OSPAR COMMISSION

Background Document on the Josephine Seamount Marine Protected Area

Biodiversity Series

2011

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Union and Spain

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998.
La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l‟Irlande, l‟Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d‟Irlande du Nord, la Suède et la Suisse et approuvée par l‟Union européenne et l‟Espagne

Acknowledgement

This report was prepared by the OSPAR Intersessional Correspondence Group on Marine Protected Areas as a contribution to OSPAR‟s work on MPAs in areas beyond national jurisdiction under the leadership of Dr Henning von Nordheim (German Federal Agency for Nature Conservation/BfN) with the assistance of Tim Packeiser. The report is based upon work by the University of York and carried out by Prof Callum Roberts, Beth O‟Leary and Rachel Brown as commissioned by BfN Germany. The report has been enhanced by contributions of the University of the Azores (Prof Ricardo S. Santos), supported by the Government of the Azores, and the Portuguese Instituto da Conservação da Natureza e da Biodiversidade (Pedro I. Arriegas).

Contents

Executive summary

The Josephine Seamount was named after the Swedish Corvette *Josephine,* whose crew discovered the seamount in 1869 while conducting a scientific expedition in the North Atlantic, the first seamount discovered as a direct result of oceanic explorations. Josephine Seamount has been found to have high biodiversity, with high incidence of rare and previously unknown species as well as commercial fish species. The boundaries of the marine protected area were chosen to also include a portion of an adjacent unnamed seamount.

In 2003, the OSPAR Commission agreed to establish a network of Marine Protected Areas (MPAs) with the aim that this should become an ecologically coherent network of well-managed sites. OSPAR agreed that the OSPAR Network of MPAs should comprise sites that are established as MPAs within the jurisdiction of OSPAR Contracting Parties as well as sites in the maritime area outside the jurisdiction of the Contracting Parties (area beyond national jurisdiction ABNJ). In the OSPAR Biodiversity and Ecosystems Strategy, OSPAR agreed to identify, on the basis of reports from Contracting Parties and observer organisations, possible components of the OSPAR Network in areas beyond national jurisdiction in order to achieve the purposes of the network.

This background document makes available the information which has been compiled and evaluated within the OSPAR framework on the biodiversity and ecosystems of the Josephine Seamount, which was proposed to OSPAR as a potential MPA in ABNJ in 2009. On the basis of this information, the 2010 Ministerial Meeting of the OSPAR Commission adopted OSPAR Decision 2010/5 on the establishment of the Josephine Seamount High Seas MPA to protect the biodiversity of the waters superjacent to the seabed of the Josephine Seamount. In parallel the government of Portugal have established an MPA covering the seabed of the Josephine Seamount, which is the subject of a submission by Portugal to the Commission on the limits of the Continental Shelf. This document also includes conservation objectives developed within the OSPAR framework for application to an MPA in the Josephine Seamount High Seas MPA which have been formalised in OSPAR Recommendation 2010/16 on the management of the Josephine Seamount High Seas MPA.

Récapitulatif

Le mont sous-marin Josephine porte le nom de la corvette suédoise *Josephine,* dont l‟équipage a découvert ce mont en 1869 au cours d‟une expédition scientifique dans l‟Atlantique du Nord. C‟était la première fois que la découverte d‟un mont sous-marin découlait directement d‟explorations océaniques. Il se trouve que le mont sous-marin jouit d‟une grande biodiversité dotée d‟une présence importante d‟espèces rares et inconnues jusqu‟à ce jour ainsi que d‟espèces halieutiques commerciales. Les limites de la zone marine protégée ont été déterminées pour pouvoir inclure également une portion d‟un mont sous-marin adjacent sans nom.

La Commission OSPAR est convenue, en 2003, de créer un réseau de zones marines protégées (ZMP) afin que celui-ci devienne un réseau de sites écologiquement cohérent et bien géré. OSPAR est convenue que le réseau OSPAR de ZMP devra englober les sites créés à titre de ZMP situés dans la juridiction des Parties contractantes OSPAR ainsi que les sites de la zone maritime situés au-delà de la juridiction des Parties contractantes (zone au-delà de la juridiction nationale (ABNJ)). OSPAR est convenue, dans sa Stratégie biodiversité et écosystèmes, de déterminer, en se fondant sur des rapports des Parties contractantes et d‟organisations observatrices, des composantes éventuelles du réseau OSPAR situées dans des zones au-delà de la juridiction nationale afin de parvenir aux objectifs du réseau.

Le présent document de fond comporte les informations qui ont été recueillies et évaluées dans le cadre de travail d‟OSPAR et portant sur la biodiversité et les écosystèmes du mont sous-marin Josephine qui a été proposé à OSPAR à titre de ZMP potentielle dans une ABNJ en 2009. La réunion ministérielle de 2010 de la Commission OSPAR a adopté, en se fondant sur ces informations, la Décision OSPAR 2010/5 sur la création de la ZMP du mont sous-marin Josephine haute mer pour protéger la biodiversité des eaux superjacentes au fond marin du mont sous-marin Josephine. Parallèlement, le gouvernement du Portugal a créé une ZMP couvrant le fond marin du mont sous-marin Josephine, qui fait l‟objet d‟une communication du Portugal à la Commission sur les limites du plateau continental. Ce document comporte également des objectifs de conservation développés au sein du cadre de travail d‟OSPAR à appliquer à une ZMP située dans la ZMP du mont sous-marin Josephine haute mer. Ces objectifs de conservation ont été officialisés dans la Recommandation OSPAR 2010/16 sur la gestion de la ZMP du mont sous-marin Josephine haute mer.

A. General information

1. Area

Josephine Seamount

2. Aim of MPA – Conservation Objectives

2.1 Conservation Vision[1]

Maintenance and, where appropriate, restoration of the integrity of the functions and biodiversity of the various ecosystems of the Josephine Seamount-MPA so they are the result of natural environmental quality and ecological processes[2].

Cooperation between competent authorities, stakeholder participation, scientific progress and public learning are essential prerequisites to realize the vision and to establish a Marine Protected Area subject to adequate regulations, good governance and sustainable utilization. Best available scientific knowledge and the precautionary principle form the basis for conservation.

2.2 General Conservation Objectives[3 4]

(1) To **protect and conserve** the range of habitats and ecosystems including the water column of the Josephine Seamount-MPA for resident, visiting and migratory species as well as the marine communities associated with key habitats.

(2) To **prevent** loss of biodiversity, and promote its recovery where practicable, so as to maintain the natural richness and resilience of the ecosystems and habitats, and to enable populations of species, both known and unknown, to maintain or recover natural population densities and population age structures.

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1 The conservation vision describes a desired long-term conservation condition and function for the ecosystems in the entire Josephine Seamount-MPA. The vision aims to encourage relevant stakeholders to collaborate and contribute to reach the objectives set for the area.

2 Recognizing that species abundances and community composition will change over time due to natural processes.

3 Conservation objectives are meant to realize the vision. Conservation objectives are related to the entire Josephine Seamount-MPA or, if it is decided to subdivide, for a zone or subdivision of the area, respectively.

4 It is recognized that climate change may have effects in the area, and that the MPA may serve as a reference site to study these effects.

(3) To **prevent** degradation of, and damage to, species, habitats and ecological processes, in order to maintain the structure and functions - including the productivity - of the ecosystems.

(4) To **restore** the naturalness and richness of key ecosystems and habitats, in particular those hosting high natural biodiversity.

(5) To **provide** a refuge for wildlife within which there is minimal human influence and impact.

2.3 Specific Conservation Objectives[5] [6]

2.3.1 **Water Column**

a. To prevent deterioration of the environmental quality of the bathypelagic and epipelagic water column (e.g. toxic and non-toxic contamination[7]) from levels characteristic of the ambient ecosystems, and where degradation from these levels has already occurred, to recover environmental quality to levels characteristic of the ambient ecosystems.

b. To prevent other physical disturbance (e.g. acoustic).

c. To protect, maintain and, where in the past impacts have occurred, restore where appropriate the epipelagic and bathypelagic ecosystems, including their functions for resident, visiting and migratory species, such as: cetaceans, and mesopelagic and bathypelagic fish populations.

