Final 30 August 2009

OSPAR Commission Submission to CBD Expert Workshop on scientific and technical guidance on the use of biogeographic classification systems and identification of marine areas beyond national jurisdiction in need of protection

29 September – 2 October 2009, Ottawa, Canada

The Charlie Gibbs Fracture Zone and six other areas approved in principle as potential components of the OSPAR network of Marine Protected Areas

Introduction

1. Following a ministerial commitment in 2003, and in accordance with Annex V of the OSPAR Convention, the OSPAR Commission is working to establish a network of coherent, well-managed marine protected areas (MPAs) for the OSPAR Maritime Area (North-East Atlantic).

2. Some 40% of the OSPAR Maritime Area lies Beyond National Jurisdiction (mostly within OSPAR Region V -The Wider Atlantic).Recent submissions to the Commission on the Limits of the Continental Shelf (CLCS) may eventually alter this percentage.

3. The Worldwide Fund for Nature (WWF), as a longstanding Observer organisation to OSPAR, has campaigned to seek protective status for selected areas in the High Seas. From 2006 a focus of that campaign in the North-East Atlantic has been the Charlie Gibbs Fracture Zone (CGFZ), an extensive area of the Mid Atlantic Ridge.

4. In 2003 OSPAR adopted guidelines for the identification and selection of Marine Protected Areas, including ecological and practical criteria for the selection of areas for protection. Working with these criteria, OSPAR has provided a forum for co-ordination with deep sea scientists, which has shown that they can be used for selection of MPAs in Areas Beyond National Jurisdiction (ABNJ). Building upon this experience, OSPAR was able to make an informed input to the CBD marine expert workshop held in Azores, Portugal (October, 2007), and the agreed outcomes of this workshop (UNEP/CBD/COP9/INF/44) have a strong synergy with the OSPAR MPA selection criteria. Significance of biodiversity for the High Seas of OSPAR Region V is summarised in a document compiled by France during 2008.[1]

5. At the 2008 OSPAR Commission meeting (OSPAR 2008) the WWF proposal for and MPA for the CGFZ, now co-sponsored by the Netherlands, Portugal and France, was approved in principle as a potential MPA in ABNJ as a component of the OSPAR network of MPAs. The scientific case for CGFZ as an OSPAR MPA, which had been developed subject to a review by the International Council for the Exploration of the Seas (ICES), OSPAR 2008 agreed a programme of work for the development of Conservation Objectives for the CGFZ and wider consultation with other Competent Authorities on the best ways to achieve these.

[1] What is at stake in OSPAR's High Seas: a preliminary study (ICG-MPA 08/03/01), April 2008

6. OSPAR 2009 endorsed the Conservation Objectives for the CGFZ MPA as set out in the nomination proforma (OSPAR 09/6/5[2]), but noted that further work was needed on management of the area.(following which the nomination proforma would need to be revised). OSPAR 2009 also agreed that six other areas[3] should be approved, in principle, as potential MPAs in ABNJ as potential components of the OSPAR network of MPAs (subject to specific study reservations).

7. The establishment of a part or the whole of the CGFZ as a component of the OSPAR Network of MPAs is a key target for the OSPAR Commission Ministerial Meeting in September 2010.

<u>Applicability to the criteria, data analysis and data availability</u>

8. OSPAR Selection Criteria combine 7 ecological criteria (as stated previously these are similar to CBD criteria for ecologically and biologically sensitive areas (EBSA), with the addition of representativity) and 5 practical criteria. Nomination proformas (accompanying this submission) provide detailed evidence of how the CGFZ and the other 6 areas have been evaluated against each individual OSPAR criteria. Whilst ecological criteria establish a *primae facie* scientific case, OSPAR has been mindful that the practical criteria (potential for restoration, degree of acceptance, potential for success of management measures, potential damage to the area by human activities, and scientific value) are also critical if EBSAs are to attain protective status. Thus the OSPAR approach considers both set of criteria in parallel.

9. Of relevance to the EBSA criteria 'uniqueness or rarity' and 'threatened, endangered or declining species and/or habitats' , OSPAR has developed the OSPAR List of Threatened and/or Declining Species and Habitats (based on the OSPAR Texel-Faial criteria). This regional-specific tool focuses debate and assists decision-making. Unique or unusual geomorphological or oceanographic features are taken into account by OSPAR when establishing the character of the area. CGFZ, for example, is located on an extremely complex and unique biogeographic boundary, increasing the probability of attainment of OSPAR/EBSA criteria.

10. EBSA criteria include reference to 'relatively' high(er) proportions of habitats/naturalness and 'comparatively' higher productivity/diversity. OSPAR work has identified problems in terms of lack of replication and paucity of information when making such judgements (see lessons learned below).

11. WWF have undertaken a detailed comparative analysis of the OSPAR selection criteria against EBSA criteria and UN/FAO criteria of VMEs, confirming that, in the context of OSPAR's well developed proposals, the EBSA criteria are effective and should be further applied globally[4] (as at Annex 1). It is hoped that comments from the University of York, who were commissioned to research and put

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[2] Revised Nomination Proforma for the proposed Charlie Gibbs Fracture Zone MPA (OSPAR 09/6/5), June 2009

[3] Nomination Proformas for 6 proposed Marine Protected Areas (MPAs) in Areas Beyond National Jurisdiction (ABNJ) (OSPAR 09/6/9), June 2009

[4] Christiansen, S. (2009) Charlie Gibbs Fracture Zone: Experience on the identification of an OSPAR MPA in Areas Beyond National Jurisdiction and application of the CBD 'EBSA' criteria – Annex 1. WWF Germany, 21 August 2009

forward the 6 areas considered by OSPAR 2009, on the 5 required properties and components for MPA networks can be raised verbally during the Workshop..

<u>Lessons learned</u>

12. Application of deep sea science in determining EBSAs in need of protection in open-ocean waters and deep-sea habitats requires a precautionary approach:

- Whilst there will probably always be a need for more research to achieve better understanding this in itself should not be a barrier to identifying EBSAs; and
- In time advances in deep sea technology (e.g. ROVs) will make these areas more accessible to science. For example, the European HERMES / HERMIONE project has been influential for European continental shelf margins, highlighting information gaps and new aspects of ecosystem functioning, key relationships and species vulnerability that have added weight to the CGFZ discussions.

13. Information on deep sea species and habitats is scarce and the scientific case for a specific area needs to be consolidated over time also using data from similar sites:

- CGFZ has benefited from targeted research cruises (MARECO and Ecomar) in areas where biogeographically there is a high(er) probability that EBSA criteria will be fullfilled. This favours a two-step approach in practice: desk study supported by subsequent further ground truthing;
- For the other potential OSPAR MPAs in ABNJ, some of which are very remote and for which research cruises would be prohibitively expensive (e.g. Milne Seamount), analogues are useful with similar ‘nearby’ sites and/or features for which studies have indicated EBSAs; and
- Pragmatically this also favours consideration of a few areas of larger extent (compared to EBSAs in coastal waters – where there are many smaller areas)

14. It is not necessary for EBSAs to meet all criteria. For example, OSPAR and EBSA criteria both include ‘naturalness’. CGFZ whilst remote is not pristine, some habitats having been affected historically by deep-sea fishing.

15. EBSA criteria will not necessarily help factor in global change:

- The impacts of future ocean warming and ocean acidification on open-ocean waters and deep-sea habitats are not well understood. EBSA criteria could certainly be influenced by such factors and EBSAs could become ‘barometers’ for biodiversity change and regime shifts. CGFZ incorporates the meandering North-East Atlantic polar front in an extremely significant area for climate change;
- A case could be made to ‘reinforce’ EBSA criteria, to identify buffer areas and/or consider those areas most resilient to global change

16. Promoting areas on the basis of EBSA criteria can prompt protective measures:

- The OSPAR 2008 decision to promote CGFZ as a potential MPA in ABNJ was in itself significant attracting global interest. Increased dialogue between key competent authorities (e.g. OSPAR Commission, International Seabed Authority, North-East Atlantic Fisheries Commission (NEAFC), International Maritime Organisation) has raised awareness and prompted formal Memorandums of Understanding. UNEP-WCMC included the area on their MPA database:

- It could be argued that the OSPAR MPA work has been influential in the decision by NEAFC in April 2009 to close 5 areas, on the Mid Atlantic Ridge in the High Seas of the North-East Atlantic, to bottom fisheries in order to protect Vulnerable Marine Areas from significant adverse impacts. These most recent closures, in force until 31 December 2015 (subject to review), incorporate 5 smaller areas closed on a temporary basis in 2004, and largely mirror the OSPAR MPA proposals.

Action requested

17. On the basis of this evidence the OSPAR Commission would welcome recognition by the CBD that the OSPAR examples presented qualify as EBSAs in need of protection in open-ocean waters and deep-sea habitats.

Links to websites an references

www.ospar.org
www.mar-eco/no
www.oceanlab.abdn.ac.uk/ecomar
www.hermes.net

Annex 1: Application of the OSPAR, CBD EBSA and UN /FAO criteria to the Charlie Gibbs Fracture Zone (please note: this comparison will be submitted similarly by WWF)

OSPAR MPA network criteria (OSPAR 2003-17)	***CBD EBSA criteria*** (COP 9 Decision IX/20 Annex I)	***UN / FAO criteria of VMEs*** (FAO 2009)	***Qualifications of the proposed Charlie Gibbs MPA*** (see OSPAR 08/7/9-E, BDC 09/5/8-E and BDC 09/11/1-E, Annex 9)
	Uniqueness or rarity Area contains either • unique („he only one of its kind), rare (occurs only in few locations) or endemic species, populations or communities, and/or • unique, rare or distinct, habitats or ecosystems; and/or • unique or unusual geomorphological or oceanographic features	**Uniqueness or rarity** An area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by similar areas or ecosystems. These include: - habitats that contain endemic species; - habitats of rare, threatened or endangered species that occur only in discrete areas; or - nurseries or discrete feeding, breeding, or spawning areas.	The combination of features represented in the proposed Charlie Gibbs MPA is probably unique, including - The ridge itself with its mountain chains and peaks providing for a substantial **hard substrate** environment from abyssal to relatively shallow depths - A major ridge fracture zone which offsets the ridge by 5° to the east and opens a deep sea **biogeographic connection** between the northwest and northeast Atlantic - A permanent frontal area which maintains a **north-south biogeographic divide,** contributing to a relatively high species diversity - An **increased faunal biomass** and probably elevated pelagic productivity near a permanent, meandering subpolar front, temporally and spatially variable between Lat 48-53 N.

OSPAR MPA network criteria (OSPAR 2003-17)	***CBD EBSA criteria*** (COP 9 Decision IX/20 Annex I)	***UN / FAO criteria of VMEs*** (FAO 2009)	***Qualifications of the proposed Charlie Gibbs MPA*** (see OSPAR 08/7/9-E, BDC 09/5/8-E and BDC 09/11/1-E, Annex 9)
Ecological significance The area has: - a high proportion of a habitat/biotope type or a biogeographic population of a species at any stage in its life cycle; - important feeding, breeding, moulting, wintering or resting areas; - important nursery, juvenile or spawning areas; or	**Special importance for life history stages of species** Areas that are required for a population to survive and thrive	**Functional significance of the habitat** Discrete areas or habitats that are necessary for the survival, function, spawning/reproduction or recovery of fish stocks, particular life-history stages (e.g. nursery grounds or rearing areas), or of rare, threatened or endangered marine species	Due to its relatively high faunal biomass and probably elevated pelagic productivity near the subpolar front, the area is of particular importance as a - **feeding area for marine mammals**, such as blue, sei and sperm whales, and **seabirds** from breeding colonies as far away as from the Azores - The ridge structure is important for **deep water sharks**, - its topographically induced hydrographic conditions enhance deepwater **teleost fish aggregations**, and - it is an important **reproduction area** for roundnose grenadier, orange roughy and bathypelagic fish. - The area provides otherwise scarce hard substrate and suitable current and feeding conditions to be an important **stepping stone** in the regional dispersal of cold water corals.

OSPAR MPA network criteria (OSPAR 2003-17)	***CBD EBSA criteria*** (COP 9 Decision IX/20 Annex I)	***UN / FAO criteria of VMEs*** (FAO 2009)	***Qualifications of the proposed Charlie Gibbs MPA*** (see OSPAR 08/7/9-E, BDC 09/5/8-E and BDC 09/11/1-E, Annex 9)
Threatened or declining species and habitats/biotopes The area is important for species, habitats/biotopes and ecological processes that appear to be under immediate threat or subject to rapid decline as identified by the ongoing OSPAR (Texel-Faial) selection process. **Important species and habitats/biotopes** The area is important for other species and habitats/biotopes as identified by the ongoing OSPAR (Texel-Faial) selection process.	**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 signifi cant assemblages of such species	see **Functional significance of the habitat** **Uniqueness or rarity**	The proposed MPA provides an important functional habitat to - **dermersal deep water fish** like a.o. orange roughy, grenadiers, redfish, alfonsinos and deep-water sharks. The decline of these taxa is documented, however the severity of decline remains unclear to date - **marine mammals** such as sperm, sei, fin and blue whales, - Migratory **seabirds** - Living *Lophelia pertusa* and 40 other **coral** taxa have been observed at all depths and locations surveyed, although not in the extensive reef-type structures found off the coast of Norway . - Rich hexactinellid **sponge** communities or ‘gardens’ around the Charlie Gibbs Fracture Zone and the associated seamounts occur down to 3000 m depth. many of the features listed as threatened and/or declining species/habitats by OSPAR (2008).

OSPAR MPA network criteria (OSPAR 2003-17)	***CBD EBSA criteria*** (COP 9 Decision IX/20 Annex I)	***UN / FAO criteria of VMEs*** (FAO 2009)	***Qualifications of the proposed Charlie Gibbs MPA*** (see OSPAR 08/7/9-E, BDC 09/5/8-E and BDC 09/11/1-E, Annex 9)
Sensitivity The area contains a high proportion of very sensitive or sensitive habitats/biotopes or species.	**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	**Fragility** (an ecosystem that is highly susceptible to degradation by anthropogenic activities) **Life-history traits of component species that make recovery difficult** (ecosystems that are characterized by populations or assemblages of species with one or more of the following characteristics: - slow growth rates; late age of maturity; - low or unpredictable recruitment; or - long-lived.	**Complex benthic habitats** Coral and sponge communities in deep water are extremely slow growing, with occurrence and growth being limited by substrate and food availabilty. **Deepwater sharks** 44 species of deep water sharks known from the area, among these three species listed as particularly threatened and/or declining by OSPAR. Generally, deepwater sharks are confined to the upper 2000 m of the ocean, all within fishing depth, and extremely sensitive to overfishing due to their life history traits. They require a high energy environment such as around seamounts, the peaks of the ridge and near the subpolar front. **Seamount fish spawning aggregations** The commercially most relevant fish species from the area (roundnose grenadier, redfish, orange roughy, alfonsino, cardinal fish, ling, tusk) are typical K-strategists and form temporal aggregations which makes them highly vulnerable to overfishing.

OSPAR MPA network criteria (OSPAR 2003-17)	***CBD EBSA criteria*** (COP 9 Decision IX/20 Annex I)	***UN / FAO criteria of VMEs*** (FAO 2009)	***Qualifications of the proposed Charlie Gibbs MPA*** (see OSPAR 08/7/9-E, BDC 09/5/8-E and BDC 09/11/1-E, Annex 9)
Ecological significance The area has: a high natural biological productivity of the species or features being represented.	**Biological productivity** Area containing species, populations, or communities with comparatively higher natural biological productivity		Compared with other oceanic habitats such as the abyssal plains and their oligotrophic pelagic zones, it is likely that the productivity on the MAR is high, within the meandering subpolar front even similar to more northern waters.
High natural biological diversity The area has a naturally high variety of species (in comparison to similar habitat/biotope features elsewhere) or includes a wide variety of habitats/biotopes (in comparison to similar habitat/biotope complexes elsewhere)	**Biological diversity** Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity	**Structural complexity** (an ecosystem that is characterized by complex physical structures created by significant concentrations of biotic and abiotic features. In these ecosystems, ecological processes are usually highly dependent on these structured systems. Further, such ecosystems often have high diversity, which is dependent on the structuring organisms)	The benthic and pelagic species diversities recorded so far, and the range of habitats found within the proposed MPA are extensive. The inclusion of at least two faunal biogeographic provinces raises the diversity above similar or smaller areas comprising fewer habitats and e.g. only a single province. The diversity of corals is assumed to be higher than on the northern continental shelves.

OSPAR MPA network criteria (OSPAR 2003-17)	***CBD EBSA criteria*** (COP 9 Decision IX/20 Annex I)	***UN / FAO criteria of VMEs*** (FAO 2009)	***Qualifications of the proposed Charlie Gibbs MPA*** (see OSPAR 08/7/9-E, BDC 09/5/8-E and BDC 09/11/1-E, Annex 9)
Naturalness The area has a high degree of naturalness, with species and habitats/biotope types still in a very natural state as a result of the lack of human-induced disturbance or degradation.	**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		The overall size of the proposed Charlie Gibbs MPA is such that most of the area can be expected to be unaffected by human activities. However the relatively small area of the ridge structures within fishing depth are likely to have been at least explored if not commercially fished involving damage of unknown scale to benthic biota and the deepwater fish community. Indications are the relatively frequent observations of lost fishing gear.
Representativity The area contains a number of habitat/biotope types, habitat/biotope complexes, species, ecological processes or other natural characteristics that are representative for the OSPAR maritime area as a whole or for its different biogeographic regions and sub-regions.	Representativity MPA network criterion(COP 9 Decision IX/20 Annex II)		The area is nominated for its importance as a section of the northern Mid-Atlantic Ridge, The area proposed is large enough to represent all functional habitats and communities of the northern Mid Atlantic Ridge around the Charlie Gibbs Fracture Zone and adjacent abyssal plains. It includes a large number of identified seamounts with a summit depth shallower than 1500 m, and a permanent oceanic front.

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OSPAR CONVENTION FOR THE PROTECTION OF THE MARINE ENVIRONMENT OF THE NORTH-EAST ATLANTIC

ICG ON MARINE PROTECTED AREAS (ICG-MPA)
BONN (GERMANY): 1-3 APRIL 2008

What is at stake in OSPAR's High Seas: a preliminary study

Presented by France

This preliminary document and its annexes propose a method, with examples, towards implementing an MPA network in the High Seas of OSPAR.

Action requested

ICG-MPA is requested to consider this document for discussion in its deliberations on matters related to developing a process for reviewing and disseminating proposals for MPAs in areas beyond national jurisdiction (ABNJ).

Preliminary study
About what is at stake in Ospar's High Sea

Agence des aires marines protégées (France)

OSPAR ICG MPA meeting in Bonn, April 1st-3rd, 2008

Introduction:

The aim of this paper is to propose a method and give examples of its possible application, which could help in implementing a MPA network in the High Seas of OSPAR, both by improving the strategic analysis and through a better participation of stakeholders. The main objective is to develop global information in the concerned area, from three points of view: 1-ecosystems, 2-habitats and species of special interest, 3-natural resources and human activities. The principle is to use existing data, to compile them and to share the way they will be used with stakeholders, and finally to reach a global cartographic synthesis for each of the three topics.

To halt the loss of biodiversity is crucial and to propose a MPA network is one of the best alternatives shared by most of the international community. However, the difficulties to work in areas beyond national jurisdiction are well known: principles of Freedom, global commons, fisheries and fish market, interaction between UNCLOS and the CBD, new trends, new uses and the difficulties to obtain reliable data are some of the most important problems. In OSPAR's High Sea – the focus is on the region V -, all these questions are relevant. A lot of publications, papers, workshops and website give information about for example the problem of overexploitation of the resources, the impacts of trawls on the seabed and the hotspots of biodiversity, as well as concerns for a new governance for biodiversity and for strategies to develop an ambitious policy for MPAs with all stakeholders such as NGO's, WGPA, SBSTTA, Regional Fisheries Organizations and Countries. Nevertheless, we suggest that the conditions for developing a shared strategy are not yet optimal, having no practical representation of the information, lacking access to relevant data and failing to take into account socio-economical deciding factors. Though it won't fill the existing gap in knowledge, we make the hypothesis that some progress made in the availability of data and the representation of information could help in the process of establishing a network of MPAs in the high seas.

Method:

The objective is to reach global information in the study area about three topics:

- ecosystems,
- habitats and species of special interest,
- natural resources and human activities.

The main principle is to associate stakeholders at each step of the process. The minimum would be through the setting up of a consultative group including representatives of the different categories of stakeholders, but we could look forward having a better commitment of stakeholders through the contribution to data gathering as well as collection of empirical information. The difficulty stays in defining who can represent stakeholders. In the context of OSPAR region V, we could propose to involve OSPAR contracting parties, North East Atlantic Fisheries Commission, International Maritime Organization, International Seabed Authority and NGOs. Other bodies should participate, like FAO or ICES, with the particular purpose of providing technical and scientific support.

The first step consists in getting existing data and information available. It means bibliography, contacts with data owners, contracts with them to handle the data, digitization of data, harmonization of data formats and constitution of metadata. With the first step stands the first list of problems: no geographic data or no data at all for several topics, privacy of data, bad quality of data, etc… The participation of stakeholders is useful at this stage for identifying sources of data and facilitating access to data.

The second step is to process the data in order to constitute a portfolio of maps documenting the area. Here starts the categorization in the three thematic fields of ecosystems, habitats and species of special interest, and natural resources and human activities. Here starts also the interpretation of data and key questions like: the balance between different points of view (e.g. impact vs economic value for one activity), the modeling of information where data is lacking (e.g. modeling presence of coral reefs rather than relying on observations), the use of indicators (e.g. species richness of marine mammals), etc…

The third step consists in elaborating a synthesis map for each of the three thematic fields. The main point is to produce original maps and avoid doing simply GIS processing. The value of the final product depends as much on its scientific and technical value as on the appropriation by stakeholders of the representations made.

At steps two and three the association of stakeholders to the process could help for scientific validation, empirical validation, and mixing expertise. But it is mainly justified by the fact that the negotiation for future MPAs somehow begins there. It is important to acknowledge that the whole process contains a strong part of subjectivity, even if it is based on the best data possible. In the process, you must choose which elements are more or less important, which criteria you must necessarily take into account and how to represent and interpret the results.

Further steps will consist in the definition of a strategy for creating a MPA network and in the formal approval procedures for this strategy. They are out of the scope of the present paper.

