 2010; Werner, 2010).

Berlenga features the only breeding populations of pelagic seabirds in mainland Portugal: the Cory’s Shearwater (*Calonectris borealis*), and the Madeira Storm-Petrel (*Oceanodroma castro*), the Cory´s only in Farilhões. Presently, the archipelago hosts approximately 850 breeding pairs of Cory’s Shearwaters, distributed among Farilhões Islets (500-550 pairs) and Berlenga Island (300 pairs) (Lecoq *et al.*, 2011). The European Shag (*Phalacrorax aristotelis*), Lesser Black-backed Gull *Larus fuscus*, and, until recently, the critically endangered Common Murre - *Uria aalge* also bred on the island. The most abundant bird is the Yellow-legged Gull (*Larus michahellis*) which possibly undertakes a negative effect on the other seabird populations as stated by Lecoq *et al.*, (2011) when they registered predation of Cory’s shearwater eggs at Farilhões islets.

Feature condition and future outlook of the proposed area

The deep sea, the largest biome on Earth, is composed of a variety of different habitats with specific biotic and abiotic characteristics (Ramirez-Llodra *et al.*, 2010). Submarine canyons and seamounts are two of these habitats. Recent novel technological developments including underwater acoustic mapping, imaging, and sampling technologies, and long-term/permanent moored or benthic observatories, have greatly contributed to our understanding of the diverse and complex hydrodynamics (Xu, 2011) and geomorphology of canyons over the last two decades (Robert *et al.*, 2014; Quattrini *et al.*, 2015), allowing the spatio-temporal tracking of oceanographic processes and the associated biological responses, with an integration level that grows every day (Aguzzi *et al.*, 2012; Matabos *et al.*, 2014; Fernandez-Arcaya *et al.*, 2017).

Most of the studies in the EBSA structures were focused in Berlengas archipelago and the Nazaré canyon. These both structures also present a high number of registered species. The Sagres canyon, Faro canyon and the Fontanelas seamount have the fewest number of studies, while Vigo seamount presents the lowest number of registered species (see table 1).

One of the reasons for the large number of studies in the Berlengas Islands is that this area became, in 1981, a Natural Reserve of major importance, for being close to the coast and for being a refuge for the marine wildlife (Radhouani *et al.*, 2010; Pereira *et al.*, 2017). The Berlengas MPA is a type VI from IUCN's protected area categories: "Protected area with sustainable use of natural resources: Areas that conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems" (Day *et al.*, 2012). The Berlengas MPA is not established strictly for conservation of species and habitats goals. It also allows for economic activities such as fishing and diving under specific regulations with concern to biodiversity conservation (Law Decree 30/98). It includes two Partially Protected Areas as well as a Complementary Protected Area. Partially Protected Areas are buffer zones where recreational and commercial fishing as well as tourism activities are allowed under specific regulation. This regulation establishes a limited number of visitors by site and allows a limited number of fishing boats. The Complementary Protected Area is open to fishing but not necessarily as an open-access fishery, as legislation does not allow for commercial fishing by vessels not registered in Peniche Port Authority, trawl fishing, gill nets, trap fishing and shellfish collecting (Queiroga *et al.*, 2009; Thurber *et al.*, 2014; Boavida *et al.*, 2016).

The other structure with a large number of studies is the Nazaré canyon. Over the centuries, several fishing communities established along this coast, profiting of the richness of the shelf waters surrounding the Nazaré canyon and creating important fishery harbors such as Peniche. Over the last few decades tourism became one of the key development factors for these communities, involving a large portion of the population and creating new activity areas based on the sea. More recently, the Nazaré area also emerged as a key region for activity areas such as oil prospection, wave energy extraction or the implementation of new strategies for fish growth such as the use of artificial reefs. All the above mentioned activities and human pressure that are presently focused in the Nazaré area require a good understanding of the oceanographic processes taking place in this area and the monitoring of these processes (Martins *et al.*, 2010).

Numerous projects have focused on the MCA EBSA:

MarinEye system (2016-ongoing)

Autonomous system for marine integrated physical-chemical and biological monitoring. It comprises a set of sensors providing diverse and relevant information for oceanic environment characterization and marine biology studies. It is constituted by a physical-chemical water properties sensor suite, a water filtration and sampling system for DNA collection, a plankton imaging system and biomass assessment acoustic system. The MarinEye system has onboard computational and logging capabilities allowing it either for autonomous operation or for integration in other marine observing systems (such as Observatories or robotic vehicles. It was designed in order to collect integrated multi-trophic monitoring data. The validation in operational environment is done on 3 marine observatories: RAIA, BerlengasWatch and Cascais.

http://marineye.ciimar.up.pt/

CANYONS project (2009-2011)

CANYONS project (Sediment transport in the Setúbal and Lisboa submarine canyons), and aims to evaluate the role of the Cascais canyon in the transport of sediments from the shelf and slope to the abyssal plains through the comparison with multi-cores recovered from adjacent slopes.

https://www.fct.pt/apoios/projectos/consulta/vglobal_projecto.phtml.en?idProjecto=114674&idElemConcurso=3549

M@rBis (2007-ongoing)

The Project M@rBis – Marine Biodiversity Information System is an outcome of the Resolution of the Portuguese Council of Ministers (RCM) No. 128/2005, in which the need for a national ocean strategy was identified. In November 2007, the Interministerial Committee for Maritime Affairs, created under the framework of the Portuguese National Ocean Strategy, approved the action-plan M@rBis-Natura 2000. M@rBis is a marine biodiversity georeferenced information system, whose main goal is to provide the necessary information in order to fulfill the Portuguese commitments under the EU process of extending the Natura 2000 network to the marine environment.

https://www.emepc.pt/en/the-m-rbis-project

LIFE Berlengas (2014-2018)

LIFE Berlengas (LIFE13/NAT/PT/000458) - Conserving threatened habitats and species in Berlengas SPA through sustainable management. The project established a legally binding management plan with

clear and measurable actions and targets for defined sites in the Atlantic coastal archipelago. Three key project phases were implemented: first, understanding the main threats affecting seabird populations and endemic plant species on land and at sea (for seabirds) and defining actions to minimize/eradicate them, including a long-term monitoring scheme; second, promoting sustainable use of the recently enlarged Berlengas Natura 2000 Special Protection Area, focusing on its three main economic activities (fisheries, recreational activities and tourism); and third, confirming the monitoring framework needed for the completion and approval of the management plan.
http://www.berlengas.eu/

LIFE+ MarPro Project (2011-2015)

LIFE+ MarPro Project - Conservation of marine protected species in Mainland Portugal (LIFE09 NAT/PT/00038). The aims of the project were to reduce the conflicts between fisheries and cetacean and seabird species by implementing solutions, concerning the by-catch and fish depredation; understanding the complex relations between the exploitation of pelagic fishes and the conservation of protected species; ensure the long-term socio-economic viability of the management, surveillance and monitoring activities of the target species and their habitats, together with the promotion of a sustainable exploitation of marine fishery resources of Mainland Portugal. A new Natura 2000 Site of Community Importance was established and another Site of Community Importance was enlarged. Both focus mainly on cetacean conservation.
http://www.marprolife.org/

RAIA.CO (2011-2015)

RAIA.CO: Marine and coastal observatory of Iberian Margin. This project offered services and products of operational oceanography, available to the coastal communities and economic agents of the region. Specifically, the maintenance and improvement of the network in the framework of the Ocean Observatory RAIA; to strengthten the productivity and competitivity of sustainable coastal activities, linked to strategic sectors, through product development and services in oceanography and meteorology; establishment and consolidation of a competitive business sector in the development of marine technologies, in Galicia and North of Portugal and development of a communication strategy with end users, through a consultive and interactive process.
http://www.marnaraia.org/

MESH ATLANTIC (2010-2013)

The MESH (Mapping European Seabed Habitats) Atlantic project aimed to promote harmonized production and use of marine habitat maps covering the Atlantic Area by adapting and enhancing previous achievements in this area. The project undertook four main activities: Collation of existing maps and seabed habitat data and ensuring this data is harmonized in accordance with EU requirements (EUNIS classification) and across countries; New surveys, to test collaborative approaches to seabed

mapping and improving existing knowledge on southern Atlantic sea bed habitats. This included mapping of some MPAs as pilot sites; Making new maps of local level MPA sites and for local/regional management, and a broad scale seabed map for EU policy making; Communication and dissemination of results – dialogue with scientists, policy makers, fishing communities, NGOs and other stakeholders that use seabed maps has been an important part of the project. External communication with the public has also helped to raise awareness of the work being undertaken. The final outputs of MESH Atlantic include a web-based GIS portal for seabed mapping. This data has now been incorporated into EMODnet's Seabed Habitats portal.
http://atlanticprojects.ccdr-n.pt/project-area/meshatlantic

HERMIONE (2009-2012)

Hotspot Ecosystem Research and Man's Impact on European Seas (HERMIONE) was an international multidisciplinary project, started in April 2009, that studied deep-sea ecosystems. HERMIONE scientists studied the distribution of hotspot ecosystems, how they function and how they interconnect, partially in the context of how these ecosystems are being affected by climate change and impacted by humans through overfishing, resource extraction, seabed installations and pollution. Major aims of the project were to understand how humans are affecting the deep-sea environment and to provide policy makers with accurate scientific information, enabling effective management strategies to protect deep sea ecosystems. The HERMIONE project was funded by the European Commission's Seventh Framework Programme, and was the successor to the HERMES project, which was concluded in March 2009.
http://www.eu-hermione.net/

MONICAN (2008-2011)