2.3.2 **Benthopelagic Layer**

To protect, maintain and, where in the past impacts have occurred, restore where appropriate:

a. Historically exploited **fish populations** (target and bycatch species) at/to levels corresponding to population sizes above safe biological limits[8] with special attention also given to **deep water elasmobranch species**, including threatened and/or declining species, such as Portuguese dogfish, Leafscale gulper shark and Gulper shark.

b. Benthopelagic habitats and associated communities to levels characteristic of natural ecosystems.

2.3.3 **Benthos**

To protect, maintain and, where in the past impacts have occurred, restore where appropriate to levels characteristic of natural ecosystems:

a. The **epibenthos and its hard and soft sediment habitats,** including threatened and/or declining species and habitats such as seamounts and coral gardens.

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[5] Specific Conservation Objectives shall relate to a particular feature and define the conditions required to satisfy the general conservation objectives. Each of these specific conservation objectives will have to be supported by more management orientated, achievable, measurable and time bound targets.

[6] Norway has a reservation on Section 2.3 “Specific Conservation Objectives”.

[7] This includes synthetic compounds (e.g. PCBs and chemical discharge), solid synthetic waste and other litter (e.g. plastic) and non-synthetic compounds (e.g. heavy metals and oil).

[8] “Safe biological limits” used in the following context: “Populations are maintained above safe biological limits by ensuring the long-term conservation and sustainable use of marine living resources in the deep-seas and preventing significant adverse impacts on Vulnerable Marine Ecosystems (FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas, 2008).

b. The **infauna of the soft sediment benthos**, including threatened and/or declining species and habitats.

c. The **habitats associated with seamount structures.**

2.3.4 Habitats and species of specific concern

Those species and habitats of special interest for the Josephine Seamount-MPA, which could also give an indication of specific management approaches, are listed at Annex 1.

3. Status of the location

On 11 May 2009 the Portuguese Republic submitted to the Commission on the Limits of the Continental Shelf (UN CLCS), information on the limits of the Portuguese continental shelf beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured, in accordance with Article 76, paragraph 8, of the Convention of the Law of the Sea. This submission by Portugal encompasses the seabed in the area of the Josephine Seamount MPA.

The water column in the area of the Josephine Seamount MPA is located beyond the limits of national jurisdiction of the coastal states in the OSPAR Maritime Area. The international legal regime that is applicable to this area is comprised of, *inter alia*, the UNCLOS, the Convention on Biological Diversity, the OSPAR Convention and other rules of international law. This regime contains, among other things, rights and obligations for states on the utilization, protection and preservation of the marine environment and the utilization and conservation of marine living resources and biodiversity as well as specifications of the competence of relevant international organizations.

4. Marine region

OSPAR Region V; Atlantic deep-sea Subregion; Warm temperate waters

5. Biogeographic region

Atlantic Subregion; Warm temperate waters

6. Location

OSPAR Region V; see Figure 1 below.

The Boundary Co-ordinates are:

Latitude	*Longitude*
37.46^{o}N	*14.65^{o}W*
37.63^{o}N	*13.75^{o}W*
36.86^{o}N	*13.42^{o}W*
36.18^{o}N	*14.45^{o}W*
36.76^{o}N	*15.72^{o}W*
36.45^{o}N	*15.39^{o}W*

7. Size

19 370 km^2

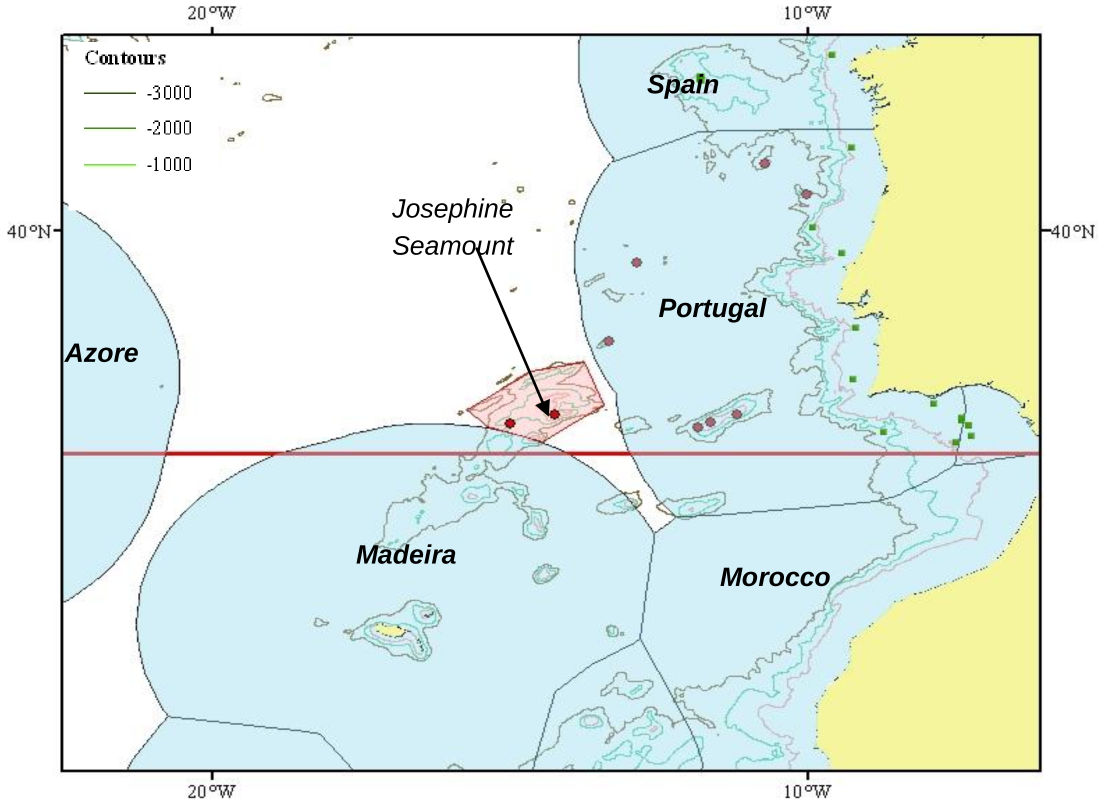

Figure 1. *The marine protected area boundaries are shown in shaded red and the relevant Exclusive Economic Zones are shown in shaded blue. The thick red line running east to west is the boundary of the OSPAR maritime area. Red dots are known seamount locations and green squares are Lophelia pertusa records.*

8. Characteristics of the area

The Josephine Seamount was named for the Swedish Corvette *Josephine,* whose crew discovered this feature in 1869 while conducting a scientific expedition in the North Atlantic. It can be considered as the first seamount discovered as a direct result of oceanic explorations. (Brewin et al., 2007) and has been studied in several scientific expeditions.

Josephine Seamount is one of Lusitanian seamounts and represents the westernmost point of east-west trending series of banks and seamounts separating the Tagus and Horseshoe Abyssal Plains also known as Horseshoe seamount chain. It is located to the east of the Mid-Atlantic Ridge and is a component of the Azores-Gibraltar complex (35-38^{o}N and 12-15^{o}E) (Pakhorukov (2008). It is oval-shaped with a minimum water depth of 170 m at the southern end and almost flat top surface of ~ 150 km^2 within the 400 m depth contour and ~210 km^2 within the 500 m depth contour. There are very steep south, south-west and south-east slopes down to water depths of 2000-3700 m. Towards the NNW the seamount extends into northward sloping ridge about 1000 m deep.

Josephine Seamount originated in Middle Tertiary as an island volcano that became extinct approximately 9 million years ago and has since had a subsidence rate of ~ 2-3 cm/1000 years. Basaltic rocks are found at the summit and there is patchy cover of limestone and bioclastic sands. Bioclastic sands are almost completely free from any terrigenous component and are well sorted, with high a content of recent and relict benthonic organisms, mostly benthonic foraminifera, bryozoans, corals, worm tubes, molluscs and echinoderms (von Rad, 1974). Rocky outcrops and limestones are covered by dense gorgonian aggregations mainly composed of *Callogorgia verticillata* and *Elisella flagellum* and also hexactinellid sponge *Asconema setubalense.* Patches of bioclastic sands are inhabited by the ascidian *Seriocarpa rhizoids* that can reach impressive densities up 250-750 specimens per 1 m^{-1}.