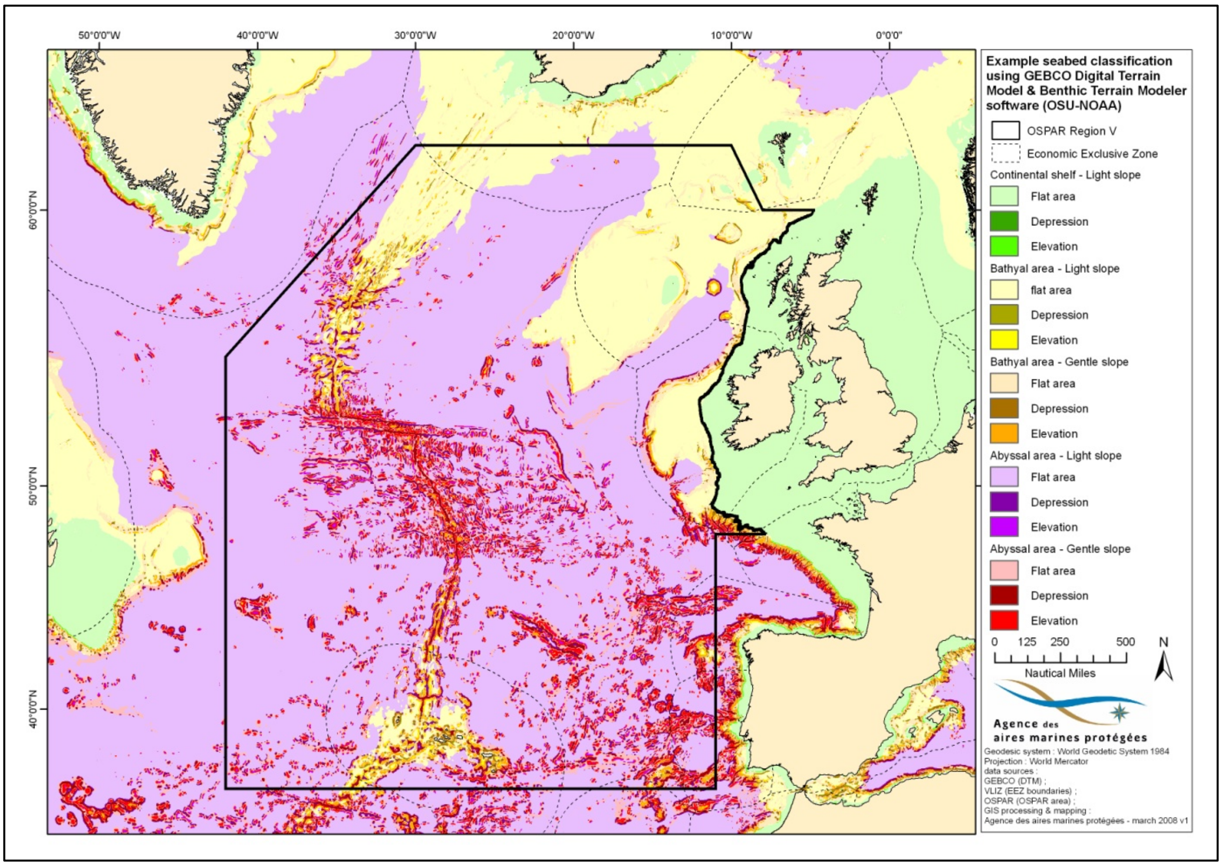
To illustrate the method, we focused in the following parts on possible products of step two, with a few examples of what kind of products we could expect. Our references were official websites which role consists in data collecting and banking such as “seamountsonline”, “serpentproject”, “seaaroundus”, “aquamaps”, “sealifebase”, “fishbase”, “cephbase”, “LargeMarineEcosystem”, “iobis”, “fao”, “ices” and some other websites like “ifremer” and the last but not the least, “Ospar”. We had some contacts with experts to give further details and information about data available. Moreover, the Technical Report from CBD titled “Patterns of species richness in the High Seas” and the book “Seamounts: ecology, fisheries & conservation” gave us some keys to describe the scientific knowledge.

<u>Ecosystems</u>

It would be perfect to be able to map the value of ecosystems or even more precisely the different services to human beings and functions in the biosphere they procure. We are far from that, but we can at least identify spatial patterns in the description of ecosystems which could make sense when defining a spatial planning strategy. We looked for examples with bathymetry, primary production, and we expect interesting perspectives from operational oceanography data.

The very first map of the deep seascape has been realized in the early 1970’s thanks to satellites. The technology has permitted to increase the precision and the representation of the deepseascape. Defining a classification of seabed and choosing colors, we tried to highlight the existence of particular features.

Fig. 1: A proposal of Seabed classification



In order to identify primary production, we looked at available remote sensing data and tried several processing. We present below results for the month of May and for a mean annual value. More work is necessary to refine what could be the most relevant information. Nevertheless, the comparison between the two maps illustrates the importance of the time factor, mean values presenting the weakness of being less spatially discriminating and occulting seasonal phenomenon.

Fig. 2 : Inter annual (2003-2006) mean concentration of Chlorophyll (mg/m^3) for months of may

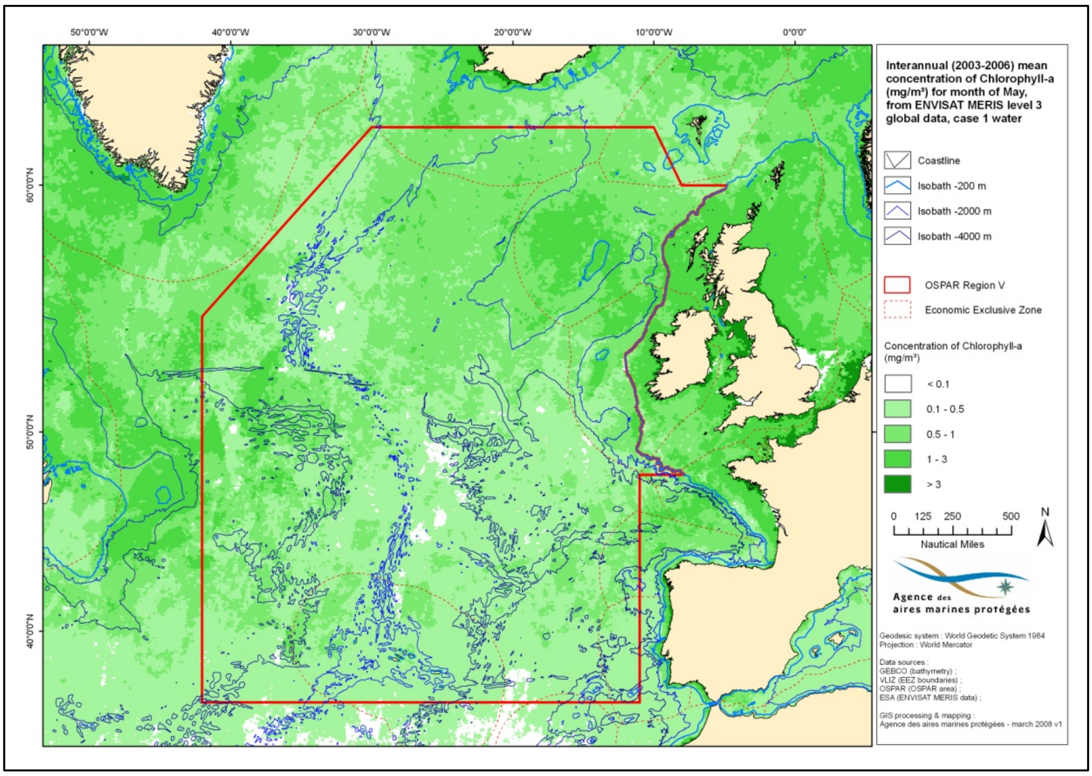
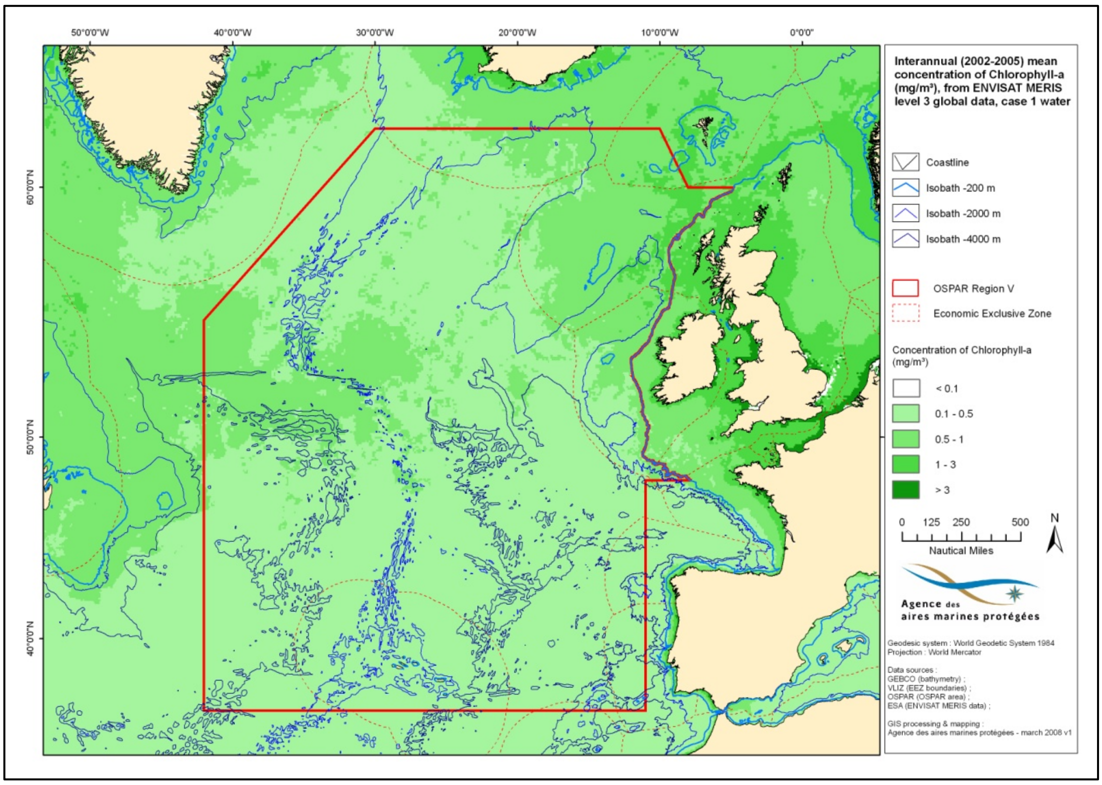


Fig.3 : Interannual (2002-2005) mean concentration of Chlorophyll A (mg/m^3)



Habitats and species of special interest

In this thematic field, the main difficulty is the data available. No systematic inventories have been made, and they are out of reach. Generalization from modeling is probably the only way. Examples are given for marine mammals and seamounts and coral reefs.

- **Marine Mammals**

Marine Mammals are considered to be some of the most spectacular and majestic mega fauna on earth. We can count around 120 species and some of them are considered to be facing imminent extinction. It's difficult to build a map to represent the distribution of marine mammals in Ospar Region V due to the gap of existing data in areas beyond margins, continental slopes and EEZ's. Kaschner et al. developed a global suitability model for predicting heterogeneous patterns of occurrence of 115 marine mammal species. As Kristin Kaschner wrote "*Most available information is based on anecdotal or qualitative descriptions, but there are nevertheless few studies –mostly conducted in the CCS – that could demonstrate a general association of a number of marine mammals species with areas of high contour indexes*".

See Annex 1

- **Seamounts**

Seamounts, as its result from tectonic and volcanic processes, focused the attention of the scientific community since the mid 20th century. Seamounts, as we pay more attention to the reliefs and because reliefs usually mean biological richness, concentrated more and more investigations and researches for the last 20 years. Mapping seamounts depends on the definition taken, particularly the size range, the scale and the method to represent them. The result could vary from 10000 to 100000 seamounts for the world oceans. For example, world distribution of seamounts as it appears from the latest references shows an important disparity with the seamounts distribution map of OSPAR Region V.

- **Coral reef (*Lophelia pertusa*)**

Deep Sea Coral reefs and especially, Lophelia pertusa's Reef, are more and more considered. This reef-forming coral is known since a long time but the technology and the concern about deep seas have increased the focus on for scientists and policy makers.

See annex 2.

Resources and human activities

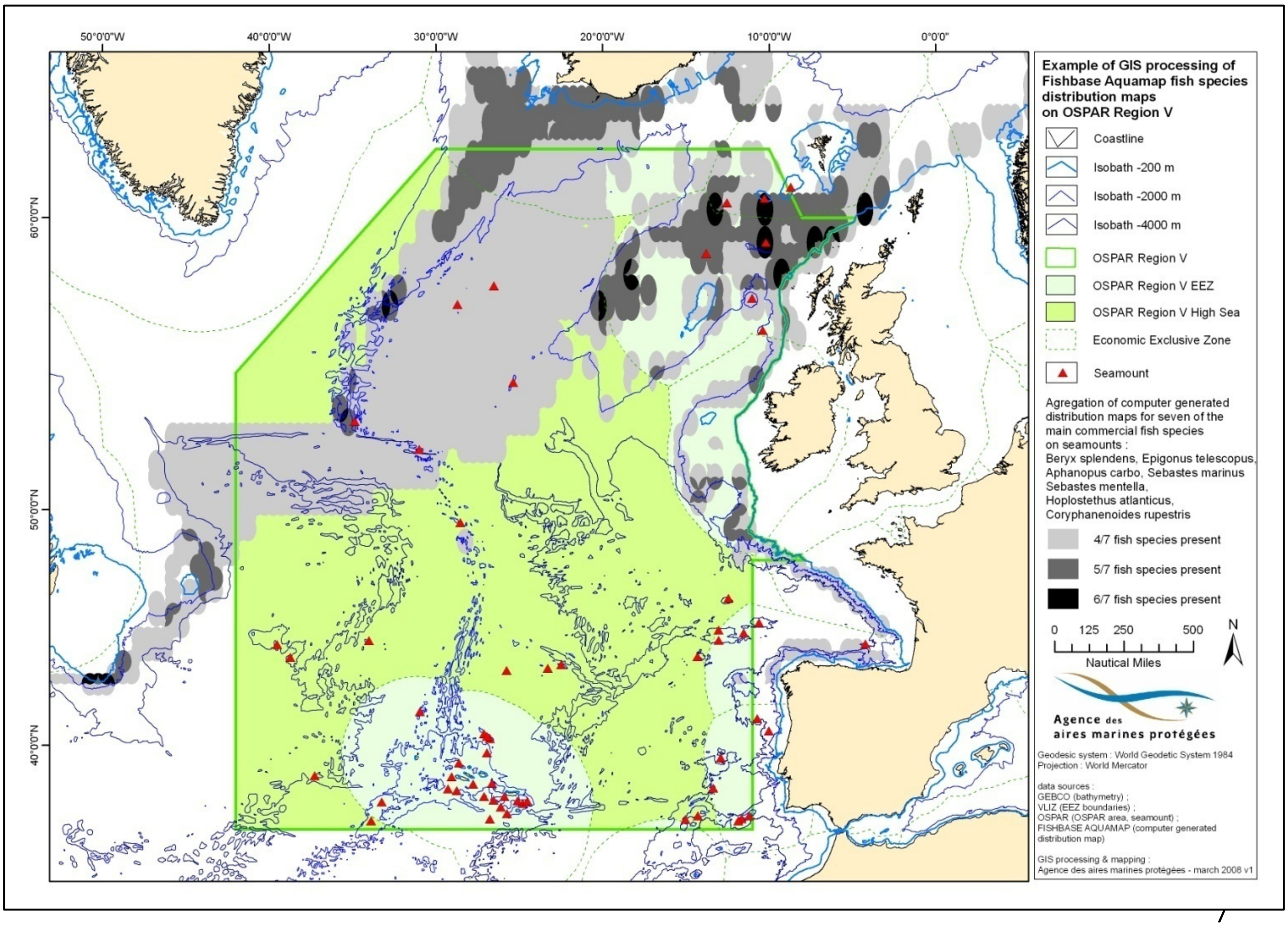
This thematic field is the most sensitive with regard to the necessary dialogue between stakeholders toward the definition of a network of MPAs. Again, it is not so easy to inform, inventories of resources being very scarce, and the existing information being often bound by confidentiality rules. Even more than for the two previous thematic fields, the association of stakeholders could be an opportunity to overcome partly these difficulties and produce new information.

To illustrate this field, we take examples concerning fish of commercial interest and fisheries activities, mining resources, nuclear waste disposals and maritime transport. None of the maps below are satisfactory, and they are presented as possible ways forward rather than final product. It is worthwhile to underline that we avoid an approach in terms of impact, which is the most common way of dealing with human activity when looking for protection measures of the sea, but not the best to expect a strong participation of stakeholders in the discussion.

- **Fish of Commercial interest**

Statistics on fish of commercial interest are not so easy to convert in maps. We took a list of 6 species: *Beryx splendens*, *Epigonus telescopus*, *Aphanopus carbo*, *Hoplosthetus atlanticus*, *Sebastes spp*. and *Coryphaenoides rupestris* which are ones of the main commercial fish species on seamounts and especially in OSPAR Region V.

Fig. 6: Example of GIS processing of Fishbase Aquamap fish species distribution maps on OSPAR Region V



- **Fisheries**

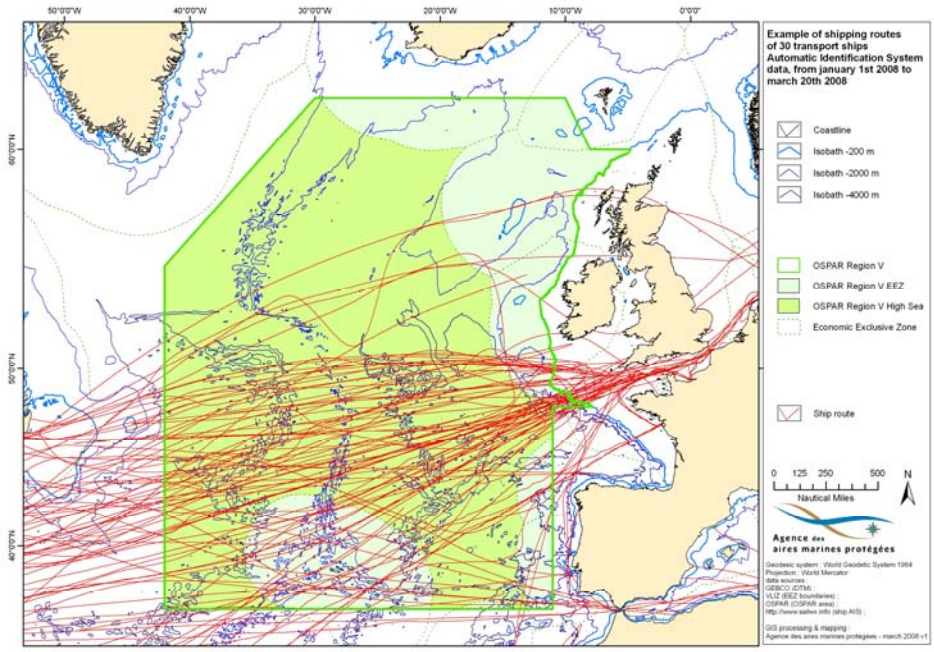
We tried to aggregate data about fisheries and we faced the reality mentioned by Rogers and al in UICN report (2008), “*it is not possible to estimate the percentage of VMEs, or even seamounts, that have been subject to deep-sea fishing because accurate geo-referenced fisheries data is incomplete and knowledge on the distribution of VMEs is poor*”. There is two kinds of problems: from the origin, the data is not well informed by fishermen and sometimes, countries don’t really cooperate to transfer data to ICES. However, ICES has a complete data set thanks to satellites and VMS. The information is confidential, with commercial interest attached to it, so ICES can’t export the data. Agreements could probably be reached on the exportation of data already processed, e.g. the map in annex 3 extracted from ICES WGDEEP 2007, chapitre 16, p 438.

- **Mining resources and nuclear waste disposal**

This example is given to illustrate the diversity of human interest for the high seas. See annex 4.

- **Maritime transport**

A final example is given on maritime transport, though it is made out uncomplete data (better sources have been identified). As for other activities, the spatial repartition of maritime transport is not homogeneous in the study area.



Conclusion

This preliminary study focused on some of the numerous data we could use to think about a MPA network in areas beyond national jurisdiction and on some ways of using them. This working paper expresses the difficulties to get valuable data and to reach exhaustiveness. It also emphasizes the necessity of a process shared with stakeholders. We suggest, as a conclusion, that further work should be done in that direction, in a collaborative way, and forsters international discussion by providing evidence of what is at stake and where in the high seas.

Main references

Barkai A., Bergh M., 2005. *Use and abuse of data in fishery management*, In: Shotton R. (ed.), Deep Sea 2003: Conference on the Governance and Management of Deep-sea Fisheries. Part 1: Conference reports. Queenstown, New Zealand, 1–5 December 2003. FAO Fisheries Proceedings. No. 3/1. Rome, FAO, 274-292.

Cheung W., Alder J., Karpouzi V., Watson R., Lam V., Day C., Kaschner K., Pauly D., 2005. *Patterns of Species Richness in the High Seas*. CBD Technical Series No. 20, Secretariat of the Convention of Biological Diversity, 1-31.

Commission Staff Working Document, 2006. *Reflections on the management of genetic resources in areas beyond national jurisdiction - Background documents for the green paper towards a future maritime policy for the union: a European vision for the oceans and seas*, paper n°12, 1-10.

Davies A.J., Roberts J.M., Hall-Spencer J., 2007. *Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management*, Biological Conservation, 138, 299–312.

Gianni M., 2004. *High Seas Bottom Trawl Fisheries and their Impacts on the Biodiversity of Vulnerable Deep-Sea Ecosystems: Options for International Action*. IUCN, 1-88.

Halpern B.S., and al., 2008. *A Global Map of Human Impact on Marine Ecosystems*, Science, 319, 948.

Kaye S., 2004. *Implementing high seas biodiversity conservation: global geopolitical considerations*, Marine Policy, 28, 221–226.

Kitchingman A., Lai S, 2004. *Inferences of potential seamount locations from mid-resolution bathymetric data*. In: *Seamounts: Biodiversity and Fisheries*. Fisheries Centre Research Report 12(5): 7–12.