The Nazare Canyon Observatory (MONICAN) was implemented from 2008 to 2011 with the support of the EEA Grants 2004-2009 Financial Mechanism (project MONICAN). Presently this observatory is integrated in the network of European coastal observatories gathered under the European project JERICO-NEXT (H2020-INFRAIA 2014-2015). The MONICAN real-time monitoring network, presently installed, includes: Two multi-parametric buoys with real-time data transmission, deployed in waters of 2000m depth (deep buoy, MONICAN1) and 90m depth (coastal buoy, MONICAN2); two tide gauges, one installed at the port of Peniche and another in the port of Nazaré and one coastal meteorological stations installed in Ferrel.
http://monican.hidrografico.pt/en

Berlenga – Laboratory of Sustainability (2007-2008)

This project was formally assumed with the signing of a Letter of Commitment on the 5th of July, 2007 between the various entities that are the partners on its development. The constitution of a non profitable Association in April, 2008, made possible the implementation of this Project, which had the purpose to

endow generation capacities and storage of energy from renewable sources, as well as production of potable water, residual water and residual solid treatment, in order to guarantee long-term sustainability and biodiversity on the Island of Berlenga.
https://www.inesctec.pt/en/news/inesc-porto-develops-and-8220-berlenga-and-8211-laboratory-of-sustainability-and-8221-project-19641#about

HERMES (2005-2009)

HERMES has examined canyons several geographic regions, including along the western Portuguese margin in the Eastern Atlantic. It has been attempted to determine the detailed morphology of the canyon systems, their tectonic history, the physical oceanography, particularly in relation to atmospheric forcing, and the sedimentary regime within the canyon. This physical background was used as a template for understanding the distribution of different-sized organisms within the canyon. Lastly, it was examined what are the actual and potential anthropogenic impacts on selected canyons.
www.eu-hermes.net, http://www.eu-hermes.net/canyons.html

DEEPCO (2007-2008)

Deep sedimentary conduits of the west-Iberian margin (DEEPCO) was a scientific project with the aim to study the geomorphological, geophysical, sedimentological and micropalaeontological characteristics of the Oporto, Aveiro and Nazaré Submarine Canyons.
https://www.fct.pt/apoios/projectos/consulta/vglobal_projecto.phtml.en?idProjecto=46367&sapiens=2002

SIMCLAVE (2006-2009)

SIMCLAVE - Studying the impact of the climate change in the Portuguese coastal waters - the Aveiro costal ecosystem. This project contributed to a better understanding of the relationship between climate change and the variability of the phytoplankton structure and productivity on the nearshore Aveiro upwelling system. It also promoted an interdisciplinary approach (bringing together meteorology, climatology, physical oceanography and biological oceanography) and an interinstitutional approach (Universidade de Aveiro, IPIMAR). It made available atmospheric, hydrologycal and biological data, both past and present data, concerning the Aveiro coastal ecosystem.

A data set containing available past data concerning nutrients, phytoplankton biomass and composition and atmospheric data, was setup. To include present day data, weekly sampling surveys, supported by this project, were carried out on the nearshore waters of Aveiro (on the river mouth).
http://www.cesam.ua.pt/index.php?menu=88&tabela=projectosdetail&projectid=114&language=pt

IBAS MARINHAS (2004-2009)

LIFE IBAs Marinhas (LIFE04NAT/PT/000213). The main objective of this project was to identify the most important areas at sea for seabirds occurring within the Portuguese EEZ, which will later be classified as Marine Important Areas for Seabirds in the Sea (IBAs) according to BirdLife International IBA criteria. Outputs: Better knowledge on the distribution and abundance of seabirds included on the Annex I of EU Birds Directive and on the main variables influencing their distribution at sea, in the Portuguese mainland and Azores and Madeira archipelagos; Marine IBAs in Portugal identified; General methodology to identify IBAs at sea defined; Database of seabird distribution available; Leaflets and CD-om about seabird conservation and marine IBAs available.

http://lifeibasmarinhas.spea.pt/pt/

EUROSTRATAFORM (2002-2005)

European margin strata formation (EUROSTRATAFORM) study marine sediment dispersal from source to sink (river output to deposit in on the shelf, slope or basin floor) on contrasted European margins, with the aim of understanding how geological strata are generated. Experimental work and data analysis will examine the water column and sedimentary processes involved in moving sediment through the system. Physical, biological and geochemical processes, which transform that sediment once deposited, will be equally investigated. To bridge the gap in knowledge from these active processes to the stratal record we will work on a variety of timescales from individual flood events to the geological record of the last 500,000 years. This will greatly improve our ability to forecast and hind cast the response of the marine system to natural and anthropogenic perturbation. This research is fundamental to understand matter and energy cycling, and to ensure the safe management of marine resources.

http://www.maretec.org/pt/projects/current/Eurostrataform

SEPLAT (1974-1991)

First cartography of sedimentary deposits of mainland Portugal (between the coastline and the upper continental slope). Products: 8 sedimentological charts to scale 1: 150 000 (1st edition in analogue format, following editions, revised and updated, also produced in digital format).

http://www.hidrografico.pt/op/40

DSDP (1968–1983)

The Deep Sea Drilling Project (DSDP) was the first of three international scientific ocean drilling programs that together lasted for more than 40 years. This project conducted basic research into Earth processes by recovering sediment and rock samples from below the ocean floor and using the resulting holes to perform downhole measurements and experiments.

http://deepseadrilling.org/index.html

The deep sea ecosystems (seamounts and canyons) are highly vulnerable and sensitive to external actions, especially the seamount areas. Most of the fauna found on seamounts are long-lived and slow-growing organisms with low fecundity and natural mortality, so called K-selected species (Brewin *et* *al.,* 2007). Recruitment events of long-lived seamount fauna seem to be episodic and rare (Brewin *et al.*, 2007). The type of gear (usually rock-hopper trawls) used to fish over the rough and rocky substrata that can be found on seamounts is particularly destructive of benthic habitat, destroying the very long lived and slow-growing sessile suspension feeding organisms that dominate these habitats (Brewin *et al.*, 2007). Benthic seamount communities are highly vulnerable to the impacts of fishing because of their limited habitat, the extreme longevity of many species, apparently limited recruitment between seamounts and the highly localized distribution of many species (de Forges *et al.*, 2000; Samadi *et al.*, 2006, 2007).

In terms of fishery production, there is a high production in canyons, when compared to regular slope environments, what has also been reported and attributed to a ‘canyon effect’; simply, the channeling and concentrating of detrital organic matter and pelagic animal populations in canyons (Vetter & Dayton, 1999; Yoklavich *et al.*, 2000; Ramirez-Llodra *et al.*, 2008). Many other unusual ecological characteristics have been attributed to canyons such as concentrating dial vertical migrators (Greene *et al.*, 1988; Mackas *et al.*, 1997), displacing deepwater species to coastal zones (King *et al.*, 1987), promoting topographically induced upwelling (Sobarzo et al, 2001; Ryan *et al.*, 2005) and enhancing diapycnal mixing via internal wave generation (Thurnherr, 2006; Kunze *et al.*, 2012).

The MCA area registers the presence of various species with interest and utility for human usages. Various subphylum, phylum, super class and class have valuable species in commercial terms. The subphylum crustacean has 12% of the total species with commercial interest, for example: Toothed rock crab (*Cancer bellianus*), Mediterranean slipper lobster (*Scyllarides latus*), European lobster (*Homarus gammarus*), soldier striped shrimp (*Plesionika edwardsii*) and others. The phylum Mollusca 4% with the black Limpet (*Patella candei*), knobbed triton (*Charonia lampas*), European squid (*Loligo vulgaris*) and common Octopus (*Octopus vulgaris*) and echinodermata with 16% of species with commercial interest, e.g. black sea-cucumber (*Holothuria forskali*), stony sea-urchin (*Paracentrotus lividus*) and common sea-star (*Asterias rubens*). The Fish superclass has a representation of 27 %, e.g. Angler (*Lophius piscatorius*), European plaice (*Pleuronectes platessa*) and Atlantic bonito (*Sarda sarda*) and 81% of the class Elasmobranchii, e.g. Thornback ray (*Raja clavata*) and Smooth-hound (*Mustelus mustelus*). The superclass fish and the class elasmobranchii have other antropogenic uses, for example as aquarium specimens: 8% of elasmobranchii species, e.g. Tope shark (*Galeorhinus galeus*) and marbled electric ray (*Torpedo marmorata*) and 10% of others fish, e.g. Rock goby (*Gobius paganellus*), seahorse (*Hippocampus hippocampus*), moray eel (*Muraena helena*). There are species of superclass fish with use for aquaculture, e.g. Common dentex (*Dentex dentex*), white seabream (*Diplodus sargus*) and European plaice (*Pleuronectes platessa*). Some species are also gamefishing targets, including 36% of elasmobranchii species, e.g. Blue Skate (*Dipturus batis*), tiger shark (*Galeocerdo cuvier*) and mako (*Isurus oxyrinchus*) and 18% of other fish, e.g. Blue Marlin (*Makaira nigricans*), Ballan Wrasse (*Labrus bergylta*) and white trevally (*Pseudocaranx dentex*).

The anthropogenic activities along canyon flanks and seamounts, such as bottom trawling, can alter seafloor community structure and biodiversity through physical habitat disturbance and the resuspension of sediments, which ultimately accumulate at greater depths inside the canyon axis (Palanques *et al.*, 2006; Martín *et al.*, 2008, 2014; Puig *et al.*, 2012, 2015a, 2015b; Pusceddu *et al.*, 2014; Wilson *et al.*, 2015).