The region around Josephine is in the zone affected by the north-eastern part of the sub-tropical gyre, whose eastern periphery is the Canary Current (Pakhorukov, 2008). The near-surface Azores Current forms a meandering pattern directed eastwards with main branches flowing towards Gibraltar to the north and towards the Canary Islands to the south (Johnson & Stevens 2000). Therefore the circulation pattern does not favor the transport of larvae from the European mainland towards Josephine Seamount and the other seamounts of Lusitanian group. At depths of 200m to 1200m there is the intermediate North Atlantic water mass (Pakhorukov, 2008). Deeper than this is the abyssal North Atlantic water and it is between these two layers that the Mediterranean appears in the Atlantic in the form of long-lived subsurface vortices known as “meddies” typically 40–150 km broad, translating westwards in a depth interval 600-1600 m deep and lasting for several years (Richardson *et al* 2000; Pakhorukov, 2008). Meddies collide repeatedly with the seamounts situated on their track and could provide a pathway for the dispersal of bathyal fauna (Richardson *et al* 2000).

To date about 150 species of invertebrates and 31 species of fish from Josephine Seamount have been identified. The invertebrate taxa reported from this seamount include Hexactinellid sponges (Tabachnick & Menchenina, 2007), Hydrozoa (Ramil et al., 1998, Zibrowius, Cairns, 1992), Scleractinia (Zibrowius, 1980), Antipatharians, Gorgonians (Grasshoff, 1985 Pasternak, 1985, Lopez-Gonzales & Briand, 2002), Polychaeta (Hartmann-Schroder, 1979, Gillet & Dauvin, 2000), Bivalvia (Dijkstra & Gofas, 2004; Gofas, 2005; Krylova, 2006; Gofas, 2007 and others), Cirripedia (Poltarukha, Zevina, 2006), Ostracoda (Hartmann, 1985), Halacarida (Bartch, 1973a,b), Picnogonida (Stock, 1970, 1992), Brachiopoda (Gaspard, 2003; Zezina, 2006), Echinoidea (Mironov, 2006), Ascidia (Monniot & Monniot, 1992). The list of reported endemics found on Josephine Seamount includes *Victorgorgia josephinae* (Alcyonaria), *Genetyllis macrophthalma* (Polychaeta), *Propontocypris josephineae* (Ostracoda), *Arhodeoporus brevocularis* and *Atelopsalis newelli* (Halacarida).

Like the majority of seamounts Josephine Seamount‟s faunal community is quite closely affiliated with the nearest continental margin (Stocks & Hart, 2007). Brachiopods (Gaspard, 2003), Polychaetes (Gillet & Dauvin, 2000), Gorgonians, Antipatharians (Grasshoff, 1985), Tunicates (Monniot & Monniot, 1992) and Pycnogonids (Stock, 1991) reported on Josephine Seamount were all either known from the nearby continental margin or widespread in non-seamount areas (Stocks & Hart, 2007). There is also some evidence of previously unknown or rare species. For example 25% of the gastropod species sampled by Gofas & Beu (2002) on Josephine and surrounding seamounts were described as unknown or rare on the nearby margin.

Pakhorukov (2008) performed an underwater visual survey of eight seamounts to the south-east of the Azores Archipelago. On Josephine seamount the species recorded included *Rostroraja alba* (the threatened white skate), *Raja maderensis* (Madeiran ray, thought to be endemic to the waters of Madeira and the Azores), *Deania calcea* (Birdbeak dogfish), *Aldrovandia oleosa*, *A. phalacra* (Hawaiian halosaurid), *Hoplostethus mediterraneus* (Mediterranean slime-head), *Antigonia capros* (deep body boarfish), *Helicolenus dactylopterus* (Blackbelly rosefish), *Callanthias ruber* (Parrot seaperch), *Lepidopus caudatus* (Silver scabbardfish) and *Trachurus picturatus* (Blue jack mackerel). *T. picturatus* shoals were found to dominate the bottom trawling catches of *R/V Ikhtiadr* in July/August 1982 and May 1986 (Pakhorukov, 2008). *L. caudatus* was found in large shoals over all eight seamounts sampled, however the largest shoal was over Josephine. This shoal measured 4.5m deep, 7m wide with an extension of 30m, it was estimated to contain 14,175 individuals with a combined weight of 7.1t (Pakhorukov, 2008). Pakhorukov (2008) concluded that there was strong variation in species composition at each seamount. Of the approximately 100 fish species observed over the eight seamounts studied only 3 species were found on all eight seamounts (Pakhorukov, 2008).

The unnamed seamount included within the boundaries has had little investigation and no species records can be found, however it is expected that due to the close proximity to Josephine Seamount faunal assemblages are likely to be similar on the slope area of the seamount. Other seamounts within the Horseshoe Seamount chain include those found on the Gorringe Bank, which is within the Exclusive Economic Zone of Portugal (Gonçlaves et al, 2004). The biology of Gorringe seamount was studied during the French SEAMOUNT 1 expedition (e.g. Bouchet & Metivier, 1988; Gofas, 2007) and the OASIS project (Beck et al., 2006). And at least for some groups like Demospongia (Xavier, van Soest, 2007) and Gastropoda were shown to have a high percentage of species (up to 26%) being endemics or species with restricted geographic distribution. Information about the marine fish species of Gorringe Bank is hidden in grey fisheries-related literature (Gonçlaves et al, 2004). One of the few visual underwater surveys over two peaks of a seamount found on Gorringe Bank, the Gettysburg and the Ormond, was conducted by Gonçlaves et al (2004). They found the majority of fish species over these seamounts to be of Atlantic-Mediterranean origin, with cosmopolitan and oceanic species having a strong presence (Gonçlaves et al, 2004). Aggregations of several species were observed, including *Seriola rivoliana* (Almaco jack), *Anthias anthias* (Swallowtail perch) and *Torpedo marmorato* (Spotted torpedo). *T. marmorato* has never been reported in massive aggregations before and is another indication of how little is known about the biology, ecology and importance of seamounts in general (Gubbay, 2003; Gonçlaves et al, 2004). There was also evidence that the upper peaks of this seamount have acted as „stepping-stones‟ for the dispersal of coastal fish species (Gonçlaves et al, 2004). It is possible that other seamount peaks within the Horseshoe Seamount chain have also acted in this way.

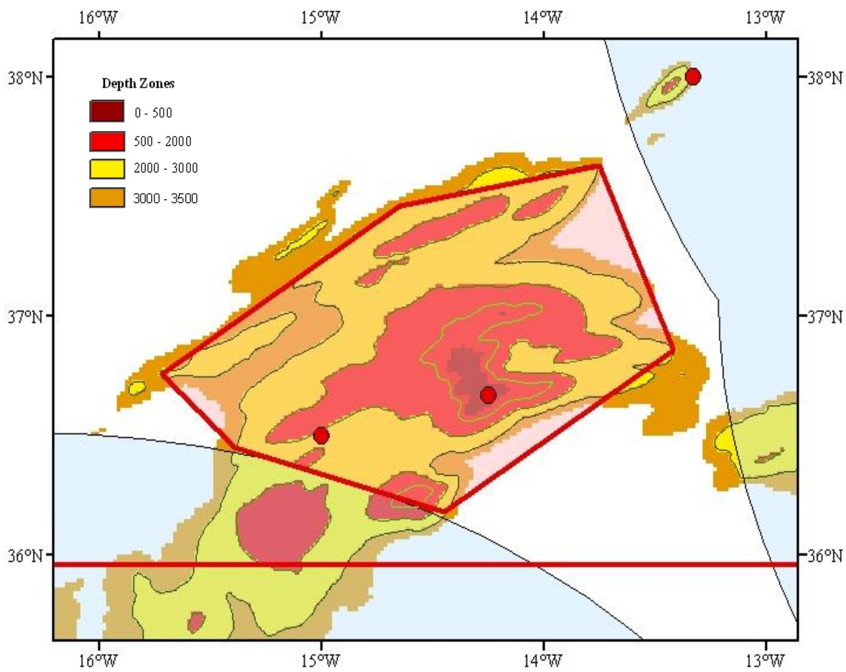

Figure 2. The fishable zones within and around the marine protected area boundaries, white areas are deeper than 3500 metres. Boundaries have been designed to incorporate as much of the area down to a depth of 3000 metres, whilst maintaining them as straight and easy to manage as possible.