Morato T., Watson R., Pitcher T.J., Pauly D., 2006. *Fishing down the deep*, Fish and fisheries, 7, 24-34.

Perrings Ch., 2005. *The conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction: the economic problem*, 1-28.

Pitcher T.J., Morato T., Hart P.J.B., Clark M.R., Haggan N., Santos R.S, 2007. *Seamounts: Ecology, Fisheries and Conservation*. Blackwell. 1-527.

PNUE/ONU. 2007. *Vue d'ensemble de la gouvernance internationale et des aspects scientifiques concernant les écosystèmes et la biodiversité de la haute mer et des grands fonds marins*. Neuvième réunion mondiale sur les Conventions et Plans d'action pour les mers régionales, Djeddah (Arabie saoudite), 29-31 octobre 2007. UNEP(DEPI)/RS.9/4.

Roberts C.M., 2002. *Deep impact: the rising toll of fishing in the deep sea*, Trends in Ecology & Evolution, Vol. 17. 5, 242-245.

Rogers A.D., Clark M.R., Hall-Spencer J.M., Gjerde K.M., 2008. *The Science behind the Guidelines: A Scientific Guide to the FAO Draft International Guidelines (December 2007) for the Management of Deep-Sea Fisheries in the High Seas and Examples of How the Guidelines may be Practically Implemented*. UICN Publication, 1-39.

Secretariat of the International Task Force on Global Public Goods, 2006. *Expert Paper Series Two: Global Commons*. Secretariat of ITF, 1-204.

Shotton R. (ed.), 2005. *Deep Sea 2003: Conference on the Governance and Management of Deep-sea Fisheries. Part 1: Conference reports*. Queenstown, New Zealand, 1–5 December 2003. FAO Fisheries Proceedings. No. 3/1. Rome, FAO,718p.

Sumaila U.R., Zeller D., Watson R., Alder J., Pauly D., *Potential costs and benefits of marine reserves in the high seas*, Marine Ecology Progress Series, Vol. 345: 305–310.

Preliminary study
About what is at stake in Ospar's High Sea

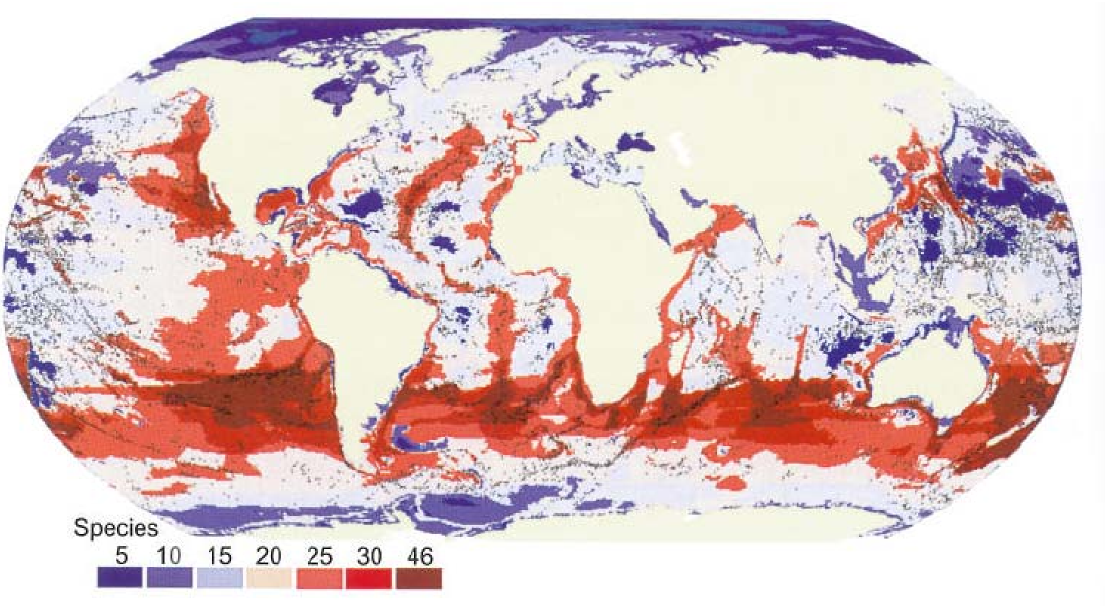
Agence des aires marines protégées (France)

OSPAR ICG MPA meeting in Bonn, April 1st-3rd, 2008

ANNEXES

Annex 1

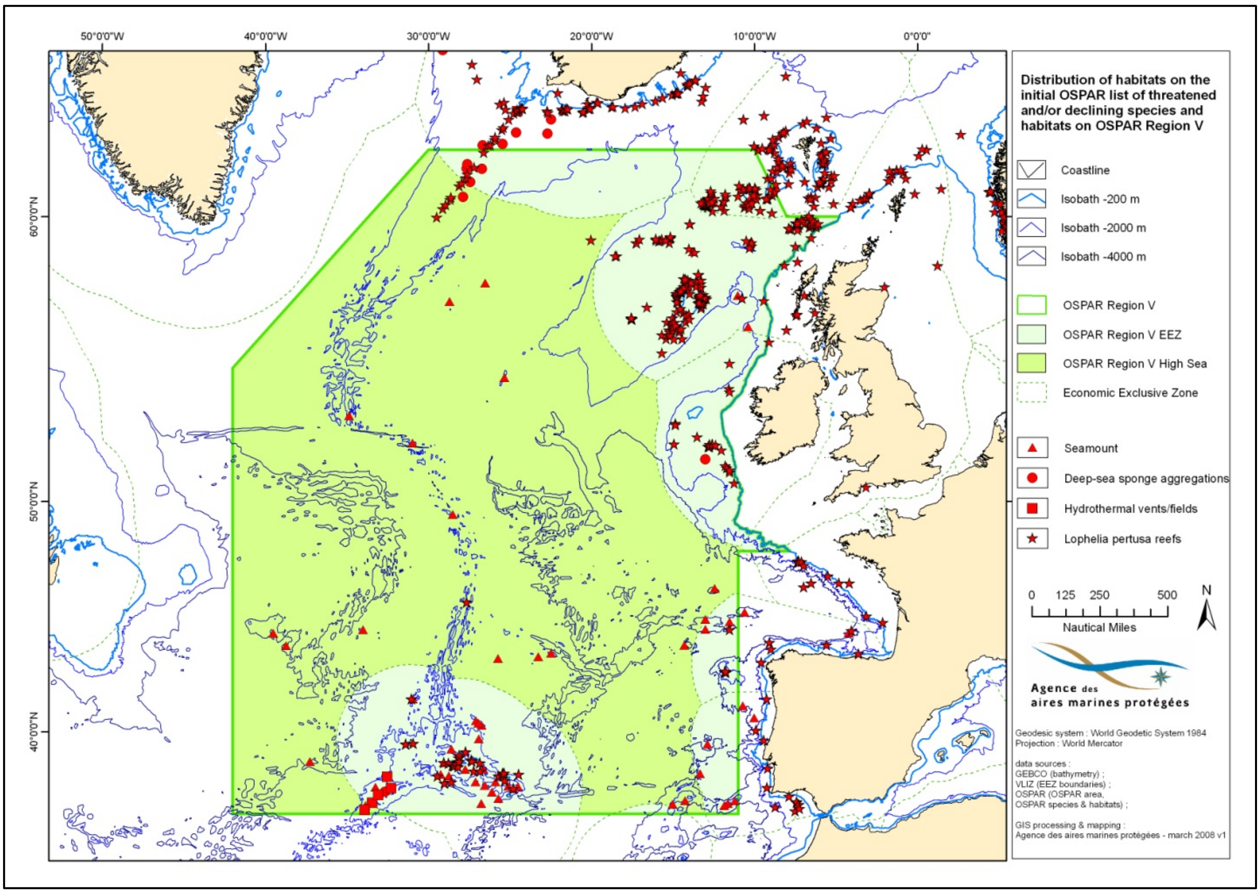
Fig 4 : Map of predicted global marine mammal species richness (115 species; core areas only) and superimposed seamount locations (black dots). Species numbers shown in key are the maximum in each color category.



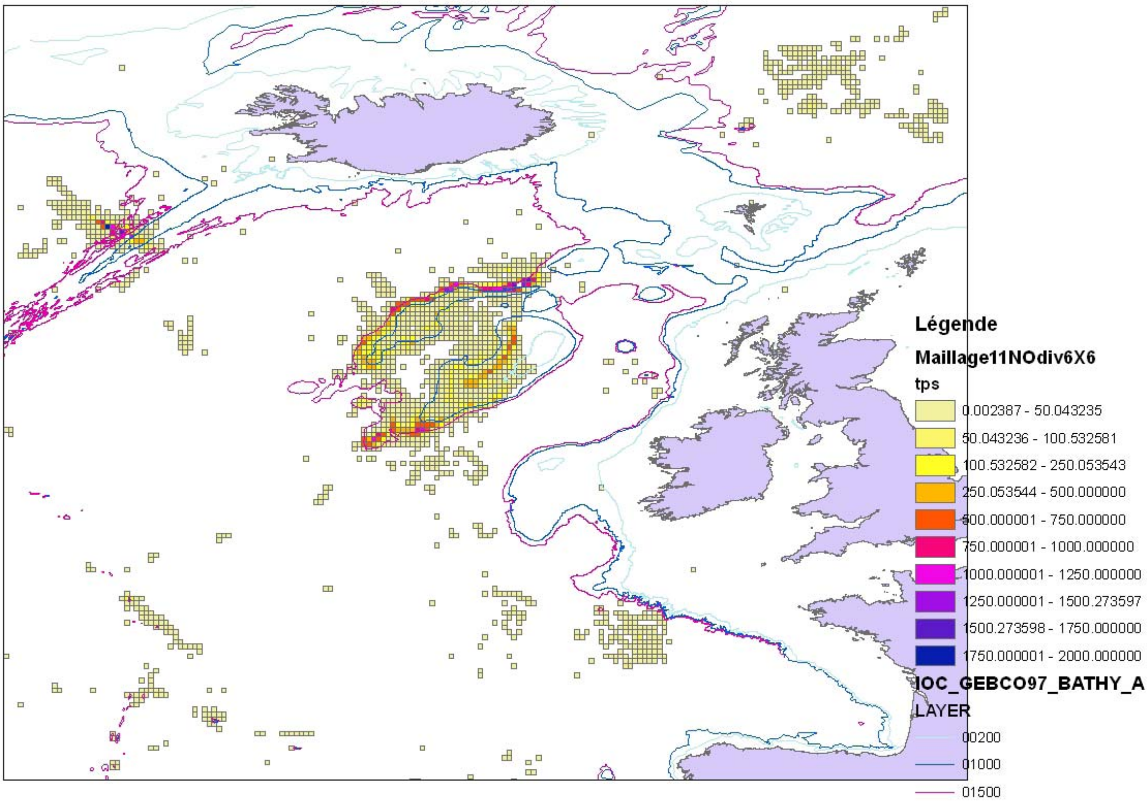
Source: Kaschner K., 2007. Air-breathing visitors to seamounts: marine mammals, in Pitcher and al., *Seamounts: Ecology, Fisheries & Conservation*, 12A, 230-238.

Annex 2

Fig. 5: Distribution of habitats on the initial list of threatened and/or declining species and habitats on OSPAR Region V

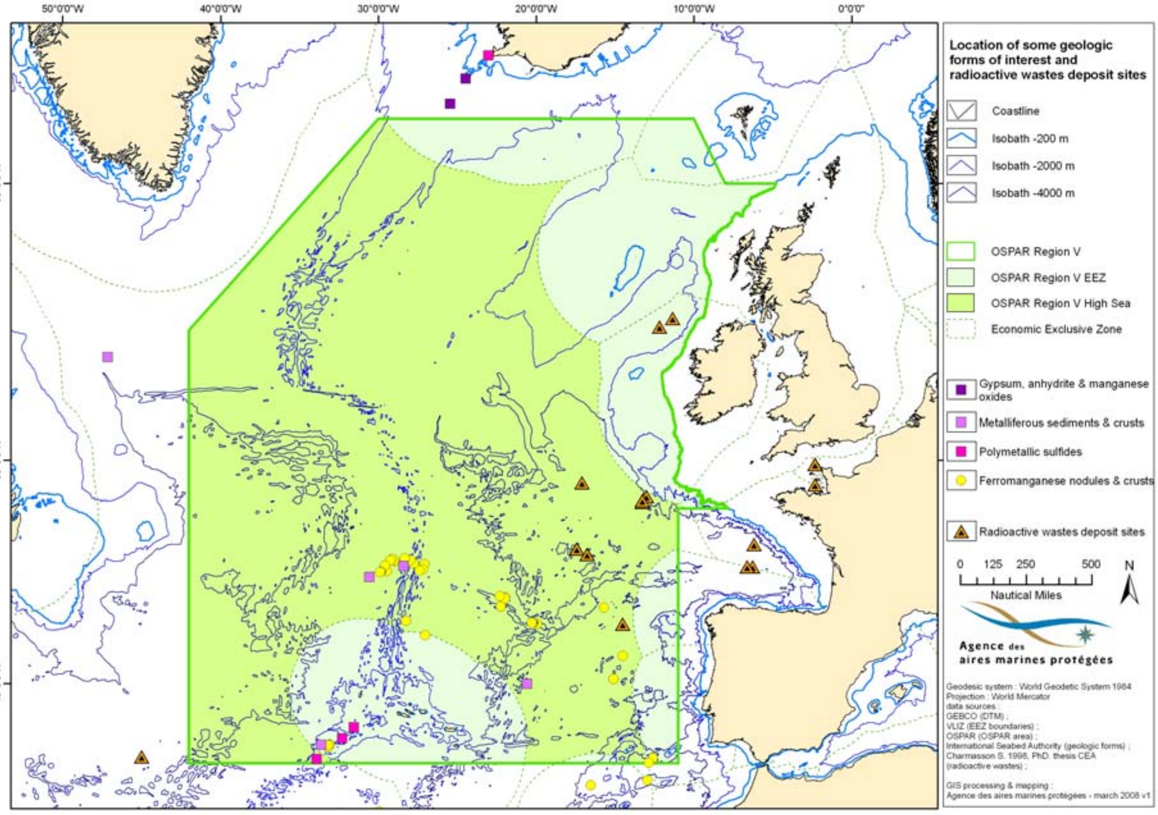


Annex 3



"Figure 16.1. 2005 spatial distribution and intensity of the fishing effort of some bottom trawlers (representing 36% of total records) in international waters within NEAFC jurisdiction. The size of each square is of 6 x 6 nautical miles. "

Annex 4



50°0'0"W
40°0'0"W
30°0'0"W
20°0'0"W
10°0'0"W
0°0'0"
60°0'0"N
50°0'0"N
40°0'0"N
Location of some geologic forms of interest and radioactive wastes deposit sites
Coastline
Isobath -200 m
Isobath -2000 m
Isobath -4000 m
OSPAR Region V
OSPAR Region V EEZ
OSPAR Region V High Sea
Economic Exclusive Zone
Gypsum, anhydrite & manganese oxides
Metalliferous sediments & crusts
Polymetallic sulfides
Ferromanganese nodules & crusts
Radioactive wastes deposit sites
0 125 250 500
Nautical Miles
N
Agence des aires marines protégées
Geodesic system : World Geodetic System 1984
Projection : World Mercator
data sources :
GEBCO (DTM) ;
VLIZ (EEZ boundaries) ;
OSPAR (OSPAR area) ;
International Seabed Authority (geologic forms) ;
Charmasson S. 1998, PhD. thesis CEA (radioactive wastes) ;
GIS processing & mapping :
Agence des aires marines protégées - march 2008 v1

OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic

Meeting of the OSPAR Commission (OSPAR)

Brussels (European Commission): 22 - 26 June 2009

Revised nomination proforma for the proposed Charlie Gibbs Fracture Zone MPA

Presented by the Secretariat

OSPAR is invited to consider the revised nomination proforma for the Charlie Gibbs Fracture Zone and agree whether this needs to be further developed to allow for its adoption to support the inclusion of the area in the OSPAR MPA network

Background

1. OSPAR 2008 agreed that a comprehensive scientific case had been established for the CGFZ as a potential OSPAR MPA and that collectively Contracting Parties had expressed substantial political support for further work on the CGFZ proposal. The CGFZ was consequently approved in principle as a potential MPA in ABNJ as a component of the OSPAR network of MPAs.

2. OSPAR agreed a 'road map' for 2008-09 setting out a critical path of considerations and steps to be taken with a view to considering for possible adoption of MPAs in ABNJ at the OSPAR Ministerial Meeting in 2010. OSPAR agreed that that OSPAR 2009 should consider the progress made on the proposed CGFZ-MPA with a view to its possible adoption. The road map included the development of conservation objectives for the proposed CGFZ-MPA and substantial liaison with other competent authorities, scientists and other stakeholders.

3. Conservation objectives for the proposed CGFZ-MPA were approved initially at MASH 2008 for use in consultation with other competent authorities. Following work by the Intersessional Correspondence Group on MPAs, BDC 2009 agreed on a revised version of the CGFZ nomination proforma, taking into account comments made in the responses from competent authorities (i.e. International Seabed Authority, Food and Agriculture Organisation, and International Whaling Commission) and enabling both Germany and Norway to lift study reservations on specific elements of the CGFZ conservation objectives. BDC agreed to invite OSPAR 2009 to consider the adoption of the Charlie Gibbs MPA proposal.

4. Noting developments in NEAFC, BDC 2009 agreed that the Secretariat should send a letter to NEAFC, setting out the latest OSPAR developments on MPAs in ABNJ including the agreed CGFZ Nomination Proforma. BDC agreed that, depending on the outcome of the NEAFC Extraordinary Meeting at the end of March, the OSPAR Executive Secretary and the ICG-MPA Chair would consider the need for further amendments to the nomination proforma and as necessary circulate these to BDC HODs in a written procedure.

5. The revised nomination proforma for the proposed CGFZ-MPA is attached. This incorporates two additional amendments to those agreed at BDC: recognition of the Icelandic Continental Shelf Claim of 29 April 2009 (Section 3) and correction of the area covered by the proposed MPA (Section 7). Further clarity is needed on how OSPAR should to take account of the NEAFC fisheries closure for the Middle MAR for the

period 2009-2015 and the Icelandic Continental Shelf Claim in its CGFZ-MPA work before further amendments are made to the nomination proforma.

Action requested

6. OSPAR is invited to consider the attached revised nomination proforma for the Charlie Gibbs Fracture Zone and agree whether, and, if so, how this needs to be further developed to allow for its adoption to support the inclusion of the area in the OSPAR MPA network

Proposed OSPAR Marine Protected Area

Charlie-Gibbs Fracture Zone and a section of the Mid-Atlantic Ridge

A. General information

1. Proposed name of MPA

Charlie-Gibbs MPA

2. Aim of MPA – Conservation Objectives

2.1. Conservation Vision[1]

"Maintenance and, where appropriate, restoration of the integrity and natural quality of the functions and biodiversity of the various ecosystems of the Charlie-Gibbs Fracture Zone 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 good governance, sustainable utilization, and adequate regulations, in conformity with UNCLOS. 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 Charlie-Gibbs 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.

(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 influences and impact.

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[1] The conservation vision describes a desired long-term conservation condition and function for the ecosystems in the entire Charlie-Gibbs 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 Charlie-Gibbs 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.

2.3. Specific Conservation Objectives[5]

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[6]) from 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.

Special attention should be given to the area of the meandering **sub-polar frontal ecosystem.**

2.3.2. Benthopelagic Layer

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

a. Historically harvested **fish populations** (target and bycatch species) at/to levels corresponding to population sizes above safe biological limits[7] 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.

2.3.3. Benthos

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

a. The **epibenthos and its hard and soft sediment habitats,** including threatened and/or declining species and habitats such as seamounts, deep-sea sponge aggregations, *Lophelia pertusa* reefs and coral gardens.

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

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

2.3.4. Habitats and species of specific concern

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

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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 oriented, achievable, measurable and time bound targets.

[6] 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).

[7] "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).

3. Status of the location

The proposed area has been designed to be located beyond the limits of national jurisdiction of the coastal states in the OSPAR Maritime Area.

However, on 29 April 2009 the Republic of Iceland submitted to the Commission on the Limits of the Continental Shelf (UN CLCS) in the area of the Reykjanes ridge, information on the limits of the Icelandic 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.

These claims submitted by Iceland – if approved by the Commission - would encompass the seabed in the area of the proposed Charlie-Gibbs MPA.

The international legal regime that is applicable to the site 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; Mid-Atlantic Ridge

5. Biogeographic region

Atlantic sub region; Cool-temperate waters; Warm temperate waters

6. Location

The proposed area covers the northern part of the Mid-Atlantic Ridge, including the Charlie-Gibbs Fracture and Maxwell Fracture Zones (see Figure 1). The proposed area comprises the seamounts Faraday (1251 km^2) and Hecate (358 km^2), and in the north a section of the Reykjanes Ridge (20644 km^2) where bottom trawling and fishing with static gear, including bottom set gillnets and longlines, has been prohibited since 2004 until presently 31st December 2009 (NEAFC Recommendation VII: 2008). The proposed MPA is significantly larger than the current NEAFC closures, with the purpose to represent a coherent area that includes all of the relevant biogeographic regions and a wide range of habitats, as well as countering the general lack of knowledge about deep-sea habitats by implementing the Precautionary Principle.

The coordinates proposed for the boundaries of the MPA are:

Latitude N	Longitude W
55^o	37.^{o} W
55^o	32^o W
53.5^o	32^o W
53.5^o	27^o W
49^o	27^o W
49^o	32^o W
51^o	32^o W
51^o	37^o W

55° 37° W

The proposed boundaries of the Marine Protected Area reflect a scientific agreement reached at OSPAR ICG MPA in April 2008 that the enclosed area will fully incorporate representative sections of the MAR north and south of the Charlie-Gibbs Fracture Zone, and the meandering Subpolar front that separates cool northern from warmer southern waters and sustains a relatively high abundance and biomass across the food web. The Sub Polar Front, usually lies just south of the Charlie-Gibbs Fracture Zone, but varies in position. The boundaries incorporate also a variety of seamount communities of different sizes and depths, including Faraday and Hecate, as well as three deep east-west trenches, the fracture zones. Overall, the summit depth of the MAR peaks increases from north to south.