Assessment of the area against CBD EBSA Criteria

(Discuss the area in relation to each of the CBD criteria and relate the best available science. Note that a proposed area for EBSA description may qualify on the basis of one or more of the criteria, and that the polygons of the EBSA need not be defined with exact precision. And modeling may be used to estimate the presence of EBSA attributes. Please note where there are significant information gaps)

CBD EBSA Criteria (Annex I to decision IX/20)	**Description** (Annex I to decision IX/20)	**Ranking of criterion relevance** (please mark one column with an X)			
		No information	**Low**	**Medium**	**High**
Uniqueness or rarity	Area contains either (i) unique ("the only one of its kind"), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				X

Submarine canyons are remarkable and unique, topographic complex and variable geomorphic features, they connect the shallow coastal ocean to the deep continental margin and contribute as preferential pathways to the channeling (efficient drainage) of water masses, sediments and organic matter from the shore to deep basins (Nittrouer *et al.*, 1994; Xu *et al.*, 2002; Canals *et al.*, 2006; Shepard, 1981; Wynn *et al.*, 2002; Normark & Carlson, 2003; Weaver *et al.*, 2004; Canals *et al.*, 2006). Much of the organic carbon input to the benthos in habiting canyons is transported by bottom currents (Vetter & Dayton, 1998). Some canyons experience episodic events involving the cascading of dense waters from the shelves (Canals *et al.*, 2006) or are characterized by sedimentary instability, which can influence benthic biomass and biodiversity (Garcia *et al.*, 2007; Company *et al.*, 2008).

These structures are categorized as a high biodiversity hotspots (Stow and Mayall, 2000; De Leo *et al.*, 2010). The higher faunal biomass reported from some deep-sea canyons apparently reflects the large amounts of organic matter available to benthic consumers in these systems (Vetter & Dayton, 1998).

There are specific examples for the MCA area that meet the uniqueness or rarity EBSA criteria:

- The Nazaré canyon is one of the largest and deepest submarine valleys of the world (Duarte *et al.*, 2000; Duarte, 2002; Duarte & Taborda, 2003; de Stigter *et al.*, 2007).
- The Setúbal and São Vicente submarine canyons are the two most prominent geomorphological features in the southwest Iberian margin (Coppier & Mougenot, 1982; Lebreiro *et al.*, 1997). Particulary the Setúbal canyon cross the western Iberian margin, extending seaward from the continental shelf near Lisbon to the Tagus Abyssal Plain at 4840 m water depth (Lastras *et al.*, 2009).
- The Berlenga archipelago fauna and flora present unique characteristics even though located near to the mainland. The first colonizers arrived, about 15000 years ago, when the valleys (nowadays submarine valleys) were solid ground. They evolved very differently to its "continental siblings" due to other types of pressures, giving rise to different life forms. The Berlengas host the only populations of Madeiran Storm-Petrel (*Oceanodroma castro*) and Cory's Shearwater (*Calonectris diomedea*) of continental Europe, the residual population of Common Guillemot *(Uria aalge*), the largest national population of Shags (*Phalacrocorax*

aristotelis), the only couples of Lesser Black-backed Gulls (*Larus fuscus*) which reproduce in Portugal, and the largest colony in the country of Yellow-legged gull (*Larus michahellis*) with more than 25000 birds (Azevedo & Nunes, 2010).

The seamounts present in the EBSA are defined as isolated topographic features of the seabed. The seamounts are singular and rare hotspots in the middle of the ocean. The seamounts are considered to support a relative higher biomass and a higher biodiversity than surrounding open ocean ecosystems and are recognized as “hotspots” of marine life (see introduction). The seamounts have an important role in the colonization and dissemination of species. They have been considered as stepping stones, vicariant pathways, and points of endemic isolation (Leal & Bouchet, 1991; Keppel *et al.*, 2009).

Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.			x	

Submarine canyons are known for playing an important role in regional ecosystems, creating regions of enhanced species diversity and biological diversity. This is in part explained by the upwelling-enhancement near the canyons. The western coast is affected by the existence of seasonal upwelling, particularly up to the north of Nazaré canyon. Fine resolution models have demonstrate that canyons affect the spatial patterns of regional upwelling, particularly in what concerns the preferential enhancing of upwelling on the canyon's head and over the canyon's downstream side (e.g. Peffley & O'Brien, 1976; Hickey, 1995).

Submarine canyons act as major conduits for transport of particles, providing a nutrient source that increases phytoplankton and zooplankton density (Hickey, 1995, Heussner *et al.*, 1996; Puig *et al.*, 2003; Canals *et al.*, 2006) and macrophytes detritus (Vetter & Dayton, 1999; Sanchez-Vidal *et al.*, 2008) to bathyal and abyssal depths affecting the populations of deep-sea species. These structures are also important as conduits of larvae to the deep sea and potential barriers to long-slope transport (Berner, 1982; Canals *et al.*, 2006) and have been identified as hotspots of faunal abundance and biomass (Curdia *et al.*, 2004; Tyler *et al.*, 2009).

In the pelagic realm, the diversity, and complexity of food webs increase in response to canyon-induced upwelling of nutrients. The high level of primary production attracts pelagic-associated secondary and tertiary consumers. Abundances of megafaunal species, including a variety of demersal fishes, large pelagic predators such as tuna, swordfish, and sharks, as well as cetaceans and birds, are enhanced. All these predators are likely to be present in canyon areas for feeding and breeding, albeit intermittently in some cases (Rennie *et al.*, 2009).

In particular, hydrological conditions are a determinant factor in the distribution and abundance of small pelagics such as sardine (*Sardina pilchardus*), mackerel (*Scomber spp.*) and horse mackerel (*Trachurus trachurus*). Moreover, the bathymetry, as well as bottom geological nature, strongly influences the distribution and abundance of pelagic and demersal species.

Other type of structure present in the MCA EBSA is the Berlengas archipelago. This archipelago is the most important breeding area for seabird species in Portugal mainland, supporting the only known colonies of Procellariiformes, and the largest colony of Yellow-legged Gull Larus michahellis in the country. Berlenga features also the only breeding populations of pelagic seabirds in continental Portugal: the Cory's Shearwater (*Calonectris borealis*), the Madeira Storm-Petrel (*Oceanodroma castro*), the European Shag (*Phalacrorax aristotelis*), Lesser Black-backed Gull *Larus fuscus*, and until recently, the critically endangered Common Murre - *Uria aalge*. The most abundant bird is the Yellow-legged Gull (Larus michahellis) which possibly undertakes a negative effect on the other seabird populations as stated by Lecoq *et al.*, (2011) when they registered predation of Cory's shearwater eggs at Farilhões islets.

In the underwater environment, the Berlengas is where in the mainland Portugal, more skate species were found, including coastal and offshore species, such as the IUCN near treated (NT) species long nosed skate *Dipturus oxyrinchus*. A study made by Serra-Pereira *et al.*, (2014) in synergy with fishermen's knowledge enhanced the understanding about the archipelago. The high variety of habitats, make these islands a favorable place for reproduction of skates, a fact confirmed by the fishermen's who mentioned that juveniles of undulate ray (*Raja undulata*) and egg capsules of smalleyed ray (*Raja microocellata*) could be found in that area. Being already partially enclosed by the Berlengas Natural Reserve, it is believed that this area could be one of the main contributors to the known biodiversity and abundance of skates in the surroundings of Peniche (Serra-Pereira *et al.*, 2014).

Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.			x	

The submarine canyons and seamounts are hotspots of benthic production (Vetter, 1994) and key habitats of exploited and non-exploited species (Ferrier-Pages *et al.*, 2007). They host cold-water coral and sponge reef habitats that also qualify as Vulnerable Marine Ecosystems in relation to high seas fisheries according to criteria developed by FAO (FAO, 2007; Rogers *et al.*, 2008).

Overall around 11% of the species identified in MCA EBSA are under some type of legal protection or threatened status from different sources: OSPAR (e.g. *Hoplostethus atlanticus* and *Madrepora oculata*), CITES Appendix I (e.g. *Balaenoptera borealis* and *Dermochelys coriacea*), CITES Appendix II (e.g. *Antipathella subpinnata* and *Lophelia pertusa*), EU Habitats Directive (e.g. *Megaptera novaeangliae* and *Physeter macrocephalus*), Annex II of the Bern Convention (e.g. *Balaenoptera physalus* and *Caretta caretta*), IUCN Red List (e.g. *Hippoglossus hippoglossus*, and *Thunnus albacares*), EU Birds Directive Annex I (e.g. *Oceanodroma castro* and *Sterna dougallii*) (see Feature description of the proposed area).

Another important area enclosed in the MCA EBSA is the Berlengas archipelago. As a marine area (see feature condition and future outlook of the proposed area), the archipelago area has a number of species and some habitats of high conservation value in a national and European context, namely the reefs and submerged or semi-submerged marine caves classified by the Habitats Directive (Queiroga *et al.*, 2008). It includes the habitat “Reefs (1170)” of the Habitats Directive, consisting of rocky substrates and /or other substrates of biological origin (e.g. Sabelaria reefs). The islands support benthic flora and fauna communities as well as associated non-benthic communities, and the habitats are characterized by a very high biological diversity. It presents seasonally a very strong growth of algae stands, which during spring and summer dominate the whole underwater landscape to depths where light is sufficient (ca. 30 m). Another feature in the Berlengas with a significant conservation value is the habitat 'Submerged or semi-submerged sea caves' “(8330)”, protected under the EU Habitats Directive.

Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.				x

Deep-sea and open ocean waters are the largest and yet least understood environments on Earth (Ramirez-Llodra *et al.,* 2010; Webb *et al.,* 2010). They are characterized by distinctive habitats and organisms and support an important part of the world’s biodiversity (Ramirez-Llodra *et al.,* 2010; Robison, 2009). This EBSA encompasses different types of habitats classified by the OSPAR Convention as threatened and/or declining, and a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) and with slow recovery. Moreover, these habitats provide valuable direct and indirect goods and services, such as food provision and climate regulation (Van den Hove & Moreau, 2007).