Seamounts in general often support sizeable fish stocks and are thus attractive fishing grounds (Samadi et al, 2007). Fishing activity has been reported in this area. A Soviet fishery for horse mackerel, mackerel and scabbardfish began in 1973-74 at the Horseshoe Seamount, with the largest catches per year as much as 17800-46500 t for the entire area. Following the establishment of Exclusive Economic Zones in 1977, the fishery was restricted to Josephine and Ampere seamounts with total catches for both seamounts being less than 1000 t per year. The main fishing gear used is pelagic trawl, but bottom trawl and purse seine are also used. The designated area falls within ICES Subarea IX, which has a main directed Portuguese longline fishery for black scabbardfish (*Aphanos carbo*) with a bycatch of deepwater sharks, and a Spanish longline fishery for Blackspot seabream (*Pagellus bogaraveo*) (ICES 2007b). There is also a bottom trawl fishery at the southern part of the Portuguese coast, which targets crustaceans on deeper grounds, such as Norway lobsters (*Nephrops norvegicus*), Rose shrimp (*Parapenaeus* *longirostris*) and Red shrimp (*Aristeus antennatus*), although there is no evidence of such a fishery on the Josephine Seamount to date (Gordon et al, 2003; ICES, 2007b). In 2006 a new deepwater gillnet fishery was begun in Subarea IX targeting deepwater crabs and sharks (ICES, 2007b). A tuna long line fishery has also been reported (summarized by Clark et al., 2007). Other parts of the Horseshoe Seamount chain are known to be exploited by several deep-water commercial fleets, including longliners targeting Silver scabbardfish (*Lepidopus caudatus*) (Gonçlaves et al, 2004).

The boundaries of the marine protected area were chosen to incorporate Josephine Seamount and the portion of the adjacent unnamed seamount that is located outside of the Exclusive Economic Zone of Madeira. The boundaries have been designed to incorporate areas surrounding the two seamounts that are at a depth that makes them vulnerable to the impacts of fishing (i.e. two thousand to three thousand metres deep). This has been done whilst maintaining the use of straight lines, which will make compliance and enforcement easier than boundaries that, for example, followed depth contours. Therefore within the designated area there are a few small areas which are deeper than 3000m, see Figure 2.

B Selection criteria

1. Ecological criteria/considerations

1.1. Threatened and/or declining species and habitats

The designated area includes seamount, habitats listed as priority threatened or declining habitats by OSPAR (OSPAR Commission, 2003). It includes seamount habitat that qualifies as Vulnerable Marine Ecosystems in relation to high seas fisheries according to criteria developed by FAO (FAO 2007, Rogers et al, 2008). It also contains seamount communities that is a habitat listed as an example of ecologically or biological significant marine areas according to criteria developed by the CBD for identifying candidate sites for protection on the high seas (UNEP 2007).

The white skate (*Rostroraja alba*) occurs within the area (Scherbachev *et al* 1985; Pakhorukov, 2008). This skate species is not on the OSPAR list of threatened and/or declining species, however it has been classified as critically endangered within the OSPAR area by the International Union for the Conservation of Nature (IUCN) and is known to be declining throughout its range (Walker *et al* 2005; Gibson *et al* 2008). It is known to have suffered severe declines within the OSPAR area, mainly as a result of bottom trawling combined with its vulnerable life history traits (Gibson *et al* 2008). The designated area is also potential habitat for Leatherback (*Dermochelys coriacea*) and Loggerhead (*Caretta caretta*) sea turtles as they are both species known to perform transatlantic migrations and have been tagged travelling in the vicinity of this area. These species are listed as priority threatened or declining habitats by OSPAR (OSPAR Commission, 2003). The seamounts may also be visited by tuna, including bluefin tuna (*Thunnus thynnus*), that use seamounts as way points and feeding stations in transoceanic migrations. The proximity of the protected areas to the Strait of Gibraltar, through which bluefin tuna migrate, raises the possibility that these seamounts could be important points on the migration of this species.

1.2. Important species and habitats

Seamounts are undersea mountains whose summits rise from the seafloor, with a roughly circular, elliptical or an elongate base. The majority of seamounts are volcanic in origin and harbour a vast array of marine life (Rogers, 1994). Seamounts often traverse several oceanographic regimes, leading to strong gradients in the biological communities that are found on and around them (i.e. Wishner et al., 1990). These elevated topographies interrupt ocean circulation and flow, often affecting local current dynamics, turbulent mixing and upwelling (Kunze and Llewellyn Smith, 2004; White et al., 2007). Combined, the effect of these processes is generally an increase in primary productivity at the ocean surface, increased abundance and diversity of benthic marine life on the seamount and an increased presence of pelagic communities (Rogers, 1994; Porteiro and Sutton, 2007). The Josephine Seamount is known to support hexactinellid sponge aggregations of the species *Asconema setubalense* (Tabachnick & Menchenina, 2007) and gorgonian coral aggregations (*Callogorgia verticillata*, *Elisella flagellum)* (Lopez-Gonzales & Briand, 2002).

Seamounts are biologically distinctive habitats of the open ocean exhibiting a number of unique features (Rogers, 1994; Probert, 1999; Morato & Clark, 2007). Being subject to intensive currents and mostly associated with hard substrates, seamounts are host to very distinctive biological communities that are different to communities on nearby soft sediment dominated abyssal plain. Representing obstacles to flow, seamounts can induce local currents that can enhance upwelling around them thereby enhancing primary productivity in the area and supporting a wide variety of life (Rogers, 1994). Seamounts may attract pelagic fish including larger, commercially valuable species and other marine top predators such as loggerhead sea turtles (*Caretta caretta*) and marine mammals (Holland & Grubbs, 2007, Kaschner, 2007, Santos et. al., 2007).

1.3. Ecological significance

Being the westernmost seamount of the Horseshoe seamount group Josephine Seamount along with the unnamed seamount can be regarded as possible stepping-stones connecting fauna of the European slope and slopes of oceanic islands such as Madeira and the Azores and also the slopes of the Mid-Atlantic Ridge. Indeed as detailed in „*Characteristics of the Area*" other parts of the Horseshoe Seamount chain have been sampled and evidence indicates that they act as stepping stones for the dispersal of coastal fishes from the Mediterranean (Gonçlaves et al, 2004). Evidence that some of the faunal assemblages on the Josephine Seamount are similar to those of the European continental margin (Stocks & Hart, 2007) further supports this hypothesis.

Seamounts in general represent areas of enhanced productivity in comparison with nearby abyssal areas. Such increased productivity has also been reported for Josephine Seamount. Dense aggregations of *Elisella flabellum* with mutual distance between colonies about 10 cm were reported on the plateau of Josephine Seamount, both from basaltic outcrops and bioclastic sand (Grasshoff, 1972). Inhabiting sandy patches, ascidian *Seriocarpa* rhizoids can reach densities up to 750 specimens per m^{-1} (Diehl, 1970).