In many fora deep-water fishing is described as that which occurs deeper than 400m. Therefore, within the proposed MPA, areas have been mapped that can be potentially fished from 500m to 2000m (Fig. 2). 2000m delimits the maximum fishing depth of the predominant past and present fishing activities. This is quite a narrow area and most fishing on the MAR concentrates on the depths of less than 1000m on the tops and slopes of the shallower hills (Bergstad, O.A. pers comm.).

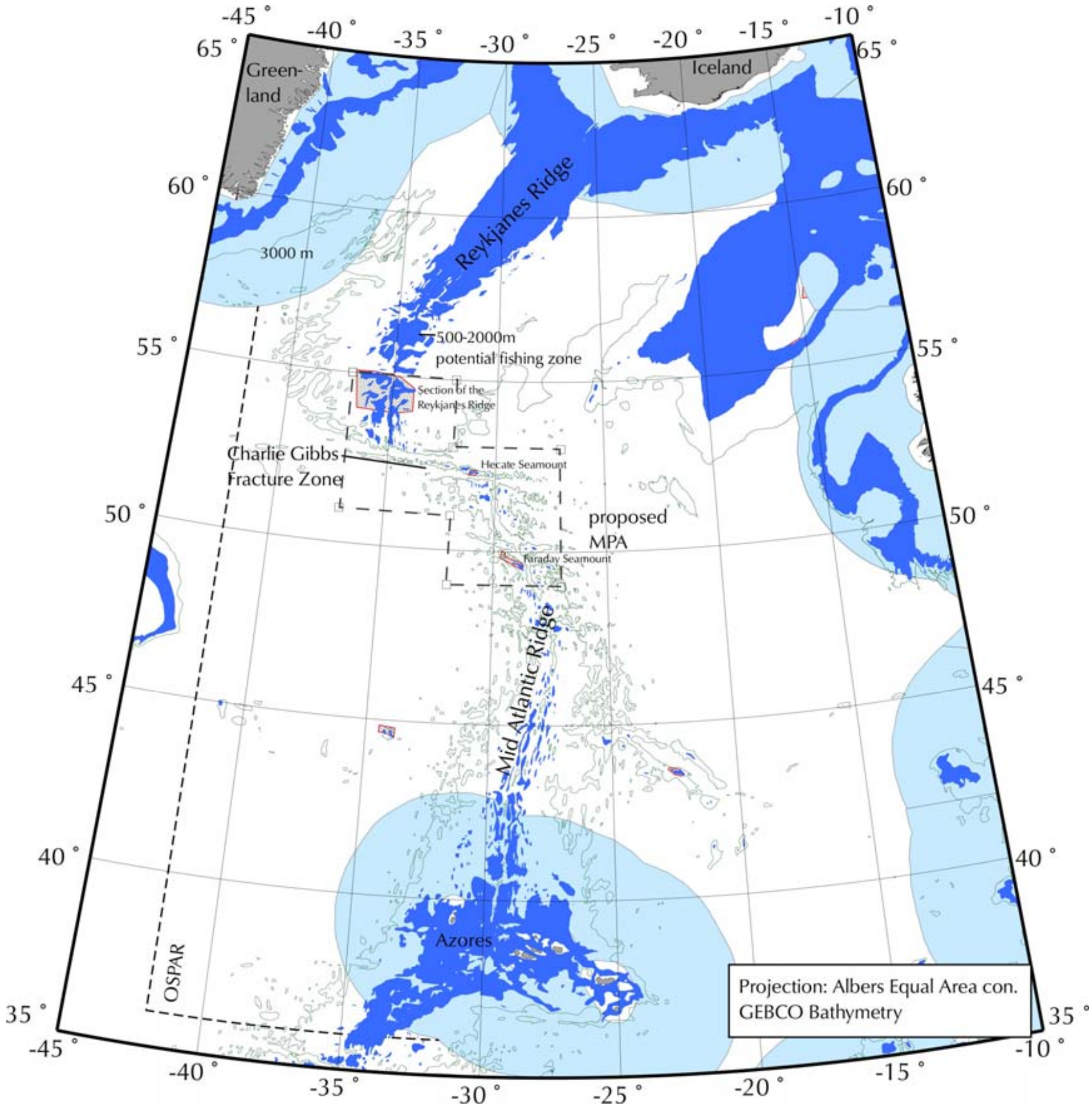

Fig. 1: Location of the proposed MPA on the Mid-Atlantic Ridge. The NEAFC closures within the proposed area are outlined in red (Hecate, Faraday Seamounts and Reykjanes Ridge).

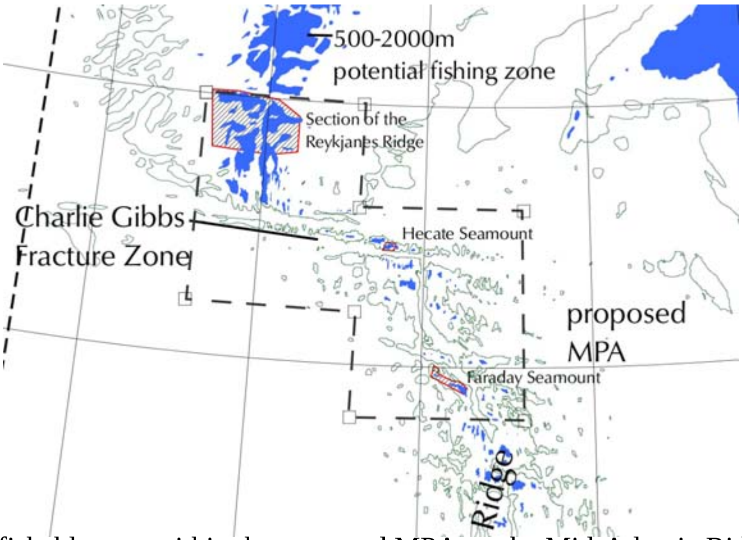

Fig. 2: The fishable area within the proposed MPA on the Mid-Atlantic Ridge (in blue). The NEAFC closures are outlined in red (Hecate, Faraday Seamounts and Reykjanes Ridge).

7. Size

323.900 km^2

8. Characteristics of the area

The Mid-Atlantic Ridge (MAR) is the major topographic feature of the Atlantic Ocean extending within the OSPAR Maritime Area, from the Lomonossov Ridge in the Arctic Ocean to its southern boundary. The MAR is a slow-spreading ridge where new oceanic floor is formed, and western and eastern parts of the North Atlantic basin spread at a speed of 2-6 cm/year. (Dinter, 2001; Heger *et al.,* 2008; Hosia *et al.,* 2008). Its shallower part is found south of Iceland towards the Azores, both groups of islands being the top of ridge-associated seamounts. Rising from bathyal and abyssal depths, the Mid-Atlantic Ridge dominates the seafloor topography in the High Seas of the OSPAR region. The topography is highly differentiated with depths ranging from 4500 m in the deepest channel to only 700-800m on top of adjacent seamounts (Dinter, 2001).

The relief of the axial part of the MAR is presented by systems of separated volcanic rocky mountains. More than 170 seamounts with summit depths less than 1500 metres were found in the northern part of the MAR between 43° and 60°N during Russian explorations in 1972-1984 (Shibanov *et al.* 2002). The majority of seamounts are concentrated in the central (rift) zone of the ridge and in the zone of the transversal (transformed) cracks. Intermountain slashes and smooth slopes are covered with irregular granular sand aleurite, silt, coral, shelly and benthos detritus (Shibanov *et al.* 2002 and literature therein). With its deep, sometimes abyssal valleys and intermittent shallow hills and islands, the ridge can be compared to a mountain chain on land. Apart from the rocky and mountainous areas, there are extensive areas of soft sediment (Feller *et al.* 2008) in particular at greater depth.

Ecologically, ridges are fundamentally different from both isolated seamounts surrounded by deep ocean and from continental slopes where effects of coastal processes are pronounced. They affect not only the availability of suitable habitats for benthic or benthopelagic species, but the topography strongly shapes also the habitat characteristics in the water column through modification of currents and production patterns (see *e.g.* Opdal *et al.*2008). The

Mid-Atlantic Ridge has a profound role in the circulation of the water masses in the North Atlantic (Rossby, 1999; Bower *et al.*, 2002; Heger *et al.*, 2008; Søiland *et al.*, 2008). The complex hydrographic setting around the Mid-Atlantic Ridge in general and the presence of the ridge itself leads to enhanced vertical mixing and turbulence that results in areas of increased productivity over the MAR (Falkowski *et al.*, 1998; Heger *et al.*, 2008; for a more detailed description see the Ecological Significance criterion B3 below). Despite generally limited surface production, there is evidence of enhanced near ridge demersal fish biomass above the Mid-Atlantic Ridge (Fock *et al.*, 2002; Bergstad *et al.*, 2008) and that the mid-ocean ridges are ecologically important for higher trophic levels relative to the surrounding abyssal plains and the open ocean (*e.g.*, blue ling and roundnose grenadier spawning aggregations on the northern MAR (Magnusson & Magnusson 1995, Vinnichenko & Khlivnoy 2004).

The proposed MPA covers an especially complex section of the Mid-Atlantic Ridge (Søiland *et al.*, 2008) and as such is expected to be home to diverse and interesting deep-sea fauna (Tabachnick & Collins, 2008). From the north, the Reykjanes Ridge stretches south-westwards from Iceland to approximately 52^{o}N, where a major fracture zone known as the Charlie-Gibbs Fracture Zone (Felley *et al.*, 2008; Heger *et al.*, 2008) offsets the ridge by 5^{o} to the east and opens the deepest (maximum depth 4500m) connection between the northwest and northeast Atlantic (Felley *et al.*, 2008; Heger *et al.*, 2008; Mortensen *et al.*, 2008; Søiland *et al.*, 2008). South of the Charlie-Gibbs Fracture zone, two pronounced deep rift valleys at 32.25^{o}W and 31.75^{o}W (Opdal *et al.*, 2008) and two further fracture zones (Faraday and Maxwell Fracture Zones, at 50^{o}N and 48^{o}N respectively) create an enormous topographic – and fairly unknown – ecological complexity.

The general circulation in the epipelagic zone (0-200m) is well understood as the warm North Atlantic current flowing north-eastwards from the subtropical gyre in the southwest Atlantic towards the European shelf with two to four branches crossing the MAR between 45° and 52° N, approximately coinciding with the three fracture zones (Sy *et al.* 1992, Søiland *et al.* 2008). Where the warm, saline North Atlantic water meets the cold, less saline water of the subpolar gyre from the Labrador and Irminger Seas, the subpolar front is a permanent feature (Figure 2). The meandering of the subpolar front between 48-53°N coincides with temporal variation in the character and spatial distribution of the watermasses and frontal features (Søiland *et al.* 2008). This front is one of the major oceanic features in the OSPAR region, being an area of elevated abundance and diversity of many taxa, including an elevated standing stock of phytoplankton (Clark *et al.*, 2001; Gallienne *et al.*, 2001; Gaard *et al.*, 2008; Opdal *et al.*, 2008; Sutton *et al.*, 2008,) biological production and biomass in the pelagial and benthal (see *e.g.* Gislasson *et al.* 2008, Opdal *et al.* 2008, Pierrot-Bults 2008, Younbluth *et al.* 2008). Due to the influence of the subpolar front on the ecosystem, Heger *et al.* (2008) saw indications for the region near the Charlie-Gibbs Fracture Zone to be distinct from the areas north and south of the frontal zone on the ridge.

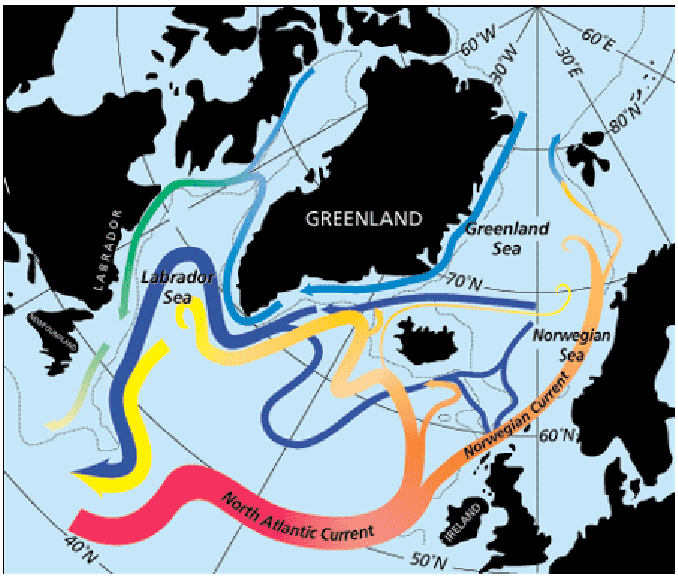

Figure 3: Pathways associated with the transformation of warm subtropical waters into colder subpolar and polar waters in the northern North Atlantic. Along the subpolar gyre pathway the red to yellow transition indicates the cooling to Labrador Sea Water, which flows back to the subtropical gyre in the west as an intermediate depth current (yellow). Credit: ©Jack Cook, Woods Hole OI

http://www.nasa.gov/centers/goddard/images/content/95324main_v39n2-ccartneycurry1en.gif

Only over the last 5 years, substantial new discoveries and new knowledge on the ecosystems of the northern part of Mid-Atlantic Ridge within the OSPAR Maritime area have started to fill up the blanc pages of our understanding of this remote area. This is due to a cooperative, multinational, large scale investigation programme focussing on 'Patterns and Processes of the Ecosystem of the Northern mid-Atlantic', acronymed MAR-ECO, as part of the global Census of Marine Life Initiative (Bergstad *et al.*, 2008a, duration until end 2010). Many scientific papers have been published in the years since the project's inception that span ecological zones and taxonomic ranges in particular in 3 focal areas, one of these being the Charlie-Gibbs Fracture Zone area (see Fig. 4 and Scientific Value criterion for a full description) (Bergstad *et al.*, 2008a). Numerous new species have been discovered, information has been derived that has allowed taxonomic revisions, and species that were not known to exist in this region have been uncovered (Gebruk *et al.*, 2008). Despite the numerous publications the information remains preliminary and represents a first look at the Mid-Atlantic Ridge. Further field campaigns, such as the UK research programme EcoMar (http://www.oceanlab.abdn.ac.uk/**ecomar**) are ongoing, and more publications will follow (Bergstad *et al.*, 2008a). Much of the information used in this proposal is from recently published papers by scientists involved in the MAR-ECO project.

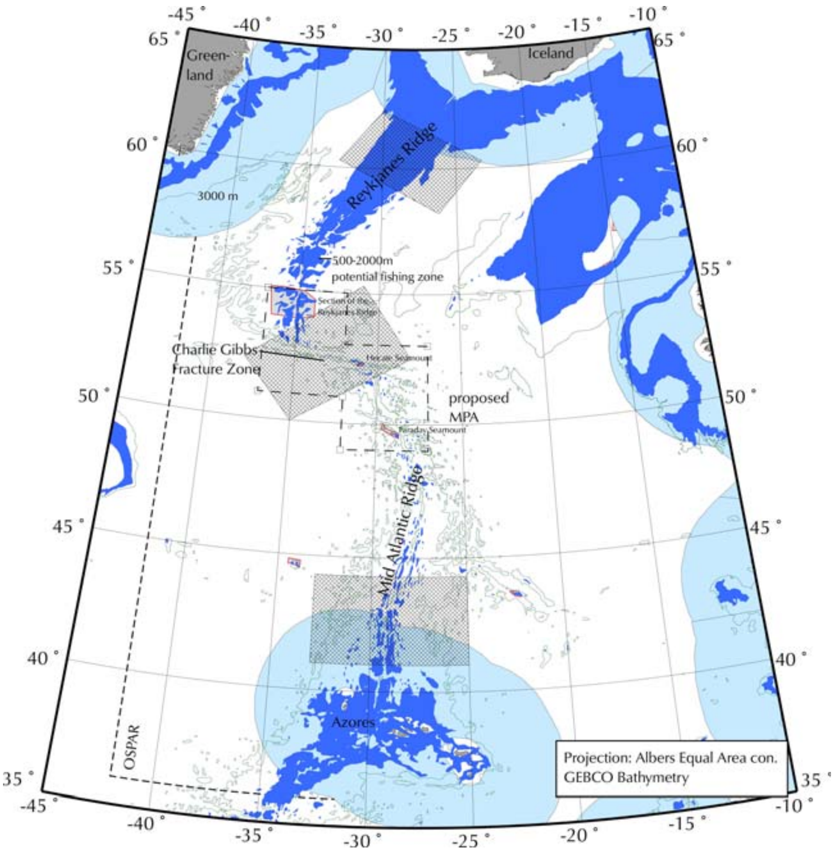

Figure 4. The MarEco Study area on the Mid-Atlantic Ridge, the three sub-areas selected for focused investigations shown as hatched area. (source: MarEco)

Bathymetry

For the benefit of the MarEco project and other users, the bathymetry of the Mid-Atlantic Ridge (between Iceland and the Azores) has been compiled from all publicly available sources until 2004 and updated with the results of modern mapping techniques employed during the cruises (by B. J. Murton, National Oceanography Centre, Southampton, UK, http://www.mar-eco.no/sci/bibliographies_and_background_papers/regional_bathymetry_for_the_mar .

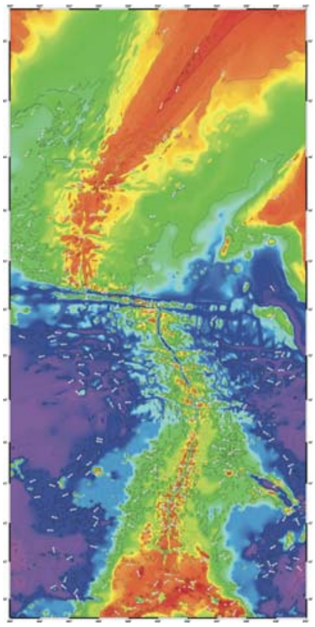

Figure 5. One of the bathymetric maps produced in the MarEco Project (source: www.mareco.no, Murton unpublished). Elevations in red. The Charlie-Gibbs Fracture Zone is clearly indicated as the blue east-west trench in the middle of the figure.

Pelagic system

The pelagic productivity of the northern part of the Mid-Atlantic Ridge (Reykjanes Ridge) and nearby areas (Irminger Sea and Iceland Basin), which form a part of the offshore North Atlantic Ocean, is considered to be very high (Gjøsæter & Kawaguchi, 1980; Magnusson, 1996), in particular when compared to the region north of the Azores (*i.e.* Longhurst 1998). More or less continuous **deep-scattering layers** exist in the area (mostly at 300–800 m depth) consisting of a great variety of organisms, including a large stock size of the commercially important pelagic redfish, *Sebastes mentella* (Travin, 1951; Magnusson, 1996; Anonymous, 1999; Sigurdsson *et al.*, 2002; Anderson *et al.*, 2005; Gislason *et al.*, 2007). Abundant taxa in these layers are, for example, fishes belonging to the family of Myctophidae and various species of shrimps, euphausiids, cephalopods and medusae (Magnusson, 1996).

Zooplankton (mainly copepods) is a very important part of the diet of small mesopelagic oceanic fish (Mauchline & Gordon, 1983; Roe & Badcock, 1984; Sameoto, 1988). The *Sebastes mentella* stock also mainly feeds on zooplankton, of which euphausiids, chaetognaths, amphipods and gastropods are most important. Myctophids also form a part of their diet, although in much smaller quantities than the zooplankton (Magnusson & Magnusson, 1995; Petursdottir *et al.* 2008). Petursdottir *et al.* (2008) found this pattern confirmed in their 2003/4 investigations. Further up the food web, the abundance and biomass of deep demersal fishes showed a mid water maximum near the summit of the ridge (Bergstad *et al.* 2008), coinciding with the maximal deep-pelagic fish biomass, their prey, as reported by Sutton *et al.* (2008).

The dominant **zooplanktonic** organisms occurring throughout the water column were crustaceans, ctenophores, siphonophores, appendicularians, medusae and chaetognaths (Vinogradov 2005, Gaard *et al.* 2008, Stemman *et al.*2008, Youngbluth *et al.* 2008). The boreal copepod species *Calanus finmarchicus* is one of the most important components of the zooplankton in the North Atlantic as it is at the basis of one major food pathway in the pelagic ecosystem through to small mesopelagic fish and shrimp (Petursdottir *et al.* 2008) and baleen whales (Skov *et al.* 2008). The copepod directly transfers the energy taken up by feeding into egg production which is therefore used as an indicator of pelagic productivity. Nowhere along the Mid-Atlantic Ridge were the egg production rates higher than in the Charlie-Gibbs Fracture Zone and Subpolar front (Gislason *et al.* 2008). The Subpolar front acts as a biogeographic boundary for several species, reflecting vertically and horizontally the different water masses and this is also clearly reflected in the zooplankton community structure north and south of Charlie-Gibbs Fracture Zone (Hosia *et al.* 2008, Gaard *et al.* 2008, Stemmann *et al.* 2008). Topographically-induced aggregation mechanisms may play a crucial role in creating a suitable habitat for plankton feeders (Skov *et al.* 2008).

Fock & John (2006) indicate a strong relationship between the **larval fish** community and hydrography and topography, species richness being highest on the Mid-Atlantic Ridge proper and lowest in the adjacent Irminger Sea. Contrary to the adjacent basins, the distribution of fish larvae was shallower over the Mid-Atlantic Ridge, indicating that the Ridge does exert a measurable effect even on pelagic fauna.

Approx. 53 species of **cephalopods** were found, representing 43 genera in 29 families. As with many taxonomic groups north-south differences were apparent in the cephalopod fauna. For example, two different squid species, *Gonatus* spp.and *Heteroteuthis dispar* occurred north/within and south of the frontal zone, respectively. The highest number of species was collected in the southern sampling area (see Fig 6). Conversely, the maximum overall abundance (number collected per trawl) came from farther north, especially from the middle-box transect located southeast of the Charlie-Gibbs Fracture Zone. Five of the ten most commonly collected cephalopod taxa were cirrate octopods. These large animals appear to be an important component of the benthopelagic and deep bathypelagic nekton in MAR ecosystems (Piatkowski *et al.* 2006).

Sigur∂sson *et al.* (2002) identified a total of 99 species of **pelagic fish** from 43 families which group into 5 main assemblages from trawl-acoustic redfish surveys south of Iceland. From the acoustic surveys it is evident that the deep scattering layer formed by among other things deep pelagic fishes is most dense over the northern Mid-Atlantic Ridge (Figure 6). Both, the latitudinal and the cross-ridge patterns were confirmed by Opdal *et al.*(2008), who observed a maximum of backscatter just south of the CGFZ related to meso- and bathypelagic fish biomass, and likely related to elevated primary productivity in the frontal zone.