The seamounts and the canyons are described as unique marine ecosystems, which often support fragile habitats and vulnerable species of flora and fauna (de Forges *et al.,* 2000, Alder & Wood, 2004). In general, our knowledge of canyons and seamounts is less comprehensive than other coastal habitats , the importance and need to protect these ecosystems, specially the canyons, is just being recognized. However, the fragility of canyon and seamounts ecosystems, and the magnitude of threats posed to them (Koslow, 1997; Morato *et al.,* 2010), renders an assessment of their management needs an urgent task.

Benthic biological communities on canyons and seamounts are highly vulnerable to human activities. Many benthic species are long-lived and slow-growing, and not resilient to human impacts. Concerns have developed about the vulnerability of the EBSA canyon and seamount communities to human impacts, especially with the development of large-scale bottom trawl fisheries in the deep sea in recent decades.

The archipelago of Berlengas located off the western Portuguese coast is also an area with biological and ecological significance. The archipelago is compounded by a small island and some islets, constituting a Protected Area with controlled access, intended to minimize the signs of the anthropogenic influences. The archipelago is part of the Nature Reserve of Berlenga, protected by Portuguese law since 1981. In 1999, under the EU Birds Diretive, the Berlengas Islands were designated as a Special Protection Area (SPA), which was directly integrated in the Natura 2000 network. This SPA was then enlargedin 2012. A wider area was identified as an Important Bird Area (IBA) for seabirds (Ramirez *et al.*, 2008). The archipelago was also declared a Biosphere Reserve by UNESCO (unesco.org, 2011) and a Site of Communitary Importance (under the EU Habitats Directive).

The EBSA MCA polygon contains 136 species of cold-water corals, with 41 belonging to CITES annex I and II (e.g. *Antipathella subpinnata*, *Flabellum alabastrum* and *Stichopathes gracilis*) and 25 belonging to a VME (Vulnerable Marine Ecosystems) (*e.g. Caryophyllia ambrosia*, *Lophelia pertusa* and *Madrepora oculata*). These corals are particularly fragile and their recovery is quite slow (Rogers *et al.,* 2007).

There are 47 species (from a total of 77) of Elasmobranchii belonging to the IUCN Red List of Threatened Species (e.g. *Chimaera monstrosa* (chimera), *Dipturus batis* (shark) and *Raja undulate* (ray)). All the cetacean species in the MCA areas belong to CITES annex I and II (e.g. *Balaenoptera musculus*, *Physeter macrocephalus* and *Tursiops truncatus*). The same happens with the 5 turtles species registered in the MCA areas, which are all protected by the CITES (e.g. *Caretta caretta*, *Chelonia mydas* and *Eretmochelys imbricate*).

Prominent megafaunal taxa including sponges (e.g. *Geodia cydonium*), deep-sea bamboo coral (e.g. *Acanella arbuscula*), sea pen (e.g. *Anthoptilum grandiflorum*), solitary corals (e.g. *Caryophyllia ambrosia*), gorgonian species (e.g. *Eunicella verrucosa*), cockscomb Cup Coral (e.g. *Desmophyllum dianthus*), soft corals (e.g. *Heteropolypus insolitus*), sea fan (e.g. *Paragorgia arborea*), antipatharian and madreporarian corals (e.g. *Antipathes glabberima* and *Madrepora oculata*), sea cucumber (e.g. *Abyssocucumis abyssorum*), dwarf brittle star (e.g. *Amphipholis squamata*), sand sea star (e.g. *Astropecten irregularis*), sea urchins (*Centrostephanus longispinus*), pea urchin (e.g. *Echinocyamus macrostomus*), sea star (e.g. *Hymenaster anomalus*), seven-armed sea star (e.g. *Luidia ciliaris*), ophiuroidea brittle stars (e.g. *Ophiura ljungmani*) would be vulnerable to bottom-contact fishing gear. Other species under some legal protection have characteristic features particularly attending to biological factors such as longevity, low fecundity, and slow growth rates (*e.g.* sharks and rays) (*e.g.*, Clark, 2001; Morato *et al.*, 2008).

The recovery of vulnerable species, and the assemblages which they form, from human impacts is predicted to be very slow in the deep sea (*e.g.* Roark, *et al.*, 2006; Probert *et al.*, 2007), and the recruitment can be intermittent as a consequence of the also intermittent dispersal between seamount populations (Rogers *et al.*, 2007; Shank, 2010). In the area a big number of commercial species is recognized, particularly fishes: *Anarhichas lupus* - Atlantic wolfish, *Anthias anthias* - swallowtail seaperch, *Antigonia capros* - deepbody boarfish, *Arnoglossus imperialis* - imperial scaldfish, *Aphanopus carbo* - black scabbardfish, *Atherina spp.* - sand smelt, *Aulopus filamentosus* - royal flagfin, *Balistes capriscus* - grey triggerfish, *Bathysolea profundicola* - deepwater sole, *Belone belone* - Garfish, *Beryx decadactylus* - alfonsino, *Beryx splendens* - splendid alfonsino, *Boops boops* - bogue, *Bothus podas* - wide-eyed flounder, *Brama brama* - Atlantic pomfret, *Callanthias ruber* - parrot seaperch, *Caranx hippos* - crevalle jack, *Caranx rhonchus* - false scad, *Chelidonichthys lastoviza* -

streaked gurnard, *Chelidonichthys lucerna* - tub gurnard, *Chelidonichthys obscurus* - longfin gurnard, *Chelon auratus* - golden grey mullet, *Chelon labrosus* - thicklip grey mullet, *Chelon ramada* - thinlip grey mullet, *Ciliata mustela* - fivebeard rockling, *Conger conger* - European conger, *Coris julis* - Mediterranean rainbow wrasse, *Coryphaena hippurus* - common dolphinfish, *Coryphaenoides rupestris* - roundnose grenadier, *Ctenolabrus rupestris* - goldsinny wrasse, *Cyclopterus lumpus* - lumpfish, *Cyttopsis rosea* - rosy dory, *Dentex spp.* - dentex, *Dicentrarchus labrax* - European seabass, *Dicologlossa cuneata* - wedge sole, *Dicologlossa hexophthalma* - ocellated wedge sole, *Diplodus spp.* - seabream, *Elagatis bipinnulata* - rainbow runner, *Epinephelus spp.* - grouper, *Epigonus telescopus* - black cardinal fish, *Euthynnus alletteratus* - little tunny, *Eutrigla gurnardus* - grey gurnard, *Exocoetus volitans* - tropical two-wing flyingfish, *Gymnammodytes spp.* - sandeel, *Helicolenus dactylopterus* - blackbelly rosefish, *Hippoglossus hippoglossus* - Atlantic halibut, *Hirundichthys rondeletii* - black wing flyingfish, *Hoplostethus atlanticus* - orange roughy, *Istiophorus albicans* - Atlantic sailfish, *Katsuwonus pelamis* - skipjack tuna, *Kyphosus incisor* - yellow sea chub, *Lepidopus caudatus* - silver scabbardfish, *Lepidorhombus whiffiagonis* - megrim, *Lophius piscatorius* - angler, *Lepidotrigla dieuzeidei* - spiny gurnard, *Lichia amia* - leerfish, *Limanda limanda* - common dab, *Macroramphosus scolopax* - Longspine snipefish, *Makaira nigricans* - blue marlin, *Merluccius merluccius* - European hake, *Microchirus spp.* - sole, *Micromesistius poutassou* - blue whiting, *Microstomus kitt* - lemon sole, *Molva dypterygia* - blue ling, *Molva molva* – Ling, *Monochirus hispidus* - whiskered sole, *Mora moro* - Common mora, *Mullus barbatus barbatus* - red mullet, *Mullus surmuletus* - surmullet, *Pagellus spp.* - seabream, *Pagrus spp.* - seabream, *Parapristipoma spp.* - grunt, *Pegusa impar* - Adriatic sole, *Phycis spp.* - forkbeard, *Platichthys flesus* - European flounder, *Plectorhinchus mediterraneus* - rubberlip grunt, *Pleuronectes platessa* - European plaice, *Pollachius pollachius* - pollack, *Pollachius virens* - saithe, *Polyprion americanus* - Wreckfish, *Pontinus kuhlii* - offshore rockfish, *Sarda sarda* - Atlantic bonito, *Sardina pilchardus* - European pilchard, *Sardinella aurita* - round sardinella, *Sarpa salpa* - salema, *Schedophilus ovalis* - imperial blackfish, *Scomber japonicas* - chub mackerel, *Scomber scombrus* - Atlantic mackerel, *Scophthalmus maximus* - turbot, *Scophthalmus rhombus* - brill, *Scorpaena spp.* - scorpionfish, *Seriola dumerili* - greater amberjack, *Seriola rivoliana* - longfin yellowtail, *Serranus spp.* – comber, *Solea spp.* – sole, *Sparisoma cretense* - parrotfish, *Sparus aurata* - gilthead seabream, *Spondyliosoma cantharus* - black seabream, *Sprattus sprattus* - European sprat, *Symphurus nigrescens* - tonguesole, *Synapturichthys kleinii* - Klein's sole, *Taractes rubescens* - pomfret, *Thunnus spp.* - tuna, *Trachinus radiates* - starry weever, *Trachyscorpia cristulata echinata* - Spiny scorpionfish, *Trachurus spp.* - mackerel, *Umbrina spp.*- drum, *Xiphias gladius* — swordfish, *Zenopsis conchifer* - silvery John dory, *Zeus faber* - John dory; Elasmobranchii: *Aetomylaeus bovinus* - bull ray, *Carcharhinus brevipinna* - spinner shark, *Carcharhinus limbatus* - blacktip shark, *Carcharhinus longimanus* - oceanic whitetip shark, *Carcharhinus obscurus* - dusky shark, *Carcharhinus plumbeus* - sandbar shark, *Carcharodon carcharias* - great white shark, *Cetorhinus maximus* - basking shark, *Dasyatis pastinaca* - common stingray, *Dipturus batis* - blue skate, *Galeocerdo cuvier* - tiger shark, *Galeorhinus galeus* - tope shark, *Hexanchus griseus* - bluntnose sixgill shark, *Lamna nasus* - porbeagle, *Leucoraja naevus* - cuckoo ray, *Mustelus spp*. - smooth-hound, *Odontaspis ferox* - smalltooth sand tiger, *Raja spp*. - ray, *Sphyrna spp*. - hammerhead, *Squalus acanthias* - picked dogfish, *Squalus blainville* - longnose spurdog. The fishing impacts in this area, attending to the biology characteristics can have a slow recovery (*e.g.*, Clark, 2001, Morato *et al.,* 2008) with unknown possibility to total ecosystem recovery. (see Feature condition and future outlook of the proposed area).

Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.				x

The biological productivity is a well studied aspect in the seamounts and canyon areas, with research aimed at better understanding the connections between oceanic motion around seamount structures and biological distribution patterns (González-Pola *et al.*, 2012; Matabos *et al.*, 2016), and also the canyons critical role in the mechanism of nutrient input into the deep marine environment (Canals *et al.*, 2006; de Stigter *et al.*, 2007; Duineveld *et al.*, 2001; Palanques *et al.*, 2009). Higher levels of primary productivity may lead to canyons and seamounts being hotspots of faunal productivity in the deep sea (De Leo *et al.*, 2010).

The canyons play a critical role in the Portugal mainland and consequently in the MCA EBSA, since they are the most important mechanism of focussed nutrient input into the deep marine environment (Canals *et al.*, 2006; de Stigter *et al.*, 2007; Duineveld *et al.*, 2001; Palanques *et al.*, 2009). Near the seafloor, alignment of the current with the direction of the canyon axis is commonly observed (Shepard *et al.*, 1979; Puig *et al.*, 2000). The adjustments of the current to the canyon topography produce vortex stretching and vertical motions (Klinck, 1996; Hickey, 1997). These modifications of the currents may result in local upwelling, which pumps nutrients to the euphotic zone and thus stimulates primary production (Ryan *et al.*, 2005). Additionally, closed-circulation cells and downwelling may develop over canyons, enhancing the capacity of the canyon to trap particles transported by long-shore currents (Granata *et al.*, 1999; Palanques *et al.*, 2005; Allen & Durrieu de Madron, 2009). When thermohaline stratification of the water column is strong, the flow in the upper mixed layer may decouple from the underlying water levels, which interact with the rims of the canyon. In such a scenario, the current flowing above the canyon head tends to follow its path, ignoring the bottom topography, while the flow below the rim is deflected by the canyon (e.g., Palanques *et al.*, 2005). This current flow can also induce the formation and focussing of internal waves (e.g., Hall & Carter, 2011). Moreover, due to frequent incisions during glacial sea-level lowstands (Bourillet *et al.*, 2006; Toucanne *et al.*, 2009; Zaragosi *et al.*, 2000), the eroded canyon flanks may offer an environment that promotes the settling of sessile organisms, which profit from the enhanced nutrient flux (Van Rooij *et al.*, 2010).

The interplay between canyon topography and oceanic currents has profound consequences for the diversity, functioning, and dynamics of both pelagic and benthic communities. For example, currents funneled through canyons likely enhance primary productivity (Ryan *et al.*, 2005) and drive sediment transport and associated particle-reactive substances toward deep environments (Puig *et al.*, 2014).

The highly variable seascapes within a canyon support diverse assemblages of species that play a wide variety of ecological roles, often across small spatial scales, giving rise to enhanced biodiversity, and ecosystem function (McClain & Barry, 2010). The canyons systems are typically characterized by high levels of endemism and host species displaying peculiar life history patterns (Rowe, 1971; Gage & Tyler, 1991; Gili *et al.*, 1999; Skliris & Djenidi, 2006).

The physical conditions influence the biological communities found within the canyons. In terms of biodiversity, biomass and abundance, they are often higher than in similar depths in non-canyon environments, although diversity may be lower (Vetter & Dayton, 1998; Curdia *et al.*, 2004). Studies comparing canyon and non-canyon assemblages also show that communities within canyons may be different to those found in nearby non-canyon areas suggesting the existence of “canyon indicator species”, which may often achieve high densities (Rowe, 1972; Vetter & Dayton, 1998). Disturbance-nutrient (food availability) gradients have been implicated as primary factors in explaining patterns of species diversity/ richness (e.g. Grime, 1973; Connell, 1978; Rex, 1983; Sousa, 1984; Picket & White, 1985; Huston, 1994; Levin *et al.*, 2001; Paterson *et al.*, 2011;). Unusual features include the presence of demersal planktivores, which exploit zooplankton during down-ward migrations (Greene *et al.*, 1988), suspension feeders benefiting of the strong bottom currents (Rowe, 1971) and deposit feeders profiting of the accumulation of macrophyte detritus (Okey, 1997; Vetter, 1994; Vetter & Dayton, 1998, 1999; Schlacher *et al.*, 2007, 2010; Vetter *et al.*, 2010). Previous investigations on microbenthic assemblages in submarine canyons reported distinct faunal assemblages from non-canyon areas at similar depths (Duineveld *et al.*, 2001). Given their local importance, canyons represent a relevant regional source of marine biodiversity and ecosystem function (Leduc *et al.*, 2014).

Similar studies in seamounts areas reveal that, there is a complex flow spectrum at the seamount, dominated by tidal and internal tidal motions (e.g., van Haren, 2006) and a high level of spatial and temporal variability (e.g., Mouriño *et al.*, 2001). These findings indicate that seamounts play a role in ocean biology far beyond the classical view of particle retention inside stationary and closed circulation cells. Productivity around the seamounts area in general is characterized as low; however, physical oceanography of seamount leads to relatively high productivity (Boehlert & Mundy, 1993; Robison, 2004; Porteiro & Sutton, 2007). Nutrients like nitrates and phosphates, which are critical to the growth of phytoplankton, are lifted from the deep to the sunlit surface waters. These nutrients fuel an explosion of planktonic plant and animal growth – biological productivity. Biological production on seamounts is often manifested in dense aggregations of benthopelagic and demersal fish that represent concentrations of high biomass for these species (Genin & Dower, 2007; Pitcher & Bulman, 2007) (see Introduction).

A circulation system in the form of an anticyclonic vortex trapped atop of the MCA EBSA seamounts, has the potential to accumulate mesopelagic zooplankton, micronekton, and even fish species with weak swimming capabilities (Boehlert & Mundy, 1993; Robison, 2004; Porteiro & Sutton, 2007).

There are specific examples of hight biological productivity in the MCA area:

- The Nazaré canyon is highly active, in particular during winter. In summer upwelling events may prevent sediment export (Pusceddu *et al.*, 2010). Several studies point to chlorophyll-a and organic carbon concentrations that are significantly higher in the canyon than in the adjacent open slope sediments (Garcıa *et al.*, 2008; Ingels *et al.*, 2009; Pusceddu *et al.*, 2010).
- The Berlengas Natural Reserve, off Peniche, is located in the Eastern North Atlantic Upwelling Region, characterized by strong and frequent coastal upwelling events during spring and summer months, with high chlorophyll-a and organic carbon concentrations, creating a biomass hotspots (Wooster *et al.*, 1976, Fraga *et al.*, 1988, Queiroga *et al.*, 2007, Alvarez *et al.*, 2008).

A list of studies made in the different structures of the MCA proves that this EBSA has a high biological productivity (*e.g.* Mougenot *et al.*, 1984; Whitmarsh & Sawyer, 1996; Vetter *et al.*, 1998; Cascalho & Fradique, 2007; Guerreiro *et al.*, 2009; Cruz *et al.*, 2010; Keijzer *et al.*, 2010; Van Rooij *et al.*, 2010; De Leo, 2012; Tuya *et al.*, 2012; Muacho *et al.*, 2013; Muñoz *et al.*, 2013; Leduc *et al.*, 2014; Souto *et al.*, 2014; Hernández-Molina *et al.*, 2015).

Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				X

Continental margins are considered major reservoirs of marine biodiversity and productivity (Sanders & Hessler 1969; Rex, 1983; Snelgrove *et al.*, 1992; Levin *et al.*, 2001; Brandt *et al.*, 2007) and have been, albeit controversially, compared with the most diverse terrestrial and shallow-water marine habitats (Rex, 1983; Orsi *et al.*, 2013). Submarine canyons are abundant and ubiquitous features along continental and oceanic island margins that connect continental shelves to deep ocean basins (Shepard & Dill 1966; Buhl-Mortensen *et al.*, 2010; Koslow *et al.*, 2015). The canyon circulation phenomena are responsible for enhancing both pelagic and benthic productivity inside canyon habitats as well as the biodiversity of many benthic faunal groups (Schlacher *et al.*, 2007; Vetter *et al.*, 2010). In addition to currents and topography, substrate heterogeneity is a key factor contributing to the highly diverse faunal assemblage present in submarine canyons (De Leo *et al.*, 2014). Submarine canyons host a wide variety of substrate types, including mud, sand, hardground, gravel, cobbles, pebbles, boulders, and rocky walls, occurring either separately or in various combinations (Baker *et al.*, 2011). Most species are restricted to either hard substratum (most scleractinians, antipatharians, gorgonians and sponges) or soft substratum (most pennatulids and some scleractinians, gorgonians and sponges). Patches of detritus have been described as hotspots of food resources in canyons. These patches not only support locally high numbers of deposit feeders that benefit from the accumulation of macrophyte detritus, but also a variety of crustaceans associated with down-welling (Vetter, 1995; Okey, 1997). Overall, the presence of detritus patches in canyons provides an additional food source, contributing to higher densities, and biomass of infauna in canyon sediments than in sediments on the adjacent shelf and slope (Vetter & Dayton, 1998). Bianchelli *et al.*, (2010) examined meiofaunal assemblages in submarine canyons and adjacent slope habitats. Their results suggest that available food sources, including detritus, as well as topographic and hydrodynamic features of canyons, influence meiofaunal abundance and biomass. The benthic macrofauna of the Portuguese canyons showed important variations in taxonomic and functional composition, abundance, biodiversity and community structure. Abundance in the upper canyons was significantly higher than in the adjacent slopes and in all canyons bathymetric trend was identical with peak abundances at intermediate depths (Cunha *et al.*, 2011).