Studies of the meiofaunal communities of the Josephine Seamount revealed that samples taken from the summit plateau at depths of 206–355m yielded mean densities of 40.3 ± 14.0 individuals cm^{-2}. Samples taken just southwest of the Josephine Seamount were much lower (Levin & Gooday, 2003). Such increased productivity inevitably affects associated fauna and attracts migrating visitors such as pelagic fish. One hypothesis regarding the occurrence of high productivity over seamounts is that it is caused by current-topography interactions such as localized upwelling, enhanced turbulent mixing, and Taylor column formation, all of which have the potential to enhance primary productivity (Hesthagen, 1970; Gubbay, 2003). Another hypothesis to explain the higher productivity seen over seamount summits suggests another mechanism, which is the trapping of diurnally migrating plankton over the summit (Gubbay, 2003). Evidence from the area around Josephine Seamount supports this hypothesis suggesting the most likely food source for the seamount communities here is the bottom trapping of vertically migrating zooplankton organisms that are carried with currents during the night to the area above the seamount summit (Hesthagen, 1970). Injection of inorganic nutrients to the near-surface zone over shallow seamounts represents a very important source of nutrients to the local area. The nutrient input caused by current-topography interactions above seamounts is important to downstream plankton production and therefore it plays an important role in generating mesoscale patchiness of production in the open ocean, which in general is oligotrophic (Genin & Dower, 2007)

The relatively high biological productivity found within the designated area represents a potentially important feeding and resting ground for migrating pelagic fish and the North Atlantic population of Loggerhead sea turtle (*C. caretta*), which is known to migrate into the Mediterranean basin (Bentvigena et al, 2003; Gubbay, 2003). Many examples can be found of the ecological importance of seamounts such as, the seamounts around the Azores are known to be important for aggregating Orange roughy (*H. atlanticus*) and the Formigas Bank seamounts that are important for groups of small cetaceans such as Common dolphins, Bottlenose dolphins and Pilot whales (Gubbay, 2003).

Dense gorgonian coral habitat-forming aggregations of *Callogorgia verticillata*, *Elisella flagellum* may represent important feeding and sheltering grounds for seamount fishes and also potential shark nurseries as it has been shown for deep-sea gorgonian beds in the Gulf of Mexico (Etnoyer & Warrenchuk, 2007). Cold water, deep, habitat forming corals in other parts of the North East Atlantic have been shown to have as many as many as 1300 associated species (Roberts et al, 2006; Rogers et al, 2008). This has also been found for the megafauna observed in recent expeditions to the Mid-Atlantic Ridge, where diversity was found to be higher in areas where corals were present (Mortensen et al, 2008).

Available information shows that in the areas around Portugal and Madeira pregnant female *Centrophorus squamosus* (Leafscale Gulper sharks) and pups are usually found, whilst those found in more northern areas are pre-pregnant and spent females (ICES, 2007; Moura *et al.*, 2006). As little information about the stock identity of this species is known, it is considered one assessment unit by ICES (ICES, 2007) and therefore this large area (of which the marine protected area is part) may be important habitat for the reproduction of this commercially valuable and vulnerable species. This is particularly important given that a quarter of all chondrichthyans in the northeast Atlantic are threatened with extinction (Gibson *et al* 2008). *C. squamosus* is and has been a very valuable resource in the North east Atlantic and commercial French trawl data suggest that there has been an approximately 90% decline in CPUE for this species in all areas fished since 1995 (Gibson *et al* 2008). Within the vicinity of Josephine Seamount Portuguese data suggests that the population is stable, however the vast reductions in other areas highlight this species vulnerability to fishing (Gibson *et al* 2008).

1.4. High natural biological diversity

No taxonomical data from the Josephine Seamount is available to compare with other Lusitanean seamounts recently studied in the course of the OASIS project (see Scientific Value criterion) (Beck et al., 2006) and the total number of species reported can be estimated only from scattered taxonomical literature. However the list of determined species often cited by NGOs (e.g. Oceana, 2006) is underestimated.

To date about 150 species of invertebrates and 31 species of fish from the Josephine Seamount have been identified to species level, which is not considered high. Among invertebrate taxa reported from Josephine Seamount are Hexactinellid sponges (Tabachnick & Menchenina, 2007), Hydrozoa (Ansin et al., 2001, Zibrowius & Cairns, 1992), Scleractinia (Zibrowius, 1980), antipatharians, gorgonians (Grasshoff, 1985 Pasternak, 1985, Lopez-Gonzales & Briand, 2002), Polychaeta (Hartmann-Schroder, 1979, Gillet & Dauvin, 2000), Bivalvia (Dijkstra & Gofas, 2004; Krylova, 2006), Gastropoda (Gofas, 2005, Gofas, 2007 and others), Cirripedia (Poltarukha & Zevina, 2006), Ostracoda (Hartmann, 1985), Halacarida (Bartch, 1973a,b), Picnogonida (Stock, 1970, 1992), Brachiopoda (Gaspard, 2003; Zezina, 2006), Echinoidea (Mironov, 2006), Ascidia (Monniot & Monniot, 1992).

It was shown in a number of publications (see Gofas, 2007 for summary) that the fauna of Lusitanian seamounts represent an impoverished fauna of the continental slopes of Europe and North-eastern Africa with a relatively high percentage of Mediterranean species. However, some taxa with limited dispersal abilities, such as the family Rissoidae (Gastropoda) show a species radiation at the

Northeast Atlantic seamounts (Gofas, 2007). Reported endemics of the Josephine Seamount represent less than 3% of total number of species and include *Victorgorgia josephinae* (Alcyonaria), *Genetyllis macrophthalma* (Polychaeta), *Propontocypris josephineae* (Ostracoda), *Arhodeoporus brevocularis* and *Atelopsalis newelli* (Halacarida). Again this is a low figure, however, because of a gap in the knowledge of the two seamounts within the designated area and of seamounts of the North East Atlantic in general (Gubbay, 2003) this may not be accurate.

1.5. Representativity

The Josephine and Horseshoe Seamounts are considered as representatives of the Lusitanean seamount group. Most of the Lusitanian seamounts are situated within the Exclusive Economic Zones of member countries and cannot be taken into consideration for incorporation into high seas marine protected areas. Being the most remote seamount in the group it is likely that Josephine Seamount has the most impoverished continental faunal assemblage with a much higher percentage of open-oceanic elements than the rest of the Lusitanean seamount group, indeed this was the case for the Molluscan family Rissoidae (Gofas, 2007).

1.6. Sensitivity

Benthic Habitat

The unique ecosystems of seamounts are highly vulnerable and sensitive to external actions. Most of the fauna that are found on seamounts are long-lived, slow-growing organisms with low fecundity and natural mortalities, 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 localised distribution of many species (Samadi et al, 2007). Unsustainable fishery techniques result in degradation or even destruction of the benthic communities of seamounts and rapid collapse of fish stocks. Both benthic communities and fish stocks have uncertain but presumably very long recovery periods (Probert, 1999; Koslow, 2001; Thiel, 2003).

No habitat-forming scleractinians (such as *Lophelia*, *Madrepora* or *Solenosmilia*) were reported from the summit or slopes of Josephine Seamount. However most of the stations surveyed during recent cruises (SEAMOUNT 1 and Meteor 9c) were restricted to the plateau about 200-400 m deep. In the area studied 12 species of gorgonian corals (Grasshoff, 1985; Pasternak, 1985, Lopez-Gonzales & Briand, 2004), 14 species of solitary scleractinian corals (Zibrowius, 1980), 2 species of stylasterid corals (Zibrowius & Cairns, 1992), 2 species of black corals (Grasshoff, 1985) and the large hexactinellid sponge *Asconema setubalense* (Tabachnick, Menchenina, 2007) were reported. At least two species of gorgonians namely *Callogorgia verticillata* and *Elisella flagellum* and hexactinellid sponges grow in high densities and can be considered as highly vulnerable and slow recovering biogenic habitats.

Some gorgonian corals are known to live for over 500 years, as seen from examples found in New Zealand and New Caledonian seamounts (Samadi et al, 2007). In New Zealand when the Orange roughy (*H. atlanticus*) fishery began, giant bubblegum gorgonian trees (*Paragorgia arborea*) were trawled out of the ocean and their age was estimated at 300 – 500 years (Tracey et al, 2003; Samadi et al, 2007). Structural sponge habitat is also vulnerable to bottom fishing and has been shown to suffer immediate declines in populations through the physical removal of sponges, which then reduces the reproductive potential of the population, thereby reducing recovery capacity or even causing further declines (Freese, 2001). Experimental trawling over sponge communities in Alaska showed that one year after the experiment, individuals within the community showed no sign of repair or growth and there was no indication of the recovery of the community (Freese et al, 1999).