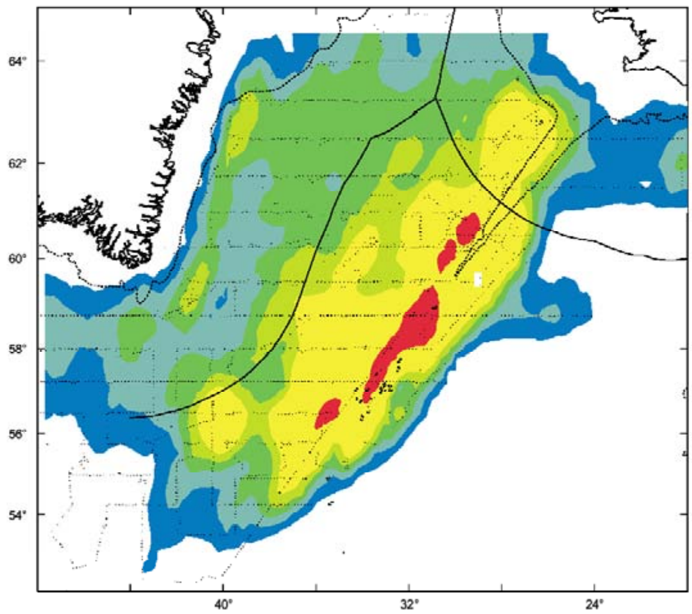

Fig. 6: Deep scattering layer of pelagic fish except redfish (red shows highest concentration) over the northern Mid-Atlantic Ridge, north of 56° N (June-July 2001). Source: Sigur∂sson *et al.* (2002, his Fig. 3).

Altogether 13 species of **cetaceans**, with 1,433 individuals were observed along the entire section of the Mid-Atlantic Ridge studied during the Mar-Eco cruise (Skov *et al.* 2008). About half of the individuals (727) belonged to 7 species of dolphins (Doksaeter *et al.* 2008): Two of the four most frequently observed species (pilot whale *Globicephala melas*, white-sided dolphin *Lagenorhynchus acutus*), occurred only north of the Charlie-Gibbs Fracture Zone, the other two species (common dophin *Delphinus delphis*), and striped dolphins

Stenella coeruleoalba) were found in the warmer, more saline water south of the Charlie-Gibbs Fracture Zone. Dolphins tended to aggregate over the slope of the ridge, independent of water depth, following the distribution of their most important prey, various species of mesopelagic fishes and squid.

The ecosystem associated with the Mid-Atlantic Ridge seems to be of particular importance to sei (*Balaenoptera boralis*) and sperm whales (*Physeter macrocephalus*). The highest aggregations of baleen whales and especially sei whales (*B. boralis*) were observed north of and in relation to the CGFZ, which overlaps with earlier observations of Sigurjónsson *et al.* (1991, in Skov *et al.* 2008). *B. boralis* in particular were most abundant over the slopes of steep seamounts and rises in water depths between 1500 and 3000 m, whereas *P. macrocephalus* were most common in waters shallower than 2000 m and often seen above high rising seamounts where they presumably found the best feeding conditions, *i.e.* the highest squid density (Nøttestad *et al.* 2005).

The MarEco cruise provided a snapshot of **seabird** distribution along the Mid-Atlantic Ridge in summer 2004: 22 species of seabirds were identified, however only the northern fulmar (*Fulmarus glacialis*), great shearwater (*Puffinus gravis*) and Cory´s shearwater (*Calonectris diomedea*) were observed by the hundreds. The distribution of these species reflects the 3 broad characters of water masses in the area (from Mar-Eco cruise report Nøttestad *et al.* 2004) and in particular the boundary effect of the frontal zone and the limited nesting sites available only on the Azores and Iceland (Skov *et al.* 1994). *F. glacialis* were distributed along most of the study transect north of 47° N, and they were by far the most common species of seabird along the central and northern parts of the Mid-Atlantic Ridge. Densities were generally below 1 bird per km^2, and no large-scale concentrations were noted. However, discrete elevations in densities were recorded both in the Reykjanes and the Charlie-Gibbs Fracture Zone regions. *P. gravis* were observed only in the vicinity of the Subpolar front just north of the Charlie-Gibbs Fracture Zone. Most of the birds recorded were found in the area of the Subpolar front, where concentrations of both sitting and flying birds were observed. The largest flock seen was of 160 birds, but flock sizes were generally between 3 and 10 birds. Outside the frontal area *P. gravis* were mainly seen in singles. *C. diomedea* on the other hand is found only south of the *P. gravis* distribution area – usually not in flocks except for an area where warm Gulf Stream water surfaced. *C. diomedea* were commonly observed with cetaceans, most notably dolphins, but also with other species, *e.g.* sperm whales.

There is only anecdotal evidence on the observation of **sea turtles** over the Mid-Atlantic Ridge (Skov, pers.com), in particular enhanced abundances over the Charlie-Gibbs Fracture Zone and Subpolar front regions (See Threatened/Declining Species and Habitats criterion B.a.1. below for more information.

Benthic system

Ridges like the Mid-Atlantic Ridge provide a large variety of benthic habitats. The hard bottom areas are often colonised by erect megafauna such as gorgonians, sponges, hydroids, and black corals (Grigg, 1997). Mortensen *et al.* (2008) presume that to a large degree, the topography of the seabed controls the distribution of habitats along the Mid-Atlantic Ridge by providing different settings for sedimentation and retention of particulate matter. They found this illustrated by the accumulation of coral rubble near the bases of volcanic ledges, and deposits of pteropod shells on level sandy bottom some tens of metres away from rocky obstructions where currents will not sweep the light shells away. The topography also controls the current patterns and velocity (Genin *et al.*, 1986), and hence the transport rate and concentration of food particle for suspension feeders. For the benthic fauna, the Mid-Atlantic Ridge is a major barrier for east-west dispersal (see *e.g.* Mironov & Gebruk 2002, 2006). Gebruk *et al.* (2006) noted that in particular in the area south of the Charlie-Gibbs Fracture Zone 48% of the 150 identified species occurred only to the west of the ridge, whereas 19 %

of the species were restricted to the eastern Atlantic. Likewise, the Charlie-Gibbs Fracture Zone acts as a barrier in north-south direction: The areas south and north of the Charlie-Gibbs Fracture Zone share only 27 % of the species (of the groups used as indicators). Due to the transition of water masses at 800-1000m depth there is also a vertical zonation of the bathyal fauna. Comprehensive sponge grounds are known to occur off south Iceland, especially on the Reykjanes Ridge (Klitgaard & Tendal 2004). *In situ* observations revealed that clumped patterns of distribution were the rule for soft-bottomed features in sediment-filled areas and for sessile organisms in rocky areas (Felley *et al.* 2008).

Cold water corals

The Reykjanes Ridge south of Iceland is an area where cold-water corals *(L. pertusa, M. oculata, S. variabilis)* are frequently dredged (Copley *et al.* 1996). In Icelandic waters, most of the existing coral areas are found on the shelf slope and on the Reykjanes Ridge. In some of the shelf areas off south Iceland remains of trawl nets and trawl marks were observed, providing evidence of the effects of trawling activities (ICES ACE 2005). Until the MAR-ECO project cruise (2004), the coral records mainly came from the upper ridge at depths of less than 1000 m (ICES ACE 2005). Video inspections in the areas south and north of the Charlie-Gibbs Fracture Zone found cold water corals at all sites, at depths of 772-2355 m, most commonly between 800 and 1400 m. 27 of the 40 coral taxa were octocorals among which the gorgonacea were the most diverse (Mortensen *et al.*, 2008). Molodtsova *et al.* (2008) found very little overlap in species composition of the coral fauna in the sampling areas north, near and south of the CGFZ. Mortensen *et al.* (2008) observed four of the coral taxa only in the Charlie-Gibbs Fracture Zone area. Otter trawls sampling at 826-3510 m depth came up with a bycatch of 10 coral taxa, and also the longlining experiments (433- 4200 m depth) brought up 11 coral taxa.

Lophelia pertusa and *Solenosmilia variabilis* were found to act as the main structure corals, probably *Solenosmilia* was most common in the deeper parts of the study areas. All *Lophelia/Solenosmilia* colonies were relatively small with a maximum diameter of less than 0.5m. *Lophelia/Solenosmilia* were most common on the video of the north and central sample sites, but rare on video of the southern site. The video-observations indicated that the diversity of corals is higher in the southern than the middle and northern study areas. Bycatch of corals was recorded in bottom trawl and on longline from all areas, but most species were caught in the southern area. (Mortensen *et al.* 2008). The number of megafaunal species was higher in areas where corals dominated compared to areas without coral. Typical taxa that co-occurred with Lophelia were crinoids, certain sponges, the bivalve *Acesta excavata*, and squat lobster (Mortensen *et al.* 2008).

Mortensen *et al. (*2008) found that rubble from scleractinian corals can be a pronounced feature of the habitat on the tops of seamounts, and may represent an important habitat for various attached and cryptic invertebrate species. No conclusive answer is possible on the likely cause of the disintegration of the corals., which may be an accumulation of naturally degraded scleractinian corals over long times. It may, however, also have been caused by human impact, though no signs of trawling were found., The video inspections of the seafloor revealed lost fishing gear in several places (Mortensen *et al.* 2008, see also Dyb & Bergstad 2004) which, given the very few stations sampled, may point to a very high number of lost gear potentially ghost-fishing for a long time. This leads to the comclusion that extensive longlining activities may have lead also to substantial coral bycatch.

Demersal (benthopelagic) fish fauna

The actual number of demersal fish species depends on the fishing gear used and the definition of "demersal" employed. In a review, Bergstad *et al.* (2008) estimate some 80 demersal fish species to occur on the northern MAR between Iceland and the Azores. The biogeography of the seamount-related fish fauna of the North Atlantic, caught mainly as bycatch in roundnose grenadier (*Coryphaenoides rupestres*) and alfonsino (*Beryx splendens*) trawls down to 1500 m depth in over 20 years of commercial exploitation by Russian fisheries is described by Kukuev (2004). He accounts for 68 species of mainly mesobenthopelagic bathyal fishes associated to the seamounts of the northern MAR (45-55° N, *i.e.* within the proposed marine protected area), including 44 species of deepwater sharks such as Chlamydoselachidae, Pseudotriakidae, Scyliorinidae and Squalidae, including Leafscale gulper shark (*Centrophorus squamosus*), Gulper shark (*C. granulosus*) and Portuguese dogfish (*Centroscymnus coelepis*)[8].

The biogeographic divide at the Charlie-Gibbs Fracture Zone is also evident in the distribution of commercially relevant deepwater fish (Hareide & Garnes 2001, Shibanov *et al.* 2002): North of 52 °N[9], sub-Arctic species such as giant redfish (*Sebastes marinus)*, tusk (*Brosme brosme*) and Greenland halibut (*Reinhardtius hippoglossoides*) are dominant in longline catches. The largest catches of Greenland halibut were made on and in the vicinity of coral reefs at approximately 1600 m depth; catches were extremely small in coral-free areas. In the southern part (south of 48° N), subtropical species such as golden eye perch (*Beryx splendens*) and cardinal fish (*Epigonus telescopus*) are the dominant species. The area between 48 and 52 ° N is a region of faunal change with species mixtures according to the species-specific distribution limits. The authors observed that all along the investigation area (43 – 61 °N) there was always one dominant species forming dense schools close to the top of seamounts: In the north, this is redfish (*Sebastes marinus*), between 53 and 46° N this niche is taken by roundnose grenadier (*Coryphaenoides rupestris*) and south of 46° N by goldeneye perch (*Beryx splendens*). The authors report about the quick exhaustion[10] of redfish and alfonsino when commercially fished in the early 1990s and speculate about a changing balance between the species of the fish community. King *et al.* (2006) confirm the biogeographic zones, however emphasize the importance of the Charlie-Gibbs Fracture Zone and the sub-polar Front for the location of the split between northern and transitional communities.

The demersal fish species, in particular those of commercial interest like redfish, alfonsino, roundnose grenadier and orange roughy are not evenly distributed within their respective biogeographic focal area on the Mid-Atlantic Ridge. Rather, all these species form temporal aggregations for mating and spawning over the summits and/or flanks of seamounts and the peaks of the MAR, respectively. Figure 7 composed by Shivanov *et al.* (2002) illustrates the interaction between seamount topography, hydrography and the aggregation of roundnose grenadiers in an area near the CGFZ. Fishing on these aggregations therefore exploits otherwise low overall population densities of these species and may lead to overexploitation, in particular in combination with serial depletion of individual fishing sites.

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8 These three shark species have been included in the OSPAR List of threatened and/or declining spoecies and habitat by OSPAR 2008.

9 Including the area on the Reykjanes Ridge and Hecate Seamount closed by NEAFC since 2004.

10 1 year of longlining on *Sebaste marinus*, 2 years of *Beryx splendens* fishery.

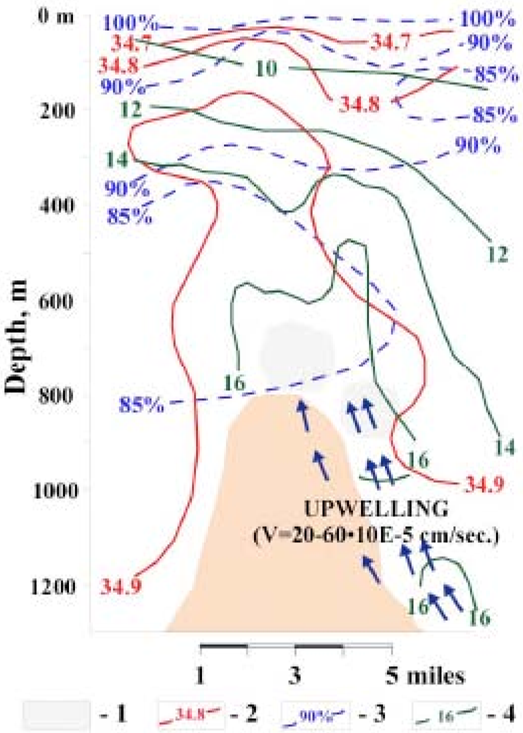

Figure 7. The distribution of roundnose grenadier (1-hatched) in relation to environmental parameters (2-salinity, 3-dissolved oxygen, 4-biogenes in meg at/l) and the seamount peak and slope in the area of the CGFZ at 53° N (Shibanov *et al.* 2002)

In particular Russian fisheries research (*i.e.* Vinnichenko 2002 and literature therein), but also other recent scientific investigations (*i.e.* Hareide & Garnes 2001, Bergstad *et al.* 2008, Fossen *et al.* 2008, Sotton *et al.* 2008) demonstrate that the overall abundance of potentially commercially relevant fish stocks on the seamounts of the MAR is rather low. It is assumed that most fish species on the seamounts form local groupings, which means that there is only a limited genetic exchange between the local populations. Vinnichenko (2002) concluded, "*Investigations and fishery indicate a high vulnerability of fish populations inhabiting the seamounts. These stocks are comparatively low and highly susceptible to overfishing. This is particularly true for deepwater species with a retarded maturation and low fecundity*".

Since 1998, ICES ACFM has continuously advised the North East Atlantic Fisheries Commission and the European Commission on a strict regulation (in 2000 even on the temporary cessation) of deepwater fisheries. In 2001, ICES ranked deepwater fishes, mostly demersal species, with regards to their vulnerability, based on their longevity, growth, natural mortality fecundity and length and age at first maturity. The deepwater sqalid sharks *Centroscymnus coelolepis* and *Centrophorus squamosus*, together with orange roughy (*Hoplostethus atlanticus*) came out as by far the most vulnerable. Roundnose grenadier (*Coryphaenoides rupestres*), redfish (Sebastes spp.) and Greenland halibut (*R. hippoglossoides*) were considered the next most vulnerable species (ICES ACFM 2001, advice to EC and NEAFC).

B Selection criteria

a. Ecological criteria/considerations

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1. Threatened and/or declining species and habitats

(The area is important for species, habitats/biotopes and ecological processes that appear to be under immediate threat or subject to rapid decline as identified by the ongoing OSPAR (Texel-Faial) selection process.)

The following species and habitats on the OSPAR List of Threatened and/or Declining Species and Habitats (Reference Number: 2008-06) occur within the boundaries proposed for the MPA:

SPECIES SCIENTIFIC NAME	COMMON NAME		OSPAR Regions where the species occurs	OSPAR Regions where the species is under threat and/or in decline
	English	French		
**Hoplostethus atlanticus* (Collett, 1889)	Orange roughy	*hoplostète orange*	I, V	All where it occurs
Centroscymnus coelolepis	Portuguese dogfish	Pailona commun	All	All where it occurs
Centrophorus granulosus	Gulper shark	Squale-chagrin commun	IV, V	All where it occurs
Centrophorus squamosus	Leafscale gulper shark	Petit squale	All	All where it occurs
Dermochelys coriacea (Vandelli, 1761)	Leatherback turtle	*tortue luth*	All	All where it occurs
Balaenoptera musculus (Linnæus, 1758)	Blue whale	*baleine bleue*	All	All where it occurs

HABITATS	OSPAR region where habitat occurs	OSPAR region where such habitats are under threat and/or decline
Deep-sea sponge aggregations	I, III, IV, V	All where they occur
Lophelia pertusa reefs	All	All where they occur
Seamounts	I, IV, V	All where they occur
Coral garden	I, II, III, IV, V	All where they occur

Importance of the proposed area to the species on the OSPAR List:

All of the above mentioned species and habitats occur in the proposed area, however, there is insufficient knowledge to prove the special importance of the MAR section proposed to the life and success of populations and communities. The state of knowledge is summarised below:

***Hoplostethus atlanticus* (Orange roughy)**

ICES (2002) considers orange roughy to be one of the most sensitive deepwater fish species due to its life history traits. The main threat to the species is from fishing, though the dependence of the overall populations on the exploited temporal aggregations of the species is still unclear. With the genetic techniques of today, no significant differentiation between orange roughy from the Atlantic or Pacific can be established (Smith 2006). However, adults are assumed to migrate no more than 200 km to their spawning site (Francis & Clark 1998), and given the weak dispersal potential of orange roughy recruits (the pelagic eggs sink and hatch near the bottom (Zeldis *et al.*, 1994), Smith (2006) suggests that only a limited gene exchange may take place between ecologically distinct population units (Smith *et al.* 2001, Smith 2006), possibly depending globally on exchange via stepping stones across the oceans (Elliott *et al.* 1994).

Currently a project seeking to unravel population connectivity of selected deepwater species is underway (DEECON, see http://www.imr.no/deecon/home).

Orange roughy is considered to be an obligate seamount associated fish, depending on the seamount topography-induced hydrographic patterns for spawning aggregations and spawning. This category of fish has the highest vulnerability to fishing (Morato *et al.* 2006, Morato & Clark 2007). On the MAR, orange roughy was taken as a bycatch in the fisheries for roundnose grenadier and alfonsino since the 1970s (Shibanov *et al.* 2002), but a directed fishery for this species in the North Atlantic did not develop until the 1990s, primarily by one to a few boats from the Faroese Islands. In 1992, the Faroe Islands began a series of exploratory cruises for orange roughy, exploitable concentrations being found in late 1994 (annual catch 260 t) and early 1995 (1040 t), mostly on the MAR. The fishery took place on five features on the MAR and Hatton Bank. Catches peaked in 1996 at 1320 t, and since then have generally been less than 500 t (ICES, 2006, and Clark *et al.* 2007 and literature therein).

The extent to which Orange roughy has been targeted in the area proposed remains unknown (Hareide & Garnes, 2001). Today, the fishery is regulated by NEAFC (see measures 2008).

Leatherback Turtle (Dermochelys coriacea)

The Leatherback turtle occurs in the region and feeds primarily on gelatinous zooplankton (Hays *et al.*, 2006; Doyle, 2007), high concentrations of which have been recorded several times around the Charlie-Gibbs Fracture Zone and Subpolar front (Fock *et al.*, 2004; Youngbluth *et al.*, 2008). This species of turtle can be found foraging at oceanic fronts during their long trans-Atlantic migrations (Eckert, 2006). One study has tracked individuals to the subpolar front area of the North East Atlantic, presumably to feed in this plankton rich environment (Ferraroli *et al.*, 2004; Hays *et al.*, 2004). It is probable therefore, that this species of turtle visits the proposed area to feed (see Sensitivity criterion also).

Blue Whale (Balaenoptera musculus)

Blue whales are roaming all oceans. As plankton feeders, they particularly depend on zones of rich plankton production during their migrations. Blue whales are known to occur along the north Mid-Atlantic Ridge from old whaling log books (Reeves *et al.*, 2004). They were sighted in the vicinity of the Mid-Atlantic Ridge during the MAR-ECO (Doksæter *et al.*, 2008). It is likely that blue whales spend some time in the subpolar frontal area with its increased pelagic biomass (Opdal *et al.*, 2008) as the sei whale does (Doksæter *et al.*, 2008; Skov *et al.*, 2008). Tagging experiments showed that sei whales migrate directly from the Azores to the CGFZ (Olsen *et al.*, 2005; Skov *et al.*, 2008). (See: Ecological Significance criterion; Skov *et al.*, 2008).

Deepwater sharks

Detailed studies of seamount ichthyofauna, even in the relatively well-investigated northern Atlantic Ocean, are only thirty years old (Kukuev, 2004). The ichthyofauna sampled by Kukuev (2004) consisted of approximately 20 elasmobranch species including Leafscale gulper shark (*C. squamosus*), Gulper shark (C. granulosus) and the Portuguese dogfish (*C.*

coelolepis). The ICES Working Group of Elasmobranch Fisheries (WGEF) considers the elasmobranch fauna of the MAR to be poorly understood (ICES, 2007b).

Deep-water sharks are caught in several mixed trawl fisheries and directed long-line and gillnet fisheries in the North East Atlantic (ICES, 2007b). Of the deepwater sharks, *C. squamosus* and *C. coelolepis* are the commercially most important species in the North East Atlantic (ICES, 2007b). *C. squamosus* and *C. coelolepis* stocks on the northern Mid-Atlantic Ridge are considered to be depleted (ICES, 2007b) although the species found here are likely to have been little exploited in comparison to continental Europe and the whole ecoregion is considered to be a sensitive area (ICES, 2007b). In 2005 ICES advised a zero catch limit for both species in the entire ICES area (the North East Atlantic) (Kyne & Simpfendorfer, 2007). As the quotas for these two species of deepwater sharks and others become more restrictive it is likely that there will be increased discarding of them as they are caught as bycatch in other fisheries (ICES, 2007b). Illegal, unreported and unregulated fishing is also known to take place for deepwater sharks especially in international waters (ICES, 2007b). Given the bycatch problem, and the vulnerability of deepwater sharks (see below B.2.), there is an urgent need to establish deepwater refuges from fishing.