The seamounts generally are known to support a large and diverse fauna, living on and around seamounts (Clarke *et al.*, 2006). Food availability is often higher on and above seamounts, supporting a rich fauna in comparison to the surrounding open ocean (Clarke et al, 2006). This fauna can include highly vulnerable pelagic predators, spawning aggregations of commercially important species, cold water coral and sponge communities that are slow-growing and highly vulnerable to fishing and a great variety of associated invertebrates (Koslow *et al.*, 2001; Lack *et al.*, 2003; Worm *et al.*, 2009; Clarke *et al.*, 2006).

The EBSA integrates different types of species belonging to Phylum Anellida (e.g. Erpobdellidae - *Erpobdella octoculata*; Hirudinea - *Glossiphonia complanata*; Oligochaeta - *Enchytraeus capitatus*; Polychaeta - *Eulalia viridis*); Phylum Acanthocephala (e.g. *Acanthocephalus clavula*); Phylum Echinordermata including ophiuroidea (*e.g. Ophiothrix fragilis*), starfish (*e.g. Echinaster sepositus*), sea urchins (*e.g. Paracentrotus lividus*), crinoide (*e.g. Anachalypsicrinus nefertiti*) and sea cucumbers (*e.g. Holothuria forskali*); Phylum Mollusca including classes Gastropoda (e.g. *Bittium reticulatum*), Bivalvia (e.g. *Bathyarca pectunculoides*), Cephalopoda (e.g. squid - *Cranchia scabra*; octopuses - *Callistoctopus macropus*), Scaphopoda (e.g. *Fissidentalium candidum*) and Polyplacophora (e.g. *Leptochiton cancellatus*), suborder Nudibranchia (e.g. *Tambja ceutae*), and order Opisthobranchia (e.g. *Aplysia fasciata*); Phylum Nemertea: (e.g. *Tetrastemma vermiculus*); Phylum Porifera (e.g. *Clathrina cerebrum*); Subphylum Crustacea with representation of orders Decapoda (*e.g.* crab - *Acanthonyx brevifrons*, hermit crabs - *Dardanus calidus*, shrimp - *Gnathophyllum elegans*) Amphipoda (e.g. *Normanion quadrimanus*), Isopoda (e.g. *Anilocra physodes*), Tanaidacea (e.g. *Tanais dulongii*), Cumacea (e.g. *Makrokylindrus inermis*), and Stomatopoda (e.g. *Pseudosquillisma oculata*), subclass Copepoda (e.g. *Paracalanus parvus*), Infraclass Cirripedia (e.g. *Lepas anatifera*), class Ostracoda (e.g. *Henryhowella sarsii*), family Balanidae (e.g. *Balanus spongicola*), family Caprellidae (e.g. *Caprella andreae*) and family Mysidae (e.g. *Boreomysis arctica*); Superclass Osteichthyes including all the reported fish (e.g. commercial - *Aphanopus carbo*; non-commercial - *Serrivomer beanie*; protected - *Hippoglossus hippoglossus*); Class Anthozoa (e.g. *Flabellum alabastrum*); Class Ascideacea (e.g. *Botryllus schlosseri*); Class Aves (e.g. seabirds - *Calonectris* (*diomedea*) *borealis*); Class Brachiopoda (e.g. *Megathiris detruncate*); Class Bryozoa (e.g. *Membranipora membranacea*); Class Elasmobranchii (e.g. shark - *Dipturus batis*; ray - *Raja microocellata*); Class Hydrozoa (e.g. *Dynamena disticha*); Class Pycnogonida (e.g. *Ammothella longipes*); Class Reptilia (e.g. sea turtle - *Caretta caretta*); Class Scyphozoa (e.g. *Catostylus tagi*); Infraorder Cetacea (e.g. *Balaenoptera musculus*); Family Chimaeridae (e.g. *Chimaera monstrosa*).

Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.		X		

In the particular case of the mainland canyons, the steep slopes and rocky topography have limited exploitation of seafloor resources within canyons through activities such as bottom-trawl fishing (Würtz, 2012). Consequently, many canyon areas experience lower levels of anthropogenic pressure than adjacent areas on the shelf and slope. Nevertheless, submarine canyons are increasingly subjected to different stressors, not only in relation to fishing (Company *et al.*, 2008; Martín *et al.*, 2008; Orejas *et al.*, 2009; Puig *et al.*, 2012). Moreover, the hydrodynamic processes of canyons enhance the transport of litter (Mordecai *et al.*, 2011; Ramirez-Llodra *et al.*, 2013; Tubau *et al.*, 2015) and chemical pollutants from the shelf to deep-sea environments (Palanques *et al.*, 2008; Koenig *et al.*, 2013; Pham *et al.*, 2014). Canyons have also been used as dumping areas for tailings of land-based mining (Hughes *et al.*, 2015; Ramirez-Llodra *et al.*, 2015). Additionally, effects of climate change may affect the physical and chemical characteristics of water masses, modifying the intensity of currents (Canals *et al.*, 2009). These modifications may seriously impact the structure and functioning of canyon communities and have important implications for nutrient supply to the deep-ocean ecosystem (Solomon, 2007; Levin & Le Bris, 2015) as well as for carbon storage (Epping *et al.*, 2002; Masson *et al.*, 2010).

The occurrence of high concentrations of litter near coastal urban areas is well known (Galgani *et al.*, 1996), while marine sources contribute mostly at greater distances from population centers (Faris & Hart, 1994; Moore & Allen, 2000; Katsanevakis & Katsarou, 2004; Lee *et al.*, 2006). If most litter in the canyons is of a terrestrial origin, controls on disposal on and from land can be implemented to mitigate impact. Anthropogenic threats to submarine canyons demand responses to ensure sound ecosystem-based management of naturalresources based on robust scientific data that will guarantee both the development of local and regional economies and the long-term sustainability of canyon ecosystems and the services they provide.

Specific cases :

- The Lisbon, Setúbal and Cascais canyons are located adjacent to the Lisbon and Setúbal regions of Portugal, where Lisbon, the capital city, and Setúbal and their suburbs are located. The Lisbon and Setúbal region is relatively heavily populated and industrialized and a potential source of more litter than less populated regions. As the abundance of litter in canyons off Lisbon was associated with the distance from the coast line and depth, we infer that the majority of the litter was from terrestrial sources. Studies performed in the Tagus estuary and prodelta indicated the occurrence of anthropogenic metals enrichments (e.g. Paiva *et al.*, 1997; Jouanneau *et al.*, 1998, Mil-Homens *et al.*, 2009). Richter *et al.*, (2009) also demonstrated a contribution of anthropogenic metals in surface sediments from the Lisboa-Setúbal Canyon System (LSC).
- The Portimão canyon has a strong influence on the regional sediment cover distribution (Moita, 1986; Hernández-Molina *et al.*, 2006). It becomes a distinct feature at only 100 m

depth, sinking for about 8 km (first from NNE–SSW then turning in a NNW–SSE direction) until it joins the Lagos Canyon at ca. 4000 m depth (Mouguenot, 1989). The head of this canyon is, therefore, in the route of the crustacean trawlers operating here with intense activity (Borges *et al.*, 2001); being aware of this feature, fishermen often choose to 'fly' their nets over the canyon rather than stopping the haul (Morais *et al.*, 2007).

- In Nazaré canyon the number of litter items remains at a relatively low constant abundance at 460 km from the coast. This canyon is less influenced by nearby population centers than the canyons further south. Over all, the distribution of litter in canyons suggests that litter from terrestrial sources (population sources) was not transported in large quantities more than a few tens of km from the source, although the observed litter distribution may primarily be a function of local oceanographic conditions (De Stigter *et al.*, 2011).
- The composition and abundance of litter varies among canyons. The litter in Lisbon, Setúbal and Cascais canyons is dominated by plastics, supporting previous studies, which found that up to 70% of the litter along the European coast was plastic (Galgani *et al.*, 2000). In contrast, the majority of the litter in Nazaré canyon is fishing gear (37%), followed by plastic (25%) and metal (17%). Although it is difficult to ascertain the exact source of litter, the results suggest that the Nazaré canyon is mostly affected by marine-sourced litter (June, 1990; Keller *et al.*, 2010; Watters *et al.*, 2010).

In terms of the seamount areas there is no information on historic or current fishing effort in these areas, although there are reports of illegal/unreported fishing by vessels using unmarked monofilament gill nets and small drift nets, which are abandoned when they are detected (Morato *et al.*, 2013). Seamount fisheries have typically proven difficult to research and manage sustainably. Many deep-sea commercial species have characteristics that generally make them more vulnerable to fishing pressure than shallower shelf species. They can form large and stable aggregations over seamounts for spawning or feeding, which enables very large catches and rapid depletion of stock size (Clark *et al.*, 2010a), b)).

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Maps and Figures

Figure 1 – Structures included in MCA EBSA.