Crustaceans

King crab (*Chaceon affinis*) is normally found on seamounts at a depth greater than 500 metres and has been shown in some areas of the Atlantic to be vulnerable to fishing (ICES, 2007b). There is evidence that this species is taken as bycatch in the gillnet fisheries for anglerfish and deepwater shark species within the ICES Subarea IX (the relevant Subarea for the marine protected area), and that there is some evidence of directed fishing effort for this species (ICES, 2007b). The traditional crustacean fishery along the continental shelf and slope off Portugal traditionally targets Rose shrimp (*P. longirostris*), Norway lobster (*N. norvegicus*), the associated Red shrimp (*A. antennatus*) and occasionally the Scarlet shrimp (*Aristaeopsis edwardsiana*) (Figuiredo et al, 2001; ICES, 2007b). In recent years the commercial trawl fishery for these species has been intensive and has resulted in them being overexploited down to depths of 500m (Figuiredo et al, 2001).

Fish Species

Examples of sensitive seamount fauna that are known to inhabit seamounts close to the Josephine and Horseshoe Seamounts come from a variety of studies. Orange roughy (*H. atlanticus*) are known to form spawning aggregations over seamounts in the Azores Archipelago (Melo & Menezes, 2002; Barceloss et al, 2002; Gubbay, 2003). In areas where concerted fishing effort for *H. atlanticus* on seamounts has occurred, for example during the 1980s spawning aggregations were found over seamounts off New Zealand and Australia, the fishery here was at first lucrative but then stocks were rapidly reduced to less than 20% of their pre-exploitation abundance (Roberts, 2002). The same thing has been observed in the North Atlantic, where populations were targeted by mainly French fishers. Initial catches peaked at 4500t but dropped to 1000t within three years (Roberts, 2002). ICES ranked seamount species according to their vulnerability to fishing and *H. atlanticus* was ranked number one most vulnerable species (ICES, 2002; Froese & Pauly, 2007). Our own mapping of the distribution of *H. atlanticus* indicates that it is likely to be found in the designated area.

Vinnichenko (2002) showed that the total catch (mainly alfonsino and black scabbardfish) from nine seamounts in the South Azores area and in three seamounts of the Corner Rise area declined, in each area, from 12 000t to below 2 000t in just 2 years. In a larger area of the Mid-Atlantic Ridge including 34 seamounts, catches (mainly of *C. rupestris* and *H. atlanticus*) declined from 30 000t to below 2 000t in about 15 years (Morato & Clark, 2007).

A recent study by Devine and colleagues has shown that if deep-water fish species found over continental slopes in the Northwest Atlantic are assessed using the criteria of the International Union for the Conservation of Nature (IUCN) then they qualify as critically endangered (Devine et al, 2006). Unfortunately deep-sea fish species have yet to be evaluated by the IUCN, but their general life-history characteristics of long life, slow growth and low fecundity, combined with examples of sharp declines and collapses in fisheries that target them (e.g. Roberts, 2002; Vinnichenko, 2002) indicate that they require immediate protection.

Sharks

Pelagic shark aggregations over seamounts in general are poorly understood and underreported (Litvinov, 2007). Queiroz et al (2005) tagged 168 blue sharks (*Prionace glauca*), along the Portuguese coast, of which 34 were recaptured. From the recaptured sharks 32 were recaptured in the vicinity of areas with high bottom relief, such as seamounts, which suggested that they may be attracted to these areas for feeding or orientation (Queiroz et al, 2005). The *P. glauca* population found within the OSPAR area is only part of the single stock unit considered for the entire North Atlantic (ICES, 2007). This species is pelagic and highly migratory. Although no known targeted fishery for this species is known, it can be found as bycatch in many of the fisheries that target tuna and billfishes, where it can comprise up to 70% of the catch (ICES, 2007). Within the ICES area *P. glauca* are caught in a number of ICES Subareas, including IX, which is where the marine protected area is located (ICES, 2007). Landings data for *P. glauca* are considered unreliable, mainly because it is one of several pelagic species that are reported generically (ICES, 2007), but the species has declined significantly in northern Atlantic parts of its range since the 19th century (Roberts, 2007).

Litvinov (1989) found dense aggregations (more than twenty times as abundant as adjacent oceanic waters) of sharks over several seamounts in the North East Atlantic, including Meteor, Yer, Erving and Atlantis. Experimental longlining on seamounts around Madeira identified several fish species which might be subject to commercial fishing. Several elasmobranch species were also identified, including the Leafscale gulper shark (*Centrophorus squamosus*), the Portuguese dogfish (*Centrophorus coelolepis*), the Gulper shark (*Centrophorus. granulosus*) and the Porbeagle (*Lamna nasus*) (Gubbay, 2003). In northern Portugal a directed long-line fishery for the Gulper shark (*C. granulosus*) exists, which also occasionally lands *C. squamosus* and *C. coelolepis* (Gordon et al, 2003). All these elasmobranch species are classified as having a low resilience and highly vulnerable to fishing by Froese & Pauly (2007). A ban on gillnet fishing in ICES Subareas VI and VII has displaced fishing effort into Subarea VIII (the Subarea directly north of the marine protected area) and IXb (the Subarea that the marine protected area is located) (ICES, 2007). A new gillnet and longline fishery developed within these two Subareas in 2006, the most important species landed from Subarea IX included several deep-water sharks (135 tons, plus 31 tons of livers and oil) (ICES, 2007). ICES noted declines in the CPUE series of both *C. squamosus* and *C. coelolepis* in other Subareas, which suggests unsustainable fishing and has recommended that the Total Allowable Catch (TAC) be set to zero for the entire distribution of both stocks and additional measures taken to prevent bycatch of both species in fisheries targeting other species (WGEF, 2007). The actual TAC for deepwater sharks in Subarea IX for 2008 has been set at 1646t, which is a reduction from the previous year (ICES, 2007). A number of other regulations are in place to prevent bycatch of these species, including bans on gillnet and trawl fisheries in waters deeper than 200 metres in the Azores,