Deepwater sponge aggregations

The sponge fauna of the proposed area is poorly known. However, video dives and sampling in the proposed area revealed rich hexactinellid sponge communities or 'gardens' around the Charlie-Gibbs Fracture Zone and the associated seamounts down to 3000 m depth, and depending more on the availability of hard substrate than depth (Felley *et al.,* 2008; ICES, 2007a; Tabachnick & Collins, 2008).

Beds of large demosponges (up to 70 cm in diameter) occur widely distributed in patches in the North East Atlantic, often slightly deeper than the coral banks (Klitgaard & Tendal 2004). These authors showed in their review that large, structural sponges are known from the Reykjanes Ridge south to at least 60° N. There was no sampling further south, however it can be assumed that the potential distribution area of the boreal type of deepwater sponge beds extends further south (Fosså 2005). The associated fauna (about 250 species) poses the same possiblilities and problems as in the case of corals, but hitherto onl< one area has been investigated in detail (Klitgaard 1995). In particular young redfish (Sebastes spp.) is known seek shelter in sponge beds which is why many of the sponge bed occurrences known stem from fishermen records.

ICES (2007a) considers structural sponge habitat as being *"extremely vulnerable to commercial trawling suffering immediate declines through direct removal of sponges and further reductions in population densities of sponges due to delayed mortality (Freese, 2001"*).

***Lophelia pertusa* reefs**

One of the preconditions for scleractinian corals like *Lophelia pertusa* to grow is hard substrate. Overall hard bottom is scarce in the world oceans and only usually steep-sided seamounts and the mid ocean ridges provide for substantial hard substrate in the overall sedimentary ocean basins. The MAR is therefore a very important habitat and stepping stone for the regional dispersal of hard bottom dwelling suspension feeders. Depending therefore on the local topography and topographically induced hydrography, as well as the general level of surface production and sedimentation (food concentration and value), a more or less dense coral fauna develops. On the MAR sections investigated by Mortensen *et al.* (2008), living *Lophelia pertusa and* 40 taxa of other corals have been observed at all depths and locations surveyed although not in the extensive reef-type structures found off the coast of Norway (Hall-Spencer *et al.,* 2002). Mortensen *et al.*(2008) state that the observed species richness of corals on the Mid-Atlantic Ridge was comparable with other regions of the North Atlantic, however because of uncertainties with visual identifications it was suggested that the species richness of corals on the Ridge is higher than in high latitude areas of the continental margin.

Coral Gardens

There is no agreement yet as to what will constitute a coral garden in a remote area like the MAR. However, the richness in ecological niches provided by the MAR topographic structure is also favourable for octocorals constituting 27 of the 40 taxa recorded (Mortensen *et al.* 2008).

Seamounts

Seamounts as a "habitat" on the OSPAR List is a substitute for the range of habitats seamounts provide vertically and horizontally not only to benthic fauna, but also functionally up the food web and to migratory species (see Pitcher *et al.* 2007). As such seamounts are similar to the MAR, which is basically a chain of more or less high mountains, intercepted by meridional or transversal valleys. Usually, seamounts are considered to be isolated features of >1000 m elevation (see *e.g.* ICES 2006) whereas the elevations on the ridge are more like peaks of a mountain chain. Nonetheless, the summit areas of these elevations are usually very steep-sided, provide substantial exposed hard substrate and generate special topographically-induced hydrographic conditions with enhanced current speed and eventually particular current patterns. The ecological importance of these features is illustrated in the justifications above and below for a broad range of species and communities, most of these, though for different reasons, being more abundant on the MAR than in adjacent areas.

All of the commercially most relevant demersal fish species are fished while aggregating over the flanks and/or summits of seamounts and the MAR peaks, respectively (see Part A.9). Therefore the MAR provides the most extensive habitat for the reproduction of these aggregation-forming deepwater fish species off the continental shelves in the OSPAR maritime area.

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2. Important species and habitats

(The area is important for species, habitats/biotopes and ecological processes as identified by the ongoing OSPAR (Texel-Faial) selection process)

As noted above, the proposed area includes deep-sea sponge aggregations and seamount habitats listed by OSPAR in 2003 as priority threatened or declining habitats (OSPAR Commission 2008). These cold-water coral and sponge habitats would qualify as Vulnerable Marine Ecosystems in relation to high seas fisheries according to draft criteria developed by FAO (FAO 2007, Rogers *et al.*, 2008). The area also contains seamount communities, coral and sponge aggregations, a frontal area (the subpolar front) and potential areas of upwelling among the habitats listed as examples of ecologically or biological significant marine areas according to draft criteria developed by the CBD for identifying candidate sites for protection on the high seas (UNEP 2007).

Additionally the Mid-Atlantic Ridge in general provides the only extensive hard substrate available for propagation of benthic suspension feeders off the continental shelves and the isolated seamounts. The northern MAR is considered to be a major reproduction area of *i.e.* roundnose grenadier (*Coryphaenoides rupestris*, see *e.g.*Vinnichenco & Khlivnoy 2004), and may be crucial for the reproduction of bathypelagic fish (Sutton *et al.* 2008). Fock & John (2004) clearly demonstrated the influence of the MAR on fish larval vertical and horizontal distribution and a peak in species richness, reflecting the pattern of adult mesopelagic fish distribution on and off the ridge. The number of species that were recorded by Kukuev (2004) over the seamounts of the northern Mid-Atlantic Ridge was higher than the numbers recorded for the Corner Rise Mounts (34° – 35°N, 48° to 52°W) and the same as on the seamounts near Rockall (56° to 59°N, 13° to 18°W).

Elasmobranchs

Kukuev (2004) recorded approximately 20 elasmobranch species as a bycatch of the Russian roundnose grenadier trawling on the MAR, including frilled shark (*Chlamydoselachus anguineus*), Greenland shark (*Somniosus microcephalus*), leafscale gulper shark (*Centrophorus squamosus*), great lanternshark (*Etmopterus princeps*) and the Portuguese dogfish (*Centroscymnus coelolepis*), all of which have been described by Froese & Pauly (2007) as having very low resilience to population reductions by fishing.

Chondrichthyan fishes, including deepwater sharks, are K-selected species, having life history characteristics that include slow growth, late maturity and a low reproductive output (Kyne & Simpfendorfer, 2007). With a few exceptions, like *C. coelolepis,* which was recorded down to 3700 m, sharks are confined to the high energy regions of the upper 2500 m of the oceans (Priede *et al.* 2006 and literature therein): They conclude that due to high energy requirements, sharks are apparently confined to ca 30% of the total ocean and distribution of many species is fragmented around seamounts, ocean ridges and ocean margins, particular conspicuous on slopes down to 2000 m where they profit of an increased food supply including from food falls such as dead whales. This indicates that the Mid-Atlantic Ridge, particularly the highly productive seamount/ridge peaks and frontal zones are of particular importance to deepwater sharks – their distribution being not at all homogenous across the oceans but concentrated around high biomass zones. Therefore deepwater sharks may concentrate in areas where commercially targeted teleost species agregate, as both taxa benefit from the same ecological patterns. Therefore, the vulnerability of deepwater sharks to overexploitation is even higher than can be deduced from their life history strategy alone. Deepwater sharks species do not have a "refuge" below fishing depth (Priede *et al.* 2006).

3. Ecological significance

The area has:

a) High proportion of habitat in the OSPAR area

The proposed MPA is a significant portion of the mid-ocean ridge habitat within the OSPAR area. As a major comparatively shallow feature in the middle of the ocean away from continental slopes, the mid-ocean ridge has a special significance among the range of oceanic habitats. Within the proposed MPA the species communities change gradually from north to south. However, the Charlie-Gibbs Fracture Zone and the subpolar front represent an important barrier to this along-ridge dispersal. The proposed boundaries aim to incorporate diversity from the northern and southern communities along with the subpolar front boundary area.

b) High Natural Biological Productivity of Features being represented

Frontal systems are usually areas of increased primary production, often also of elevated biomass of phytoplankton, translating into higher biomass in the food web. The subpolar front at about 52° N is a typical high production convergence zone of subpolar and Atlantic water. It was suggested that this frontal zone between cold and warm water masses is a mixing area that provides favourable conditions for plankton growth, consequently attracting other pelagic fauna (Opdal *et al.*, 2008). (The subpolar front is not a static feature and moves latitudinal on a time scale of days, but is normally found just south of the Charlie-Gibbs Fracture Zone (Bergstad *et al.*, 2008). Therefore the boundaries of the proposed protected area were drawn to incorporate this oceanographic feature.

As a surrogate for phytoplankton biomass, surface Chlorophyll a concentrations measured around the subpolar front, usually in the vicinity of the Charlie-Gibbs Fracture Zone, were found to be elevated compared to the adjacent oceanic areas (Clark *et al.*, 2001; Gallienne *et al.*, 2001; Gaard *et al.*, 2008; Opdal *et al.*, 2008; Sutton *et al.*, 2008). Opdal *et al.*, (2008) hypothesise that the latitudinal gradient in Chl a concentrations and backscatter may be an indication of different productivity patterns, finding in particular that phytoplankton abundance around the Charlie-Gibbs Fracture Zone (53 – 46° N) is significantly higher than in the northern area of the Mid-Atlantic Ridge and supports what appears to be a higher standing stock of fish.

Fock *et al.*(2004) noted a greater abundance of gelatinous zooplankton over the Mid-Atlantic Ridge than the rest of their Atlantic sample sites, which they linked to higher primary production. Further evidence of increased faunal densities in the area of the Charlie-Gibbs Fracture Zone was also found by other scientists working on the MAR-ECO research project for a range of species: Youngbluth *et al.*(2008) found the highest abundance of gelatinous zooplankton occurring at a depth range of 350 to 730 m in the region just south of the Charlie-Gibbs Fracture Zone; Pierrot-Bults (2008) observed a peak in abundance for chaetognath species just north of the Charlie-Gibbs Fracture Zone; Gislasson *et al.*(2008) found a peak in copepod egg production near the subpolar front area; Heger *et al.* (2008) recorded increased deep-sea pelagic bioluminescent activity in the water column over both the Faraday Seamounts and the subpolar front region; Opdal *et al.* (2008) noted a pronounced maximum in the backscattering and therefore presumably fish density, in the area of the Charlie-Gibbs Fracture Zone.

The deep-pelagic ecosystem over the MAR is different from ‘typical’ open ocean regimes, at least in respect to fishes, in that there is a dramatic increase in fish biomass in the benthic boundary layer (0 to 200 metres above the seafloor) not seen in other areas (Sutton *et al.*, 2008). The reason for this difference is thought to be the enlarged bathypelagic food sources that are available in the shallower depths of the Ridge as compared to the abyssal plains (Sutton *et al.*, 2008).

The MAR-ECO project has been extended to 2010, with future field time to be spent studying the ecological processes around the subpolar front, because of the apparent high concentrations of megafauna (Bergstad *et al.*, 2008a). Despite more research being required, today’s knowledge as reviewed here clearly indicates that the Mid-Atlantic Ridge and in particular the Charlie-Gibbs Fracture Zone and subpolar front provide important ecological processes to support an elevated autochtonous standing stock of deep-sea fauna there, as well as pelagic species.

c) Important Feeding Aggregations

The elevated plankton production at the subpolar front attracts a large number and variety of secondary consumers and top predators. Groups of feeding sperm (*Physeter macrocephalus*) and sei whales (Balenoptera borealis) were observed in areas of high zooplankton abundance (Sigurjónsson *et al.*, 1991, Skov *et al.*, 2008). Sei whales are planktivorous and it is likely that the observed aggregations are linked to the high concentration of the calanoid copepod Calanus finmarchicus, just north of the Charlie-Gibbs Fracture Zone (Gaard *et al.*, 2008). These observed sperm whales (*Physeter macrocephalus*) likely benefit of an elevated abundance of other elements of the food web, *e.g.* cephalopods. Several species of dolphins have also been recorded feeding along the Mid-Atlantic Ridge, and it is thought that their distribution is also influenced by prey availability (Doksæter *et al.*, 2008).

The Charlie-Gibbs Fracture zone may also be of importance to the great shearwater (*Puffinus gravis*) which was observed in highest densities in the frontal area.

4. High natural biological diversity

(The area has a naturally high variety of species (in comparison to similar habitat/biotope features elsewhere) or includes a wide variety of habitats/biotopes (in comparison to similar habitat/biotope complexes elsewhere).

The recent MAR-ECO expeditions have reported a diverse and extensive range of taxonomic information regarding the benthos of the Mid-Atlantic Ridge in general (Bergstad & Gebruk, 2008). In this one expedition taxa have been found that are new to science, new to the geographic region and others that have contributed to taxonomic re-descriptions and revisions of known species (Gebruk *et al.,* 2008). For example, the Hexactinellid fauna of the northern Mid-Atlantic Ridge has been poorly investigated in the past. Recent work has shown that it is relatively rich, with fourteen new species described in one report and similarities being found between the fauna in the Charlie-Gibbs Fracture Zone and the fauna of the Indian Ocean and Indo-Pacific (Tabachnick & Collins, 2008).

Increased diversity was also seen in the gelatinous zooplankton of the Mid-Atlantic Ridge. Visual observations of what appeared to be undescribed species were made in submersible dives along the entire length of the Mid-Atlantic Ridge (Youngbluth *et al.*, 2008).

In comparison to adjacent abyssal plains and other studies from the North Atlantic, Sutton *et al.*(2008) found that the deep-pelagic fish assemblage along the entire Mid-Atlantic Ridge is taxonomically diverse, with 205 species from 52 families. Between 70 and 80 deepwater benthopelagic fish species were caught by Bergstad *et al.* (2008) during experimental trawls over the Mid-Atlantic Ridge. This sample was described by the authors as being a substantial subset of the demersal fish species listed by both Haedrich & Merrett (1988) and Kukuev (2004) for the North Atlantic deep sea. Bergstad *et al.*(2008) were unable to statistically compare the sites along the Mid-Atlantic Ridge that they sampled due to a lack of replication. However, twelve out of the nineteen stations are within this proposed protected area.

The Charlie-Gibbs Fracture Zone marks a biogeographic boundary for numerous taxa (Bergstad *et al.*, 2008; Doksæter *et al.*, 2008; Gaard *et al.*, 2008; Sutton *et al.*, 2008) and it is an especially complex area that is likely to be home to diverse deep-sea fauna (Søiland *et al.*, 2008; Tabachnick & Collins, 2008). This proposal incorporates sections north and south of the Charlie-Gibbs Fracture Zone to allow the diversity of the species assemblages either side to benefit from protection. The diversity information now coming forward for a range of taxa documents what species occur in the area and adds to previous knowledge of ranges, habitat uses and abundance patterns. The diversity is extensive within the proposed MPA, but a full account is not yet available. Whether the proposed area has particularly high diversity is unclear, but the ranges of habitats and the inclusion of at least two faunal provinces raises the diversity above similar or smaller areas comprising fewer habitats and *e.g.* only a single province. The diversity of the Mid-Atlantic Ridge in general has been understudied, both in terms of the pelagic ecosystem (Youngbluth *et al.*, 2008) and the benthos (Tabachnick & Collins, 2008). The findings of the MAR-ECO expedition have allowed glimpses into the structure and patterns of fauna there (Mortensen *et al.*, 2008; Opdal *et al.*, 2008) and have furthered our understanding of this important region (Gebruk *et al.*, 2008).

5. Representativity

(The area contains a number of habitat/biotope types, habitat/biotope complexes, species, ecological processes or other natural characteristics that are representative for the OSPAR maritime area as a whole or for its different biogeographic regions and sub-regions.)

The Mid-Atlantic Ridge is the only mid-ocean ridge in the OSPAR maritime region and is representative of this type of geological feature (Dinter, 2001). The area is nominated for its importance as a section of the northern Mid-Atlantic Ridge, including a major biogeographic east-west and north-south divide. The Mid-Atlantic Ridge provides the only hard substrate and relatively shallow depths in the otherwise sedimentary abyssal plains of the North Atlantic. The most recently accepted biogeographical classification of the OSPAR maritime area shows that an MPA over the Charlie-Gibbs Fracture Zone and the areas north and south will include both warm and cool-temperate pelagic waters (Dinter, 2001). In terms of the deep-sea region the whole of the Mid-Atlantic Ridge is within what is described by Dinter (2001) as the Atlantic sub region.

Fock *et al.* (2004) found that the fish assemblages along the Mid-Atlantic Ridge were as expected for each water mass (*i.e.* representative). The deep-sea fish assemblages that have been caught over this area of the Ridge in experimental trawls are described as being 'typical' of those found in the North Atlantic (Bergstad *et al.*, 2008). In terms of benthic habitat the coral taxa observed during submersible dives performed by Mortensen *et al.*(2008) revealed a similar species richness as seen on continental shelf areas of the OSPAR region. Felley *et al.*(2008) described the cnidarian and sponge morphotypes observed in the Charlie-Gibbs Fracture Zone area as being characteristic of deep-sea habitats.

6. Sensitivity

(The area contains a high proportion of very sensitive or sensitive habitats/biotopes or species.)

The proposed MPA on the Mid-Atlantic Ridge through its associated substrate, current and feeding conditions, provides a habitat to a number of particularly sensitive/vulnerable species and communities both on soft and hard substrate and in the water column. In particular deepwater species such as orange roughy (*H. atlanticus*), and biogenic habitats such as formed by cold water corals and sponges are considered vulnerable, as often fragile, and slow (if at all) to recover due to slow growth, retarded maturity, irregular reproduction and high generation length, as well as community characteristics of high diversity at low biomass. This is an adaptation to stable, low food environments. Propagation and dispersal of larvae is largely unknown and therefore little can be said about a possible recovery of neither invertebrates nor fishes.

Benthic Habitat

a) Site Specific Information

The most abundant and diverse order of corals in the Charlie-Gibbs Fracture Zone area was the Gorgonacea (Mortensen *et al.*, 2008). Mortensen *et al.*(2008) observed corals on all sites on the Mid-Atlantic Ridge surveyed with ROVs at depths between 800 and 2400m, and reported a high species richness of corals with a total of 40 taxa observed. *Lophelia pertusa* was repeatedly observed on seamounts around the Charlie-Gibbs Fracture Zone, although, as noted earlier, not in the reef structures observed elsewhere (Mortensen *et al.*, 2008). Rich hexactinellid sponge communities or 'gardens' have been observed on the Mid-Atlantic Ridge around the Charlie-Gibbs Fracture Zone and the associated seamounts (Felley *et al.*, 2008; ICES, 2007a; Tabachnick & Collins, 2008).

b) General Evidence of Vulnerability/Sensitivity

Cold-water deep-sea corals and other associated sessile benthic fauna are vulnerable because they have a low capacity to recover from disturbance (Rogers *et al.*, 2008). Growth rates for such structural species are slow (a few millimetres per year) and some patches – where? -- of *L. pertusa* have been estimated to be 200 – 366 years old (Rogers *et al.*, 2008). For the extensive *L. pertusa* reefs seen around Norway, estimates indicate they are approximately 10,000 years old (Schröder-Ritzau *et al.*, 2005; Rogers *et al.*, 2008). Fecundity of deep-sea corals varies and *L. pertusa* is known to have a relatively high fecundity. However most recruitment probably occurs from larvae produced near to the same site. Therefore damage to a site may have long-lasting effects on population replenishment (Le Goff-Vitry *et al.*, 2004; Rogers *et al.*, 2008). There is, however paucity in the information about *L. pertusa* reproduction and therefore these results may reflect just regional and sub-regional patterns.

The high financial cost of investigating the deep-sea limits our understanding of the impacts of deep-sea fishing (Hall-Spencer *et al.*, 2002). However, evidence of trawl marks in the deep-sea region (200 – 1400m depth) of the European continental margin indicates that the potential impact of towed gears on deepwater corals is high (Hall-Spencer *et al.*, 2002), as does evidence of removal of these corals from deep continental slopes by fisheries in the past (*e.g.* Joubin, 1922; Pechenik & Troyanovskii, 1971). Towed gear has had long-lasting detrimental effects on shallow biogenic reefs in European waters (Hall-Spencer & Moore, 2000) and has caused extensive damage to deepwater reefs in other parts of the world, including off the coasts of Norway, Australia, USA and Canada, among many other nations (Hall-Spencer *et al.*, 2002; Roberts 2007). Fosså *et al.* (2002) estimated that 30-50% of Norwegian Lophelia reefs had been seriously damaged or destroyed by trawls. The scars of trawl passes have been widely reported in deepwater (Roberts *et al.* 2000, 2003 and references therein) and trawls are responsible for destroying many of the Darwin Mounds, deepwater coral habitats off the North West Coast of Scotland which were given protection from bottom trawling by the EU in 2004 (Duncan & Roberts 2001; Davies *et al.*, 2007). There is great concern over the damage, actual and potential, caused to corals that have built up over centuries and millennia (Hall-Spencer *et al.*, 2002). With growth rates for *L. pertusa* in the North Atlantic estimated as being between 2 and 25mm yr-1, the build up of reefs is slow (Mortensen, 2001; Hall-Spencer *et al.*, 2002). As yet there is no clear evidence of recruitment of new coral individuals to sites damaged by trawling (Waller *et al.*, 2007; Rogers *et al.*, 2008). Therefore despite no large reefs being found during the MAR-ECO expeditions it is possible that patchy damage may have already occurred decades ago if trawling activity has been ongoing since the 1970s in this region (Hareide & Garnes, 2001; ICES, 2007c).

Structural sponge habitat is also extremely vulnerable to trawling, suffering immediate declines through direct removal of sponges and further reductions in population densities due to delayed mortalities (Freese, 2001; ICES, 2007a). Experimental trawling of sponge communities in the Gulf of Alaska showed similar results to those found for coral communities. After one year no damaged sponges showed signs of repair or regrowth and there was no sign of recovery of the community (Freese *et al.*, 1999).