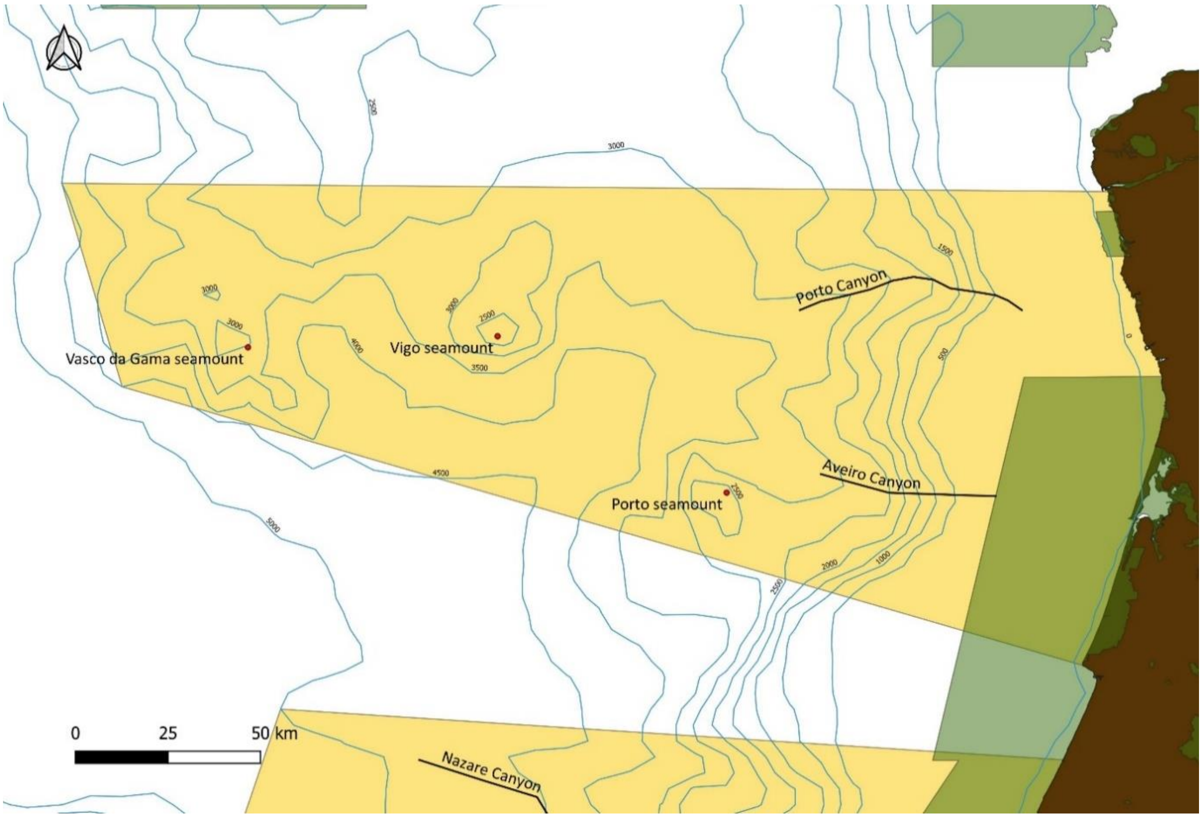

Figure 2 - MCA EBSA - North. Yellow shadow – EBSA polygon (total area). Olive shadow – Marine areas under legal protection.

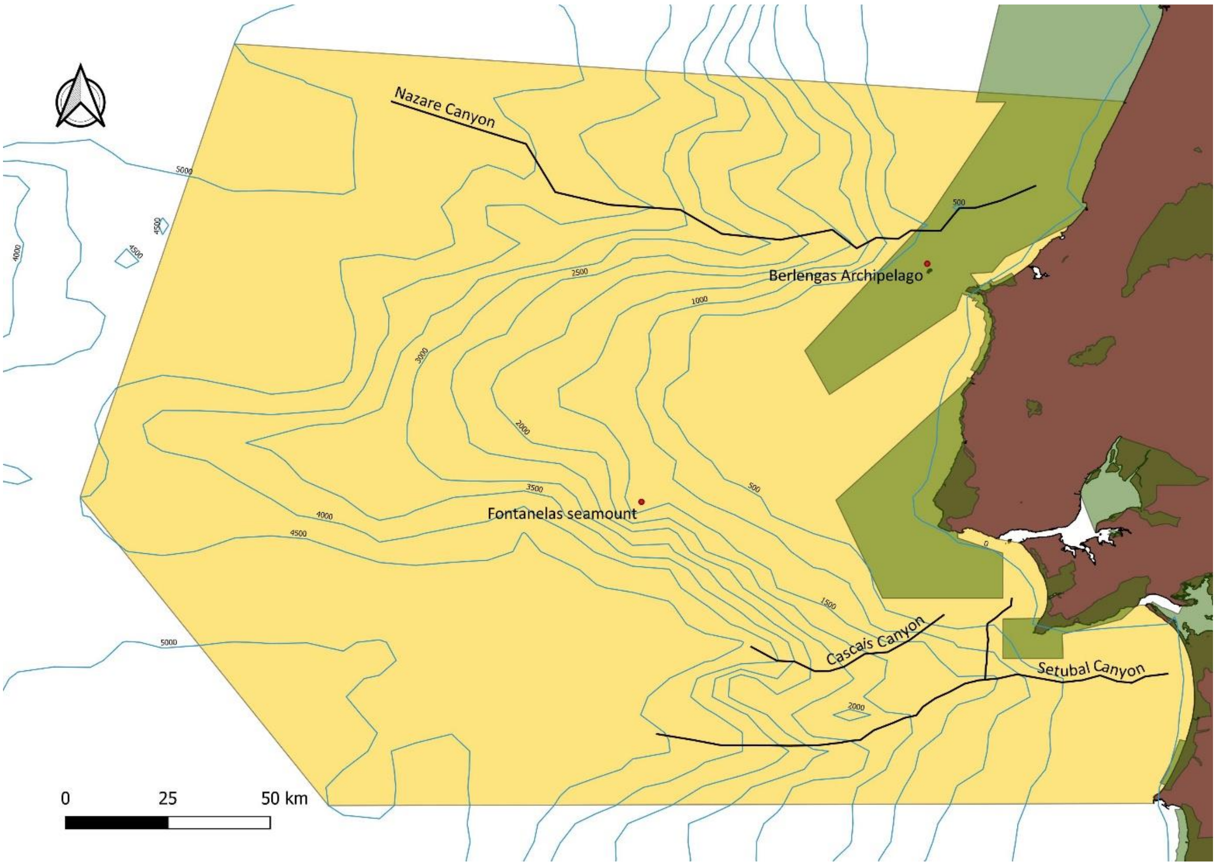

Figure 3 - MCA EBSA Center. Yellow shadow – EBSA polygon (total area). Olive shadow – Marine areas under legal protection.

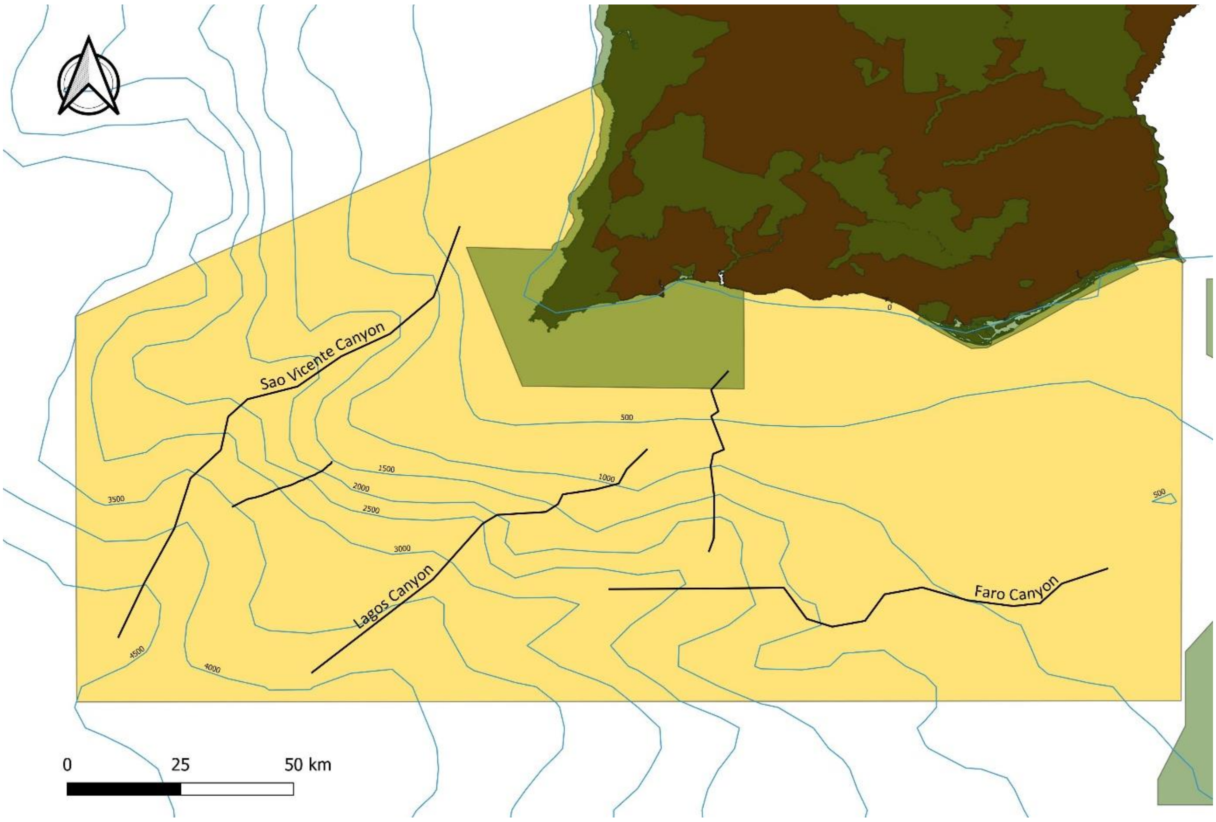

Figure 4 - MCA EBSA South. Yellow shadow – EBSA polygon (total area). Olive shadow – Marine areas under legal protection.