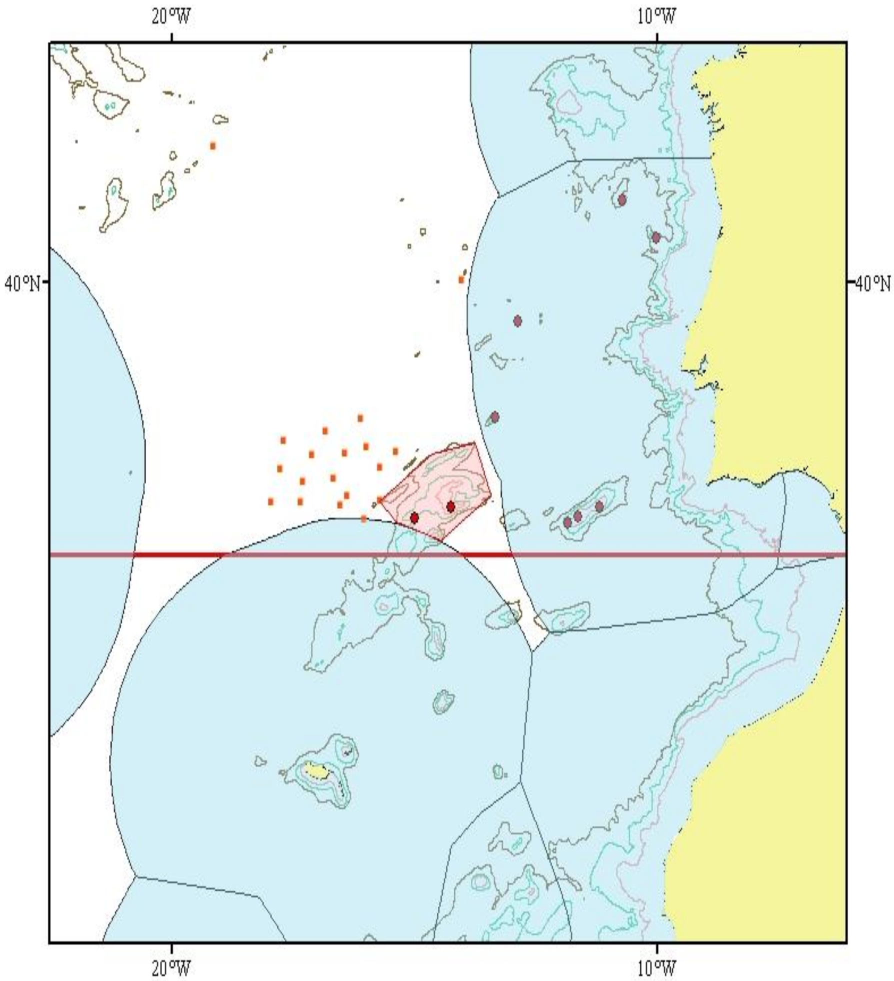

Figure 5. *Historical Sperm whale catch data (orange squares), shows that the region to the northeast of the designated area has a cluster of recorded catches. Red circles are known seamount locations, blue shaded areas are Exclusive Economic Zones, the red shaded area is the marine protected area and the red line running east to west is the southern limit of the OSPAR maritime boundary.*

Madeira and the Canary Islands and a gillnet ban in all waters deeper than 200m in NEAFC regulatory areas (ICES area international waters) (ICES, 2007).

Landings data for the two most important commercial deepwater sharks (*C. squamosus* and *C. coelolepis*) within the ICES area, have been combined by some of the main countries involved in their exploitation since the beginning of the fishing (ICES, 2007). Therefore, despite having differing biological traits, ICES is forced to combine these two species for assessment (ICES, 2007). Recent landings data for deepwater sharks (primarily consisting of *C. squamosus* and *C. coelolepis*) show that they are the lowest for the entire ICES area since the fishery reached full development in the early 1990s and much lower than the available TACs (7100t) (ICES, 2007). As quota restrictions have increased in the southern areas and populations have remained relatively stable in comparison to northern areas it is predicted that discarding of deepwater sharks will have increased (ICES, 2007). Indeed there is evidence of Irish fishers discarding their entire catch of *C. squamosus* and other species due to rotten deepwater sharks from excessive soak times in gillnet fisheries (ICES, 2007). IUU fishing is also known to take place for deepwater sharks, especially in international waters (ICES, 2007). ICES has also categorised both *C. squamosus* and *C. coelolepis* as highly vulnerable to exploitation (ICES, 2007), therefore protection for these highly vulnerable species in international waters is vital.

As highly mobile pelagic species that are known to frequent seamounts in the region and are landed from Subarea IX it is highly likely that several of the most commercially important deep-water shark species will be found with this area. The IUCN"s Shark Specialist Group has assessed the threatened status of deepwater sharks globally. It concluded that all deepwater chondrichthyan species have limited productivity and therefore should be considered as having limited ability to sustain high levels of fishing pressure and will be slow to recover from overfishing (Kyne & Simpfendorfer, 2007)

Cetaceans

Seamounts are known to be ecologically important to top predators. This is emphasized by the fact that some far ranging pelagic species concentrate their mating or spawning on seamounts (Gubbay, 2003). An example of this within the OSPAR maritime area is found on Formigas Bank (approximately 37°19'N, 24°40'W), which is found near the Azores Archipelago. This area appears to attract groups of small cetaceans such as bottlenose and common dolphins and pilot whales (Gubbay, 2003).

Data from historical Sperm whale (*Physeter macrocephalus*) catches in the North East Atlantic, show clustered records in the region just north west of the marine protected area (Figure 5). This suggests that this species was once common in this area and may even have frequented the seamounts of the region as feeding grounds.

Sea Turtles

Two species of ocean-going sea turtle are present in the North East Atlantic, the Leatherback (*D. coriacea*) and the Loggerhead (*C. caretta*), both of which are known to make long migrations across the Atlantic from nesting sited to foraging grounds (Ferraroli et al, 2004; Hays et al, 2006; Doyle et al, 2008). A few satellite tracking studies have been conducted within the OSPAR region and have shown that individuals can be found in the area off the coast of Spain, amongst other areas (Hays et al, 2006; Doyle et al, 2008). There are known nesting sites for *C. caretta, D. coriacea,* and *Chelonia mydas* (Green turtle) found within the Mediterranean (Tomás et al, 2002; Bentvigena et al, 2003; Delaugerre & Cesarini, 2004). Atlantic *C. caretta* are known to migrate into the Mediterranean (Encalada et al, 1998).

The knowledge of sea turtle associations with seamounts is primarily based on the Loggerhead (*C. caretta*) (Santos et al, 2007). Most of the loggerheads that are found in the North East Atlantic have been carried across the Atlantic Ocean via the Gulf Stream from nesting sites in the South East United

States (Santos et al, 2007). The loggerheads that frequent the waters around the Azores, Madeira and the Canary Islands are in the juvenile oceanic stage of development (Carr, 1986; Bolten et al, 1998; Santos et al, 2007). The possible reasons for sea turtle associations with seamounts include an increase in prey items and the fact that they use geomagnetic fields for navigation and may therefore use the magnetic signatures of seamounts for this purpose (Santos et al, 2007).

1.7. Naturalness

Fishing is affecting these seamounts, although there is possibly a high degree of naturalness in deeper slopes of the seamounts (Clark et al., 2007). Ongoing bottom fishing may result in damage to large suspension-feeders such as hexactinellid sponges, gorgonians and black corals (Freese, 2001).

2. Practical criteria/considerations

2.1. Potential for restoration

Given the lack of mapping effort in the area there is little detailed knowledge of benthic structures that exist within the designated area or their present condition. Given the on-going fishing, it is likely that any affected species will take time to recover from past impacts. Shallow areas over the summits can be expected to recover more rapidly than deep areas.

2.2. Degree of acceptance

As noted earlier, the designated area includes seamount and deep sea sponge aggregations, habitats listed as priority threatened or declining habitats by OSPAR (OSPAR Commission, 2003). It includes seamount and cold-water sponge habitats that qualify as Vulnerable Marine Ecosystems in relation to high seas fisheries according to criteria developed by FAO (FAO 2007, Rogers et al, 2008). It also contains seamount communities and sponge aggregation that are habitats listed as examples of ecologically or biological significant marine areas according to criteria developed by the CBD for identifying candidate sites for protection on the high seas (UNEP 2007). Therefore there are strong scientific grounds for protection of the area.

The marine protected area occurs in ICES Subarea IX, where a directed Portuguese longline fishery for Black scabbardfish (*A. carbo*) and a Spanish longline fishery for Red seabream (*Pagellus bogaraveo*) occur (ICES, 2007b). In 2006 a new English deepwater gillnet fishery was initiated targeting deepwater sharks and crabs (ICES, 2007b). The use of gill nets at depths over 200 metres has been banned in the waters of the Azores, Madeira and the Canary Islands (ICES, 2007b). Therefore it is possible that these fisheries may operate in or near to the marine protected area, which may cause some resistance to implementation. Given that several nations are known to fish within the site it is thought that some form of consultation will be required if management decisions are to be made regarding their activities.

There is no information about mining within or near the marine protected area. In the future, exploitation of seamounts by humans could expand in scope. A possible threat could be mineral exploitation and mining their deeper cobalt crusts, (Probert, 1999). However, no valuable mining resources are known for this area.

Bioprospecting on seamounts for possible sources of biotechnology (for example bacteria on hydrothermal vents) may occur in the future (Gubbay, 2003). Extensive samples of large and small suspension-feeders (Porifera, Alcyonaria, Ascidia) that represent potential interest to bioprospectors have been found on the Josephine Seamount (Lopez-Gonzales & Briand, 2002). Their exploitation could seriously affect the vulnerable ecosystem of both seamounts in the designated area (Synnes, 2007). However, no information is known about proposed bioprospecting on Josephine Seamount and it seems more likely that this will occur around hydrothermal vents in the near future (Synnes, 2007).