Koslow *et al.*, (2001) compared invertebrate assemblages on pristine, unexploited seamounts in Tasmanian waters with nearby seamounts that had been fished by trawlers targeting orange roughy (*H. atlanticus*). They found dense, species rich assemblages of bottom living invertebrates on unfished seamounts. By contrast, trawling operations had removed these communities from exploited seamounts. The corals and coral aggregate had been scraped off, or crushed and pulverised. Unfished seamounts supported on average twice the biomass of bottom living invertebrates and supported 46% more species per sample. The bare rock, rubble and sand characteristic of trawled seamounts were not seen on any of the unexploited seamounts. High bycatch of deepwater corals and associated organisms has also been reported from seamount fisheries for orange roughy (*H. atlanticus*) in New Zealand (Probert *et al.*, 1997; Anderson & Clark 2003). Very similar findings of serious damage were made by Waller *et al.* (2007) on the North Atlantic Corner Rise seamounts. The bare summits of trawled seamounts were in marked contrast to unfished (or at least very little fished) seamounts nearby that were rich in invertebrates and exploitable fish. The latter were virtually absent from fished peaks.

Fish Species

a) Site Specific Information

The northern Mid-Atlantic Ridge is considered to contain more than forty seamounts of commercial importance, in terms of fisheries (ICES, 2007c). The deepwater fishery along the Mid-Atlantic Ridge began in 1973 when dense concentrations of Roundnose grenadier (*C. rupestris*) were discovered (ICES, 2007c). Later concentrations of orange roughy (*H. atlanticus),* alfonsino *(B. splendens*), cardinal fish (*Epigonus telescopus*), tusk (*B. brosme*) and blue ling (*Molva dypterigia*) were also discovered (ICES, 2007c). Significant schools of *C. rupestris* have been observed over Hecate Seamount in the past and it is thought that they are the 'summit-living species' for this seamount (Hareide & Garnes, 2001; see ecological significance criterion for a more detailed description). The fact that they are known to school over seamounts makes them vulnerable to over-fishing (Hareide & Garnes, 2001, Morato *et al.* 2006, Morato & Clark 2007). Even following closure to fishing by the North East Atlantic Fisheries Commission (NEAFC), the Faraday and Antialtair seamounts were still targeted by fishermen, perhaps legally using mid-water trawls (which can still touch bottom from time to time causing damage to benthos) (ICES 2007a).

b) General Evidence of Vulnerability/Sensitivity

Many deep-sea fish species and communities are particularly susceptible to overexploitation due to their having generally slow growth, late maturity and great longevity, and often intermittent recruitment success (Roberts, 2002; Fossen *et al.*, 2008). ICES attempted to rank seamount species in order of their vulnerability to fishing based on their longevity and orange roughy (*H. atlanticus*) and roundnose grenadier (*C. rupestris*) were ranked the top two most vulnerable species, respectively (ICES, 2002). Froese & Pauly (2007) also classify both species as being highly vulnerable and having very low resilience to fishing pressure. In addition to this it is probable that based on geographical patterns the stocks of the Mid-Atlantic Ridge in general are isolated from others in the North Atlantic making them particularly vulnerable (ICES, 2007c). Devine *et al.*(2006) studied catch data for *C. rupestris* from eastern Canada (see also Ecological Significance criterion) and concluded that if it were to be assessed by the IUCN it would be classified as critically endangered because it has experienced drastic reductions in abundance since the onset of targeted fisheries.

Black scabbardfish (*A. carbo*) is known from the bycatch of trawl fisheries on and around the Mid-Atlantic Ridge. This species is described as having low resilience and high vulnerability by Froese & Pauly (2007) and ICES (2002) (it was ranked fourth most vulnerable species by ICES). *A. carbo* is a valuable species of fish in markets of the UK, Ireland, northern France, Spain and in particular Portugal (Stefanni & Knutsen, 2007). It is the target of two Portuguese long-line fisheries, a long established (since the 19th century) Madeira fishery and a more recent fishery off the Portuguese mainland (Figuieredo *et al.*, 2003). It reaches northern European markets primarily through the multi-species trawl fisheries of the UK and France (Figuieredo *et al.*, 2003). In Madeira the specialised long-line fleet is dedicated to taking this species and it makes up 55% of their total landings (Stefanni & Knutsen, 2007). Despite the commercial interest in this species, little is known about it's life cycle, information about the biology, maturity, growth and spawning of this species is scattered (Figueiredo *et al.*, 203; Stefanni & Knutsen, 2007). *A. carbo* is widely distributed around the world, in the Atlantic it is found in temperate-cold waters, from Iceland to Madeira, at depths between 200 and 1800m (Figueiredo *et al.*, 2003; Stefanni & Knutsen, 2007).

Sharks

a) Site Specific Information

Deepwater sharks are caught in several mixed trawl fisheries and directed long-line and gillnet fisheries in the North East Atlantic (ICES, 2007b). The most important species are the Portuguese dogfish (*Centroscymnus coelolepis*) and the Leafscale Gulper shark (*Centrophorus squamosus*) (ICES, 2007b). Both of which have been caught in experimental fishing on the seamounts of the northern Mid-Atlantic Ridge (Kukuev, 2004). Both species are migratory and are found widely distributed through the North East Atlantic and can be found on the Mid-Atlantic Ridge from Iceland to the Azores (Clarke *et al.*, 2001b; Froese & Pauly, 2007; Hareide & Garnes, 2001; ICES 2007b). When surveying the seamounts of the Mid-Atlantic Ridge Kukuev (2004) identified approximately twenty species of elasmobranch (see ecological significance criterion). All of these species are described as being vulnerable and having low resilience to fishing pressure by Froese & Pauly (2007).

b) General Evidence of Vulnerability/Sensitivity

ICES intend to assess the status of deepwater sharks in its 2008 report (ICES, 2007b). Unfortunately at the time of preparing this proposal that report was unavailable, but the World Conservation Union's Shark Specialist Group has recently assessed the threatened status of deepwater sharks globally (Kyne & Simpendorfer, 2007). It was concluded within this report that all deepwater chondrichthyan species have limited productivity and therefore should be considered as having little ability to sustain fishing pressure and be slow to recover from overfishing (Kyne & Simpendorfer, 2007). The most commercially important species in the North East Atlantic are *C. squamosus* and *C. coelolepis* (ICES, 2007b). Less than 20 years of fishing for these two species in the deep waters west of the UK has led to their depletion, to the point where a zero catch limit has been introduced, *i.e.* a moratorium on deepwater shark fishing (Kyne, & Simpendorfer, 2007). *C. squamosus* and *C. coelolepis* stocks on the northern Mid-Atlantic Ridge are also considered to be depleted (ICES, 2007b). As the quotas for these two species of deepwater sharks and others become more restrictive it is likely that there will be increased discarding of them as they are caught as bycatch in other fisheries (ICES, 2007b). Illegal, unreported and unregulated fishing is also known to take place for deepwater sharks especially in international waters (ICES, 2007b). Given the bycatch problem, there is therefore an urgent need to establish deepwater refuges from fishing for shark species and other vulnerable fishes.

Cetaceans

a) Site Specific Information

In total 14 species of cetaceans were observed during the MAR-ECO 2004 expedition along the Mid-Atlantic Ridge, including Blue (*Balenoptera musculus*), Fin (*Balenoptera physalus*) and Humpback (*Megaptera novaengliae*) whales (Doksæter *et al.*, 2008). The most frequent whale species seen were Sperm (*Physeter macrocephalus*) and Sei (*Balaenoptera borealis*) whales, of which more than 80 individuals of each species were observed (Doksæter *et al.*, 2008). Skov *et al.*(2008) observed schools of Sperm and Sei whales feeding in the nutrient rich waters just north of the Subpolar front (around the Charlie-Gibbs Fracture Zone), which overlaps with similar observations made almost a decade earlier by Sigurjónsson *et al.*(1991). The current hypothesis is that the Mid-Atlantic Ridge is an area that whale species use as a migration corridor and the frontal zones are used as feeding areas (O.A. Bergstad, pers comm.).

The distribution of dolphin species recorded along the Mid-Atlantic Ridge during the 2004 MAR-ECO cruise was linked to sea-surface temperature and salinity (Doksæter *et al.*, 2008). The species composition of dolphins, fish, cephalopods and zooplankton changes abruptly around the Charlie-Gibbs Fracture Zone (Bergstad *et al.*, 2008; Gaard *et al.*, 2008; Sutton *et al.*, 2008), which is more evidence that the Subpolar front acts as a distribution barrier (Doksæter *et al.*, 2008). Common (*Delphinus delphis*) and striped (*Stenella coeruleoalba*) dolphins were most frequently found in the waters south of the Charlie-Gibbs Fracture Zone, whereas white-sided dolphins (*Lagenortiynchus acutus*) and, to a certain degree, pilot whales (both *Globicephala melas/macrorhynchus*) were found to the north of the Zone (Doksæter *et al.*, 2008). The proposed protected area incorporates habitat areas used by all the species observed, see Figure 8.

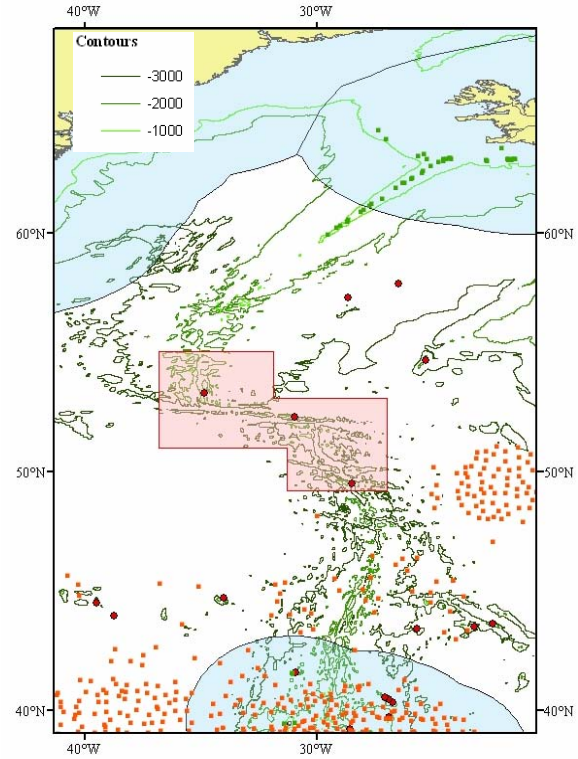

Figure **8.** Historical Sperm whale (*Physeter macrocephalus*) catch data around the proposed MPA. Orange squares are recorded catch locations, red circles are known seamount locations. Data from Townsend (1935)

b) General Evidence of Vulnerability/Sensitivity

Sperm whales have a long history of exploitation and today's population levels make them a high priority for management (Reeves *et al.*, 2003). Observations made by Skov *et al.* (2008) indicate that feeding aggregations have been observed in the Charlie-Gibbs Fracture Zone and Subpolar front region. Abundances will have been much greater prior to the onset of commercial whaling. It is possible that poor recruitment may occur as a residual effect of historic whaling (Whitehead & Weilgart, 2000). Although the sperm whale is not immediately threatened, some regional populations may require close evaluation and monitoring (Whitehead *et al.*, 1997). The IUCN has evaluated sperm whales in 2008. Their assessment listed them as vulnerable on the IUCN Red List (Cetacean Specialist Group, 2008).

Sei whales were classified by the IUCN as endangered in 1996, based on an estimated decline of 50% in worldwide abundances over the last three generations (Cetacean Specialist Group, 1996). This is a species that is widely distributed in temperate oceanic waters globally and was heavily exploited before gaining full protection from commercial whaling in the 1970s and 1980s (Reeves et al., 2003). The International Whaling Commission (IWC) recognises three stock divisions for sei whales in the North Atlantic: Nova Scotia; Iceland – Denmark Strait; and Eastern (Donovan 1991). These stocks of sei whale differ in their status. There are indications that that the Sei whales in the Iceland – Denmark Strait area is considerably better than inferred from the global perspective taken by the IUCN listing (Cattanach et al 1993). In the eastern North atlantic, however, the species seems to be virtually absent now. Areas of seai whale abundance seem to shift markedly between years relative to the northern extent of the distribution, more so than for other baleen whale species (gunnlaugsson et al 2004). Sei whales were observed feeding in the same areas near the subpolar front as sperm whales (Skov et al., 2008).

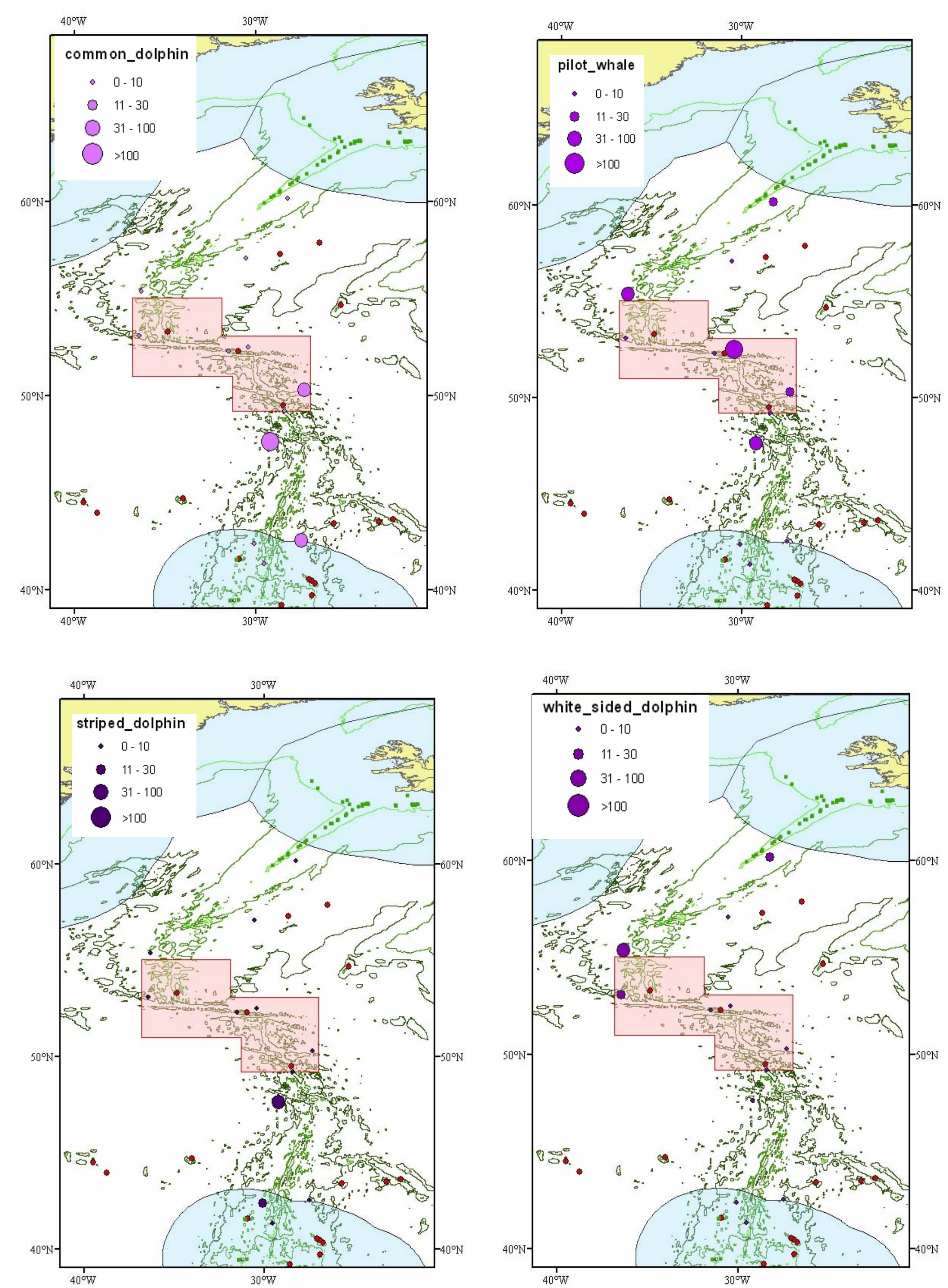

Figure **9.** Mapped distributions of cetaceans observed during the first leg of the MAR-ECO expedition on the R.V. G.O. Sars in 2004, data are taken from Doksæter et al.(2008). Common dolphins (*Delphinus delphis*) (n = 273) and striped dolphins (S*tenella coeruleoalba*) (n = 86) were observed in the warmer more saline waters to the south of the Sub Polar Front. Pilot whales (*Globicephala melas*) (n = 326) and white sided dolphins *(Lagenoryhnchus acutus*) (n = 103) were observed in the colder and less saline water masses to the north of the Sub Polar Front. All species preferred the steep slopes of the Mid-Atlantic Ridge. Red shaded area is the proposed MPA boundary and red circles are known seamount locations.

Sea Turtles

a) Site Specific Information

Leatherback turtles (*Dermochelys coriacea*) are known to forage at oceanic fronts during migration (Eckert, 2006). One study has tracked individuals to the subpolar front area of the North East Atlantic, presumably to feed in this plankton rich environment (Ferraroli *et al.*, 2004; Hays *et al.*, 2004). Indeed an area just south of the Charlie-Gibbs Fracture Zone (coinciding with the subpolar front) had the highest abundance of gelatinous zooplankton as compared to the rest of the Mid-Atlantic Ridge in 2004 (Youngbluth *et al.*, 2008). Therefore it is possible that *D. coriacea* migrating across the Atlantic visit the subpolar front area of the Mid-Atlantic Ridge to feed.

b) General Evidence of Vulnerability/Sensitivity

The entire North Atlantic is considered priority habitat for the critically endangered (Sarti Martinez, 2000) Leatherback turtle (*D. coriacea*) (Hays *et al.*, 2004; Doyle, 2007; Doyle *et al.*, 2008). The dramatic worldwide decline in *D. coriacea* is primarily because of the high mortality from their interaction with fisheries (Ferraroli *et al.*, 2004). Recently an observer program with the albacore tuna (*Thunnus alalunga*) drift net fishery found in the Bay of Biscay region of the North East Atlantic recorded 6 turtles being caught as bycatch, one of which was positively identified as *D. coriacea* (Rogan & Mackey, 2007).

In the Pacific Ocean conservation priorities can focus on foraging and nesting grounds and a relatively narrow oceanic migratory corridor (Ferraroli *et al.*, 2004). However, in the Atlantic Ocean leatherback migration is much more widely dispersed. They tend to follow two main patterns after breeding in the tropics, either heading towards the Gulf Stream area or dispersing east and remaining in tropical waters (Ferraroli *et al.*, 2004). Several high use foraging areas have been identified, including off the coast of Nova Scotia, Canada (James *et al.*, 2005), and the Iberian Peninsula/Bay of Biscay area (Eckert, 2006).

D. coriacea primarily feeds on gelatinous zooplankton (Hays *et al.*, 2006; Doyle, 2007) and a study to try and identify their primary foraging grounds in the North East Atlantic by Witt *et al.*(2007) was done by mapping the distribution of gelatinous zooplankton. This study identified the European Continental Shelf and Rockall Bank as probable foraging grounds (Witt *et al.*, 2007). Hays *et al.*(2006) showed that individuals that left breeding grounds in the Caribbean sometimes travelled all the way across the Atlantic into European waters, continually foraging as they travelled.

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7. Naturalness

The area has a high degree of naturalness, with species and habitats/biotope types still in a very natural state as a result of the lack of human-induced disturbance or degradation.

Despite the remoteness of the Mid-Atlantic Ridge, the area is not pristine anymore. Starting in the early 1970 with Soviet/Russian trawlers the roundnose grenadier (*C. rupestris*), orange roughy (*H. atlanticus*) and alfonsino (*B. splendens*) stocks of the Mid-Atlantic Ridge were exploited (Shibanov *et al.* 2002, Clark *et al.* 2007, ICES 2007). It can be assumed that most hills along the ridge were at least explored (usually by midwater trawl close to the seafloor), and at least 30 seamounts were exploited for *C. rupestris*. After 1982, the targeted fishery for redfish developed, dwarfing the catches of roundnose grenadier. After the transition from Soviet to Russian fisheries, the Russian fishing effort and absolute catch on the MAR was significantly reduced, however catch per fishing day settled at relatively low levels end of the 1990s (see Fig. 10) and the fishery was conducted only periodically (ICES 2007). The fishery on *C. rupestris* takes deepwater redfish (*Sebastes spp*), orange roughy (*H. atlanticus*), blackscabbard fish (*A. carbo*) and deepwater sharks as bycatch (Shibonov *et al.* 2002, Clark *et al.* 2007). In the 1980s, a significant longline fishery for tusk developed on the seamounts between 51 and 57° N, including on Hecate Seamount. In 1992, the Faroe Islands began a series of exploratory cruises for orange roughy (*H. atlanticus*), exploitable concentrations being found in late 1994 (annual catch 260 t) and early 1995 (1040 t), mostly on the Mid-Atlantic Ridge. The (trawl) fishery took place on five features on the Mid-Atlantic Ridge, incl. Faraday Seamount, and Hatton Bank. Catches peaked in 1996 at 1320 t, and since then have generally been less than 500 t (ICES, 2006, and Clark *et al.* 2007 and literature therein). The Faroese fishery was the only one of the many experimental fisheries in the 1980s and 90s from many countries which lasted more than a few years (Bergstad, pers. com.). Also the exploratory longline and trawl surveys on the MAR conducted by Norway between 1993 and 1997 (Hareide & Garnes 2001) were not further developed as the fishery did not seem economically viable: Already after one year of fishery for "giant" redfish, (*Sebastes marinus)* and two year of fishery for alfonsino (*Beryx spp.),* catch rates dropped drastically, indicating the limitations of the resource (ICES 1998 quoted in Hareide & Garnes 2001).