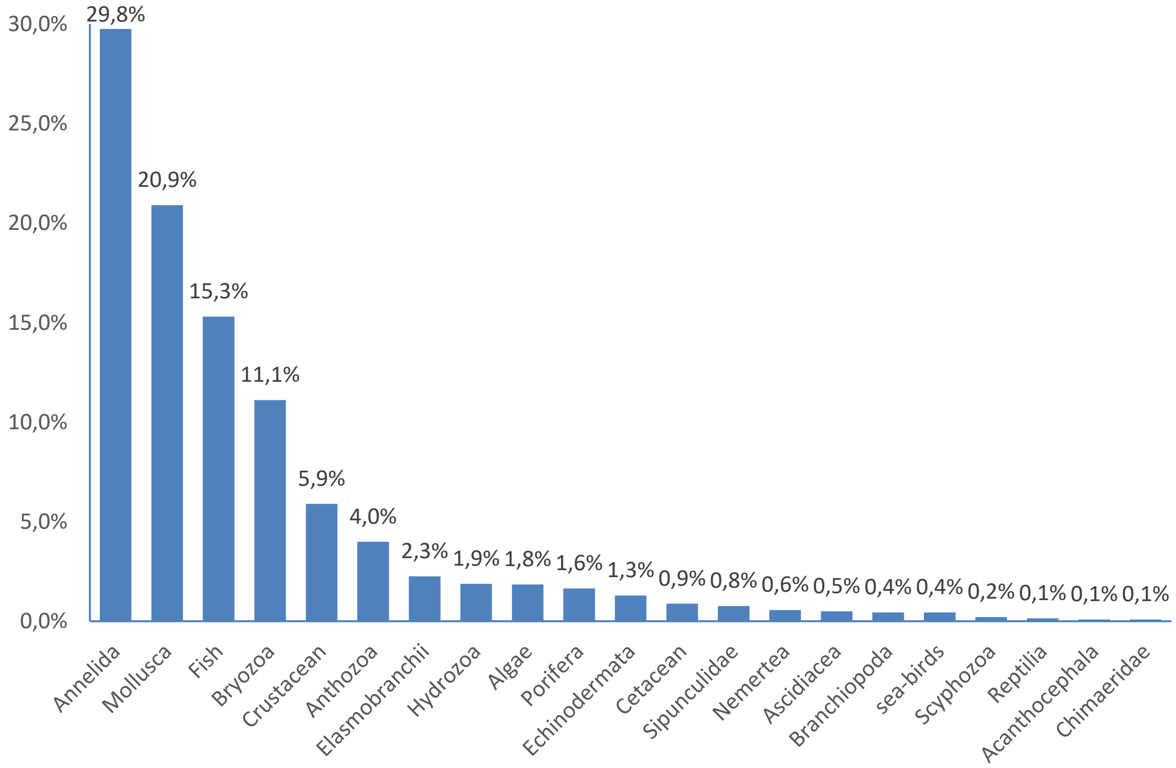

Figure 5 - Relative frequency (%) of the different phylum/subphylum/class/superclass/order of the species identified in the MCA EBSA.

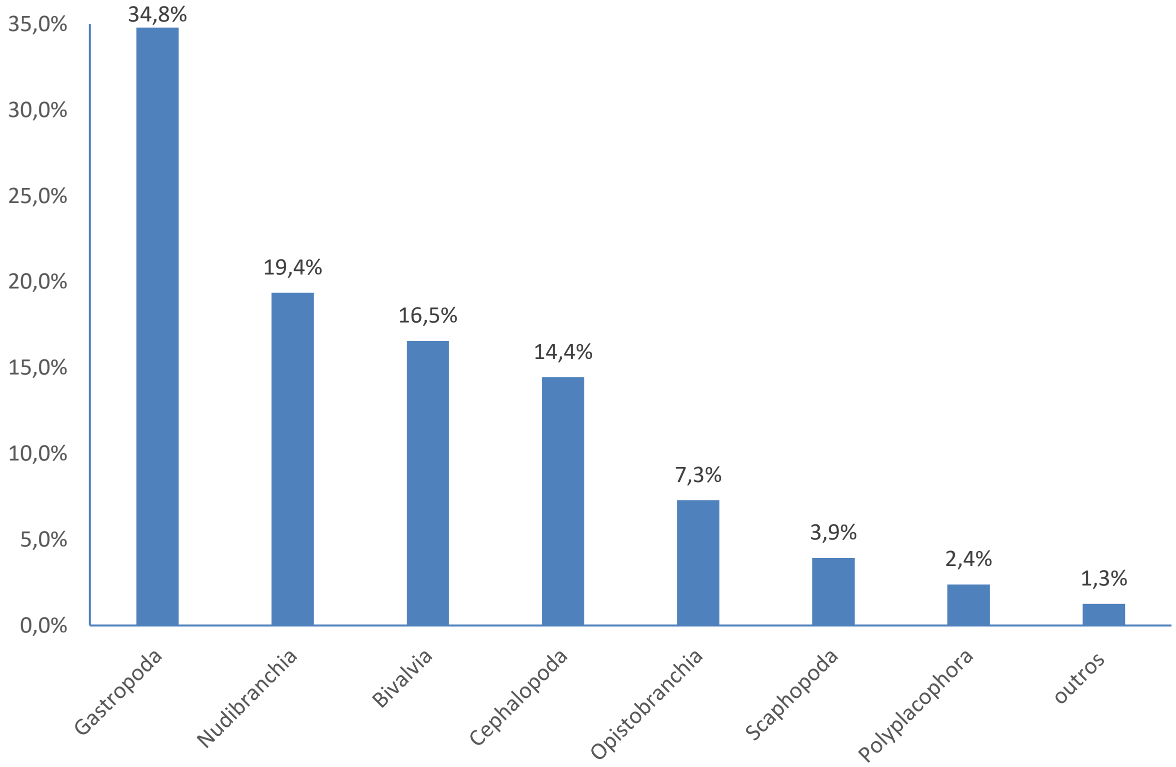

Figure 6 - Relative frequency (%) of the different species identified in the MCA EBSA belonging to different taxa included in the phylum Mollusca.

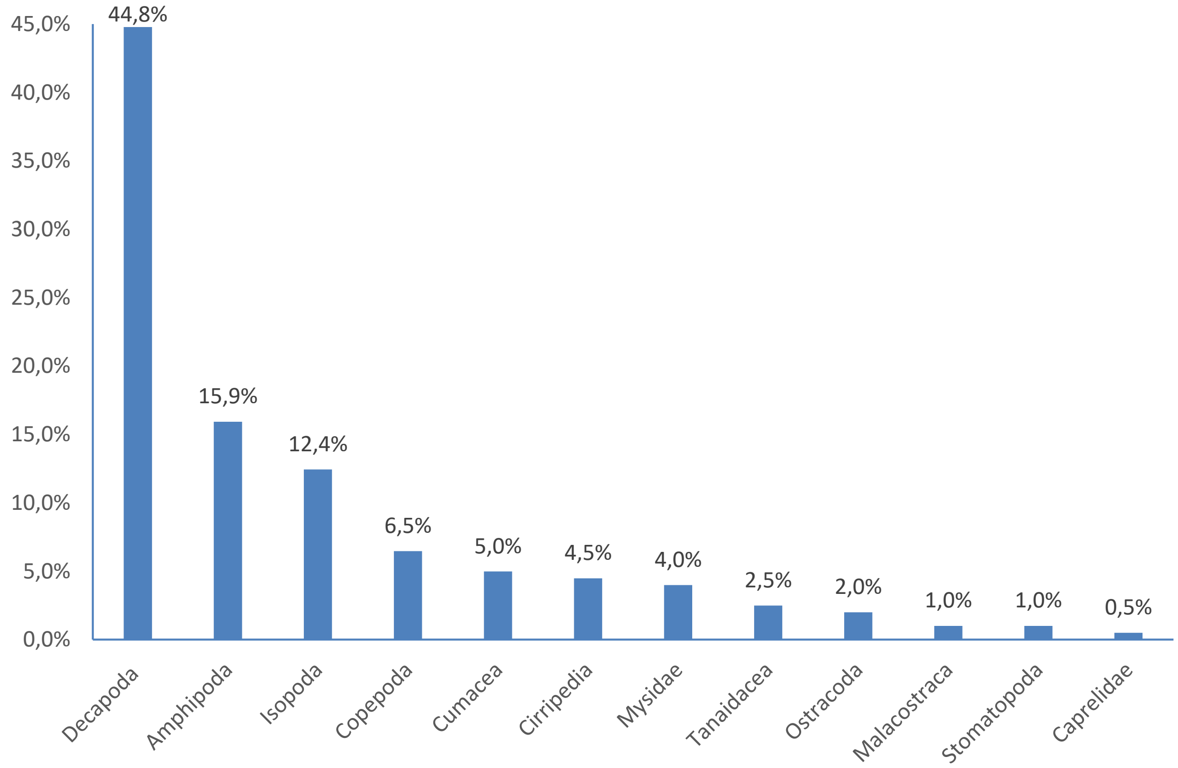

Figure 7 - Relative frequency (%) of the different species identified in the MCA EBSA belonging to different taxa included in the subphylum crustacea.

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