No known tourist activity occurs in the marine protected area, therefore it is an unlikely source of conflict.

The area may be used by ships and if restrictions were put in place to prevent ship passage (e.g. to protect cetaceans from boat collisions) there may be objections to the designation.

There may be possible conflicts in terms of cable laying at some point in the future, however no data are available to discuss this further.

2.3. Potential for success of management measures

Present knowledge of seamount biology demonstrates that preventive measures can be considered as the only way to successful manage the vulnerable and highly sensitive ecosystem of the Josephine Seamount. To successfully manage the area a complete cessation of all bottom trawling and long-line fishing is required as well as the protection of the area from the potential negative impacts from future bioprospecting.

On the one hand, high seas marine protection will be more difficult to implement than in places closer to land, where patrols and enforcement measures can be easily administered. However, on the other hand, protection may be easier to achieve because the number of users of the areas a much more limited, and their activities can be monitored remotely and in a cost-effective way by Vessel Monitoring Systems and satellites (Kourti *et al.*, 2001; Marr and Hall-Spencer, 2002; Deng *et al.*, 2005; Kourti *et al.*, 2005; Murawski *et al.*, 2005; Davies et al, 2007; Rogers et al, 2008).

2.4 Potential damage to the area by human activities

For the habitats included in this area, the most damaging industry operating the North East Atlantic is deep-sea and high seas fishing (OSPAR, 2007). Seamount related fisheries represent a significant proportion of the total high seas fish catch. Of all the deep-sea fisheries, most target species are associated with seamounts (Brewin et al, 2007). Historically seamount research has lagged behind, or at best paralleled seamount exploitation (Brewin et al, 2007). Intensive fishing may seriously impact entire seamount ecosystems, resulting in damage of large suspension-feeders such as hexactinellid sponges, gorgonians and black corals. Long-line fishing may affect the abundance of top-predators attracted to seamount such as loggerhead sea turtles, shark species and cetaceans, as well as impacting on benthic invertebrates when lines are hauled at an angle. Since the introduction of Exclusive Economic Zones in 1977, Josephine Seamount has become one of only two fishable seamounts in the high seas, within the vicinity of Madeira, the Canary Islands and Portugal. Fishing has continued there intermittently since 1977 (Fomin et al, 1980; Vinnichencko & Khlopenyuk, 1983; Clark et al, 2007). However, there is a real threat that as shallower fish stocks are depleted, the focus will turn to further exploitation of the deep ocean and the seamounts of the high seas (Clark et al, 2007).

Extensive samples of large and small suspension-feeders (Porifera, Alcyonaria, Ascidia) that represent potential interest to bioprospectors have been found on the Josephine Seamount (Lopez-Gonzales & Briand, 2002). Their exploitation could seriously affect the vulnerable ecosystem of both seamounts in the designated area (Synnes, 2007).

It is unlikely that mining activities will occur at the Josephine Seamount as no valuable minerals have been reported and the relatively young age, hydrology and sedimentation regime results in low potential for cobalt-crust accumulation.

Hazardous materials have accumulated in Mediterranean water with atmospheric rainout and riverine input and polycyclic aromatic hydrocarbons can be transported with Mediterranean outflow via Strait of Gibraltar (Green et al, 2003). This water is transported as highly saline bottom water, which is most likely to affect bottom communities (Green et al, 2003). It is estimated that 50,500km^3 of

Mediterranean Sea water is exported to the Atlantic Ocean each year (Green et al, 2003). These hazardous substances can be trapped via meddies collisions over both the Josephine and Horseshoe Seamounts and the other Lusitanian seamounts and also via current-topography interactions. This would then allow them to be taken up by plankton and so enter the trophic chain (see Thiel, 2003). The implementation of a marine protected area in this region clearly will not solve this problem, however several international agreements such as the Barcelona Convention and the EU Water Framework Directive deal with such issues (Green et al, 2003).

2.5. Scientific value

Scientific knowledge about seamounts in general, including those in the North East Atlantic is poorer than for many other marine habitats and as such there is a clear need for information about these areas (Gubbay, 2003). The severe lack of knowledge means that the designated area should be protected now, using the Precautionary Principle and then a basis for study and monitoring of the area should be developed, which will inform future decisions regarding spatial protection of similar habitats.

The European Commission funded a fifth framework programme called OASIS (Oceanic Seamounts: An Integrated Study) that has sponsored a series of expeditions to North Atlantic seamounts (primarily the Sedlo and Seine seamounts) (Brewin et al, 2007). OASIS is the epitome of the growing emphasis on interdisciplinary seamount research and has combined geologists, physical oceanographers, taxonomists, ecologists and conservation scientists on its repeated cruises (Brewin et al, 2007). The OASIS project concluded its fieldwork phase in 2005, however a more recent programme began called EuroDEEP (under the European Commission initiative called EuroCores) that will include seamounts in their study of deep-sea habitats (Brewin et al, 2007). The Census of Marine Life also launched a programme in 2005 that focused on seamounts, the Census of Marine Life on Seamounts (CenSeam) (Brewin et al, 2007). The CenSeam programme has several goals including the co-ordination and expansion of existing research through developing standard methods and reporting and also to aggregate existing data by further developing the SeamountsOnline (http://seamounts.sdsc.edu/) an open-access portal for seamount data (Brewin et al, 2007).

The Josephine seamount has potential value for a number of disciplines. It has been studied since its discovery in 1869 as the direct result of oceanic explorations (Brewin et al., 2007), and has also been studied in the scope of many national and oceanographic expeditions. Both the Josephine and Horseshoe Seamounts can be regarded as areas of great scientific value and have been suggested as unique science priority areas that should be protected for future generations (Thiel, 2001). The long-term data set available for this seamount provides a unique opportunity for long-term monitoring of seamount ecosystems. Given the proximity of Josephine seamount to the continent this sort of monitoring would be easier to conduct than on a more remote seamount.

C. Proposed management and protection status

1. Proposed management

Indicate which actual or potential human activities taking place in the area might need regulation through a management plan.

The following actual or potential human activities taking place in the area will or might need regulation through a management plan:

- Deep sea and high seas fishing using fixed and mobile gears (both at the seabed and in the water column)
- Vessel traffic

- Seabed mining or other resource exploitation
- Bioprospecting
- Cable laying
- Military sonar

2. Any existing or proposed legal status

I National legal status (e.g., nature reserve, national park):

II Other international legal status (e.g., NATURA 2000, Ramsar):

None to date.

Presented by
Contracting Party: Portugal (Ministry of Environment and Spatial Planning)
Organisation: Instituto da Conservacao da Natureza e da Biodiversidade
(Contact persons: Pedro Ivo Arriegas and Mário Silva)
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Annex 1

Species and habitats of special interest for the Josephine Seamount-MPA

A. Habitats

Threatened and/or declining Habitats[9]

- Seamounts
- Coral Gardens

Other Features of special concern

- Deepwater and epipelagic ecosystems, including their function for migratory species
- Habitats associated with seamount structures, including their function as recruitment and spawning areas
- Benthopelagic habitats and associated communities, including commercially fished species
- Hard substrate habitats and associated epibenthos, including cold water corals and sponges
- Soft sediment habitats and associated benthos, including "coral gardens" of non-scleractinian corals

B. Species

Threatened and/or declining Species

- Portuguese dogfish (*Centroscymnus coelolepis*)
- Gulper shark (*Centrophorus granulosus*)
- Leafscale gulper shark (*Centrophorus squamosus*)
- Porbeagle shark (*Lamna nasus*)

- **Other Species of special concern**

- Cetaceans
- Deep water sharks
- Oceanic seabirds

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9 According to the OSPAR List of threatened and/or declining Species and Habitats (OSPAR Ref. No.: 2008-6)

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OSPAR's vision is of a clean, healthy and biologically diverse North-East Atlantic used sustainably

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