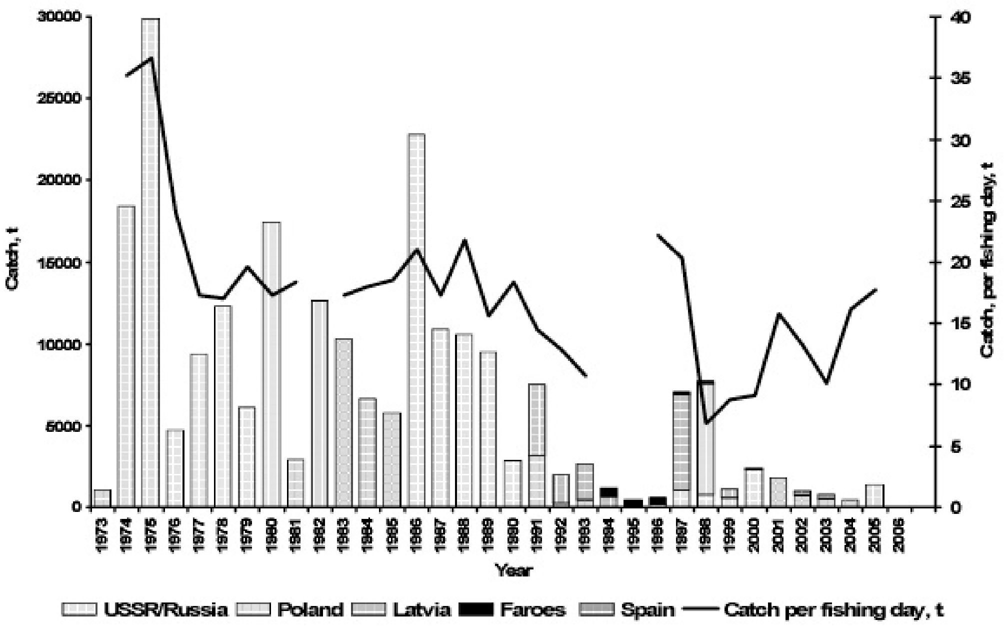

Figure 10. International catch and Soviet/Russian CPUE of roundnose grenadier on the MAR 1973-2006 (ICES 2007, Report WGDEEP Fig. 11.2.1)

Table 1 summarises the seamount-related fisheries on the MAR by species and year. Evidently, the fishery for roundnose grenadier affected the highest number of the MAR seamounts and revealed by far the largest catches. It is unclear to what extent the seamounts fished for different species were the same or different.

Tab. 1: Summary data on seamount fisheries on the MAR (ICES WGDEEP 2007)

Main species	Discovery		No. of commercial seamounts	Maximum catch/yr ('000 t)
	Year	Country		
Coryphaenoides rupestris	1973	USSR	34	29.9
Beryx splendens	1977	USSR	4	1.1
Hoplostethus atlanticus	1979	USSR	5	0.8
Molva dypterigia	1979	Iceland	1	8.0
Epigonus telescopus	1981	USSR	1	0.1
Aphanopus carbo	1981	USSR	2	1.2?
Brosme brosme	1984	USSR	15	0.3
Sebastes marinus (giant)	1996	Norway	10	1.0

It can be concluded that past fishing activities have significantly impacted on the natural ecosystem of the MAR by removing large quantities of highly vulnerable fish species (Hareide & Garnes 2001, ICES WG RED 2006, 2007)., Of particular concern are aggregation-forming fish species such as orange roughy (*H. atlanticus*), alfonsino (*B. splendens*), redfish (*Sebastes spp*) and roundnose grenadier (*C. rupestris*), where relatively stable catch rates may be maintained by serial exploitation of aggregation sites. However, currently available figures on the CPUE rates for roundnose grenadier do not allow for conclusive evidence on a depletion of this species – the strongly reduced (known) fishing effort on this species since the 1990s may have stabilized the biomass (ICES 2007).

There is no evidence yet of any human-caused physical damage to the seafloor and its habitats and species (possibly because of poor data coverage), however, lost fishing gear was found entangled with corals on the seafloor, and large fields of *Lophelia* rubble on the Mid-Atlantic Ridge, which raises questions about the possible cause of disintegration or destruction .

Destruction is not completely unlikely since Waller *et al.* (2007) documented extensive human–caused impacts on two of the Corner Rise seamounts to the west of the MAR, which were also subject to exploitation by Russian trawling since the 1970s. They found multiple scars, scleractinian debris, broken soft coral branches and broken manganese crusts.

So although the scale of human impacts are unclear and similar habitats on the continental slope have probably been impacted to a much higher degree, it is unlikely that areas shallower than 2000 metres on the Mid-Atlantic Ridge are pristine.

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b. Practical criteria/considerations

1. Potential for restoration

The need for restoration measures, *i.e.* recovery from human impacts by excluding further human pressure, is not known. There is some documentation for depletion to non-economical levels of alfonsinos and giant redfish. The former species (mainly *Beryx splendens*) was however not fished in the proposed MPA. The collateral damage to corals and other erect megafauna on the hills has not been well quantified, but has likely happened to some extent. The giant redfish that were located at some northern hills were probably accumulated concentrations of old fish. The species is still abundant in the adjacent Irminger Sea where it is being monitored by international ICES-coordinated surveys. The orange roughy is likely to be the most vulnerable teleost fish in the area due to its extensive longevity and late maturation, and tendency to aggregate. The abundance of this species within the MPA area is unknown. The potential for restoration of damaged erect sessile fauna exists but it is likely to take very long time. The fishes that have been targeted by past fisheries, *e.g.* grenadier, redfish, tusk, orange roughy a. o. may recover substantially faster than *e.g.* coldwater corals and sponges, but some may require decades of reduced mortality and good recruitment.

2. Degree of acceptance

As noted earlier, the proposed area includes habitats and species listed as priority concern for OSPAR (OSPAR Commission 2003), and which qualify as Vulnerable Marine Ecosystems in relation to high seas fisheries according to the draft criteria developed by FAO (FAO 2007, Rogers *et al.*, 2008). The represented seamount communities, coral and sponge aggregations, a frontal area (in the form of the Sub Polar Front) and potential areas of upwelling all correspond to 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 warranting protection of the area.

a) Fishing

North East Atlantic Fisheries Commission (NEAFC) fishery closures already exist in this region of the Mid-Atlantic Ridge incorporating the Faraday Seamounts, Hecate Seamounts and a section of the Mid-Atlantic Ridge (Figure 2)(NEAFC, 2008). These closures were instigated in 2004 and will be in effect until 31st December 2008 (NEAFC, 2008), and further on subject to renewal every 3 years. Compliance with these closures appears to be relatively good. No fishing activity was recorded for the entire first year of the closures in the area of the Reykjanes Ridge and Hecate Seamount (ICES, 2007a). The story is different for Faraday Seamount, which actually experienced increased fishing in the year following protection as compared to when it was unprotected (ICES, 2007a). No information is available for subsequent years.

The Mid-Atlantic Ridge within the proposed protected area has been described as difficult to fish with bottom gear (even using rock-hopper trawls) due to the topography (Magnússon & Magnússon, 1995a; Bergstad *et al.*, 2008). Fishing has been attempted in the region, but has been sporadic (Hareide & Garnes, 2001). Commercial landings in the area have declined since 1996 (see *e.g.* ICES 2007) and Gordon *et al.* (2003) suggest that this is due to a reduction in yields, indicating that the fisheries were not sustainable at their previous level.

Presently, the fishing effort exerted on the Mid-Atlantic Ridge is very low. ICES (2005) in its advice to NEAFC summarizes the number of European and Russian vessels currently operating in the area. These were in 2004 1 Norwegian, 4 Russian, 1 Spanish, 1 Faroe, 1 Irish and 2 Portuguese vessels. Therefore, a MPA safeguarding not only sensitive benthic habitats but also critical deepwater species and stocks should be acceptable to all North Atlantic coastal states. Another point is displacement of fishing effort, the Mid-Atlantic Ridge is relatively unexplored (Bergstad *et al.*, 2008), and the precautionary principle dictates that efforts should be made not to displace fishing effort from an area of high intensity to an area of little or no fishing without good reason. By incorporating the NEAFC closures into the proposed area, combined with the fact that fishers appear to avoid some sections of the Mid-Atlantic Ridge completely, it is thought that minimal displacement will occur.

The already existing closures, the currently low fishing effort in the proposed area and an increasingly stricter management of deepwater fishery by NEAFC and the European Community (see *e.g.* NEAFC recommendations 2007, EC 2015/2006, European Parliament 2007) may indicate a certain degree of acceptance of measures related to the establishment of an MPA on the Mid-Atlantic Ridge. The measures required will have to be proportionate to the conservation objectives of the MPA and will be in the responsibility of NEAFC.

b) Science
Science will not be affected by any management regime other than being bound to a code of conduct to minimize impacts – see draft OSPAR guidelines for research (BDC 08/4/6).

c) Tourism

No tourism present

d) Bioprospection

It is unknown what the extent of this activity within the proposed area currently is.

e) Mining

Subject to ISA licensing, no exploration or exploitation plans known as yet.

f) Transport

Will not be affected

g) Cable laying

Not known, however it seems likely that an agreement can be reached.

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3. Potential for success of management measures

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 is 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). Any management or enforcement of fisheries will be the responsibility of NEAFC, however cooperation will be needed. The challenge will be to bring illegal and unregulated fishing under control although some progress is being made on this within the NEAFC region. Because the area in question incorporates the current NEAFC fishery closures, which include a section of the Mid-Atlantic Ridge, the Faraday Seamounts and the Hecate Seamount (NEAFC, 2008) the management or at least enforcement of measures may be easier.

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4. Potential damage to the area by human activities

For the habitats included in this area, the most damaging industry operating in the North East Atlantic is deep-sea and high seas fishing (OSPAR, 2007). Recent underwater video footage of the area was collected during the 2004 MAR-ECO cruise of the Mid-Atlantic Ridge. Mortensen *et al.*(2008) recorded evidence of fishing at a couple of stations during their sampling . At approximately 53°N, 35°W a pelagic gillnet was found in a small mound with dead coral skeleton pieces. At a station slightly further away from the Charlie-Gibbs Fracture Zone, at 51.5°N, 30.3°W ropes from fishing gear were found on the seabed and entangled in a large and partly broken colony of *Paragorgia arborea*. However, there were no clear marks on the seabed from contact with heavy fishing gear such as trawl doors (Mortensen *et al.,* 2008). Lost longlines were also caught when fishing on hills of the Mid-Atlantic Ridge by the chartered longliner *MS Loran* (Dyb & Bergstad, 2004) that was operating as part of the MAR-ECO program at the same time in the same areas as sampled by Mortensen *et al.*(2008). Loss of longlines and gillnets from commercial vessels is almost certainly frequent (Hareide *et al.,* 2005). Remains of former large *Lophelia* reefs were observed at several locations during the sampling undertaken by Mortensen *et al.*(2008), the causality of the degradation of these reefs could not be ascertained, however it was noted by the authors that there were no obvious natural causes that could account for such dramatic reductions in the extent of the reefs seen. Les Watling of the Darling Marine Center at the University of Maine and his colleagues discovered massive damage to deepwater seamounts at the nearby Corner Rise in 2006. There, great blocks of seabed had been "*torn up, crushed and crumbled. It had evidently been covered by a crust of some sort that had been slashed by deep gouges which were everywhere*." (Watling quoted in Roberts 2007). Watling attributed this damage to fishing by Soviet vessels fishing there between the 1970s and 1990s (Waller *et al.,* 2007).

The results from MAR-ECO cruises must be regarded as first glances at the status of deep-sea corals along the Mid-Atlantic Ridge and Mortensen *et al.*(2008) state that their results regarding fishing activity are inconclusive.

As noted earlier, there has been commercial fishing activity on the Mid-Atlantic Ridge since 1973, when dense concentrations of *C. rupestris* were discovered by USSR exploratory trawlers (ICES, 2007c). Aggregations of *C. rupestris* may have occurred on over 70 seamount peaks between 46° and 62°N , but only 30 of them were commercially important and subsequently exploited (ICES, 2007c). The primary gear used in this area has been semi-pelagic trawl close to the bottom, but bottom gear, longlines and gillnets have also been used (ICES, 2007c; Mortensen *et al.,* 2008). This fishery ended in the 1990s due to the break up of the Soviet Union rather than a lack of yields (Hareide & Garnes, 2001; Gordon *et al.,* 2003; ICES, 2007c). In 1994 a Russian fishery for alfonsino (*B. splendens*) developed in the same year as a Faroese fishery for orange roughy (*H. atlanticus*) (Hareide & Garnes, 2001; Gordon *et al.,* 2003). In 1996, Norwegian and Icelandic longliners began a fishery for *Sebastes marinus* (Giant redfish), *B. brosme* (Tusk), *Reinhartius hippoglossoides* (Greenland halibut) and *Hippoglossus hippoglossus* (Halibut) in the area between 54 and 61°N (Hareide & Garnes, 2001; Gordon *et al.,* 2003).

The true extent of fishing activity in the area is hard to document, however ICES (2007) The closures relevant to this proposal are the closure of the Hecate and Faraday Seamounts and a part of the Reykjanes Ridge to all bottom trawling and fishing with static gears (NEAFC, 2008). As noted earlier, Gordon *et al.*(2003), however, attributed the reduction in activity over the Mid-Atlantic Ridge around the beginning of the 21st century as an indication that yields, of commercially important species such as redfish, tusk and halibut, have dropped as opposed to the introduction of regulations. Many of the deepwater fish stocks in the entire North East Atlantic are heavily exploited and some are severely depleted (Anon, 2001; Gordon *et al.,* 2003). The realisation of this led ICES in 2000 to provide the management advice that recommended '*immediate reductions in these* (deepwater) *fisheries unless they can be shown to be sustainable*' (Gordon *et al.,* 2003). Since then restrictions and closures (such as the prior mentioned NEAFC closures) have occurred to attempt to create sustainable deepwater fisheries (ICES, 2007c).

The actual scale of the impact that fishing and other human activities have had on the Mid-Atlantic Ridge is largely unquantified. Magnússon & Magnússon (1995a) reported that the Reykjanes Ridge section of the Mid-Atlantic Ridge is in general a very difficult area for bottom trawling mainly because of its extremely irregular bottom topography. They reported that on both sides of the ridge huge quantities of sponges can be encountered in some places and loose mud in others (Magnússon & Magnússon, 1995a). In 2004 fishing effort was recorded to a small extent over the Reykjanes Ridge and over Faraday seamount and more frequently above Hecate seamount (ICES, 2007a). In 2005, when the NEAFC fisheries closures in this area came into force, no bottom fishing was observed over the Reykjanes Ridge and Hecate seamount during the entire year, however fishing effort increased over Faraday seamount (ICES, 2007a).

Threats from future fishing activity to this area are high. As inshore stocks are depleted and fishing technology advances deepwater fish stocks in general are being increasingly exploited (Turner *et al.,* 2001; Roberts, 2002). Deep-sea fish species such as *H. atlanticus* and *C. rupestris* are long-lived and highly vulnerable to fishing. While catches early on in such fisheries can be highly rewarding and encourage increased effort, fishing soon leads to stock collapses such as those that have happened in the fisheries for *H. atlanticus* in New Zealand (Roberts, 2002).

Deepwater fishing gear does not just deplete target species it causes damage to the benthic habitat, decreasing habitat heterogeneity, simplifying ecosystems and reducing the number of micro-habitats available (Turner *et al.,* 2001; Roberts, 2002). These benthic habitats can take decades or even centuries to recover (Freese *et al.,* 1999; Freese *et al.,* 2001; Hall-Spencer *et al.,* 2002; Waller *et al.,* 2007; Rogers *et al.,* 2008) and there is evidence that this simplification of benthic habitat reduces the overall diversity of the ecosystem (Turner *et al.,* 2001; Roberts, 2002). Investigations of *Lophelia pertusa* reefs in the North East Atlantic have shown that they are host to rich fauna, with as many as 800 - 1300 species being associated with the coral, this is estimated as being three times higher than the number of species associated with the surrounding seabed (Husebø *et al.,* 2002; Roberts *et al.,* 2006).

There is no information available regarding prospecting for minerals from the seabed or bioprospecting in the Charlie-Gibbs Fracture Zone area. It is likely that both of these activities are more of a threat to areas of hydrothermal activity (Glowka, 2003; Synnes, 2007) on the Mid-Atlantic Ridge than the Charlie-Gibbs Fracture Zone. Likewise tourism is a highly unlikely threat in this remote part of the Atlantic Ocean. Scientific investigations in the area will continue, and establishment of an MPA is likely to enable co-ordinated effort that can be sustainably conducted.

5. Scientific value

Mid-ocean ridges are vast features of all oceans (Heger *et al.,* 2008; Hosia *et al.,* 2008). Despite their importance, the fauna and ecological significance of mid-ocean ridges remains poorly understood, mainly because ridge studies in the past have been understandably biased towards newly discovered chemosynthetic ecosystems (Bergstad *et al.,* 2008a).

The high scientific value of the Charlie-Gibbs Fracture Zone and the area of the Mid-Atlantic Ridge within the OSPAR region is illustrated by the fact that there is a major scientific research project underway focusing on the ‘Patterns and Processes of the Ecosystem of the northern mid-Atlantic’, (MAR-ECO, Bergstad *et al.,* 2008a). Many papers have been published, some early on in the project (Fock *et al.,* 2004; Holland *et al.,* 2005; Sanamyan & Sanamyan, 2005; Vinogradov, 2005; King *et al.,* 2006; Fock & John, 2006; Fossen & Bergstad, 2006; Priede *et al.,* 2006; Vecchione & Young, 2006; Young *et al.,* 2006a, b). Others, after substantial field research, were published recently in the journal Deep-Sea Research II (see reference list) and others have been published in Marine Biology Research in February 2008 (Bergstad & Gebruk, 2008; Brandt & Andres, 2008; Dilman, 2008; Gebruk, 2008; Gebruk *et al.,* 2008; Martynov & Litvinova, 2008; Mironov, 2008; Molodtsova *et al.,* 2008; Murina, 2008; Tabachnick & Collins, 2008; Zezina, 2008).

In this issue of Marine Biology Research, 15 new species and one new genus were described, which represented about 10% of the total number of benthic species sampled during the expedition (Gebruk *et al.,* 2008). Some specimens were recorded in the North Atlantic for the first time (Dilman, 2008; Zezina, 2008), while others added information to records of species only sampled a few times before (Molodtsova *et al.*, 2008).

The MAR-ECO project is still underway and the UK consortium has been successful in initiating a second field campaign from 2007-2009, focusing on the subpolar front. This research will investigate the transition zone between northern and southern faunal provinces, constituting a sub-area of apparent concentration of macrofauna and presumably high production levels (Bergstad *et al.*, 2008a). As a result of these ship-time commitments MAR-ECO has been extended to 2010, when a final report will be issued as an element of the Census of Marine Life (CoML) (Bergstad *et al.,* 2008a).

Our knowledge of mid-ocean ridges remains sparse at best. Even with the MAR-ECO project ongoing many questions remain unanswered or partially answered (Bergstad *et al.,* 2008a). Ongoing monitoring and research is required but, as any research, is very expensive (Hall-Spencer *et al.,* 2002). The vulnerability of the deep-sea to human impacts may mean that, without swift protection, much of the diversity that is as yet unknown will be lost before we can catalogue it (Roberts, 2002).

C. Proposed management and protection status

1. Proposed management

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

Underwater noise

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.

Sponsoring Contracting Parties

The Netherlands, France, Portugal, Germany

Sponsoring Observer Organisations

WWF

Last revision of proforma

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References

Anderson, O.F. & Clark, M.R. (2003) Analysis of bycatch in the fishery for orange roughy (*Hoplostethus atlanticus*), on the South Tasman Rise. *Marine & Freshwater Research* **54(5):** 643 – 652

André, M., Ramos, A.G. & Lopez-Jurado, L.F. (1994) Sperm Whale acoustic survey off the Canary Islands, in an area of heavy marine traffic: preliminary results. *European Research in Cetaceans **8:** 65.*

Auster, P.J., 2005. Are deepwater corals important habitat for fishes? In: Freiwald, A., Roberts, J.M. (Eds.), Cold-water Corals and Ecosystems. Springer-Verlag, Berlin Heidelberg, pp. 747-760.

Basson, M., Gordon, J.D.M., Large, P., Lorance, P., Pope, J. & Rackham, B. (2002) The effects of fishing on deepwater fish species to the west of Britain. Joint Nature Conservation Committee Report No. 324. JNCC, Petersborough.

Bergstad, O.A. & Gebruk, A.V. (2008) Approach and methods for sampling of benthic fauna on the 2004 MAR-ECO expedition to the Mid-Atlantic Ridge. *Marine Biology Research* **4:** 160 – 163.

Bergstad, O.A., Menezes, G. & Høines, Å.S. (2008) Demersal fish on a mid-ocean ridge: Distribution patterns and structuring factors. *Deep-Sea Research II* **55:** 185 – 202.

Bergstad, O.A., Falkenhaugh, T., Astthorsson, O.S., Byrkjedal, I., Gebruk, A.V., Piatkowski, U., Priede, I.G., Santos, R.S., Vecchione, M., Lorance, P. & Gordon, J.D.M. (2008a) Towards improved understanding of the diversity and abundance patterns of the mid-ocean ridge macro- and megafauna. *Deep-Sea Research II* **55:** 1 – 5.

Bower, A.S., Le Cann, B., Rossby, T., Zenk, W., Gould, J., Speer, K., Richardson, P.L., Prater, M.D. & Zhang, H.-M. (2002) Directly measured mid-depth circulation in the northeastern North Atlantic Ocean. *Nature* **419:** 603 – 607.

Brandt, A. & Andres, H.G. (2008) Description of *Aega sarsae* sp. nov. and redescription of *Syscenus atlanticus* Kononenko, 1988 (Crustacea, Isopoda, Aegidae) from the Mid-Atlantic Ridge. *Marine Biology Research* **4:** 61 – 75.

Cetacean Specialist Group (2008) *Balaenoptera musculus*. In: IUCN 2008. *2008 Red List of Threatened Species* www.iucnredlist.org. Downloaded 09 February 2009.

Clark, D.R., Aazem, K.V. & Hays, G.C. (2001a) Zooplankton abundance and community structure over a 4000km transect in the north-east Atlantic. *Journal of Plankton Research* **23:** 365 – 372.

Clark, M. R., Vinnichenko, V. I., Gordon, J. D.M., Beck-Bulat, G. Z., Kukharev, N. N., Kakora A. F. (2007) Large-scale distant-water trawl fisheries on seamounts. In: Pitcher, T., Morato, T., Hart, P., Clark, M., Haggan, N., Santos, R. (Eds.) (2007) Seamounts. Ecology, Fisheries & Conservation. Blackwell Publishing, 361-399

Clarke, M.W., Connolly, P.L. and Bracken, J.J. (2001b). Aspects of reproduction of deepwater sharks *Centroscymnus coelolepis* and *Centrophorus squamosus* from west of Ireland and Scotland. *Journal of the Marine Biological Association of the United Kingdom*, **81**: 1019 – 1029.

Clarke, M.W.; Connolly, P.L. & Bracken, J.J. (2002) Age estimation of the exploited deepwater shark *Centrophorus squamosus* from the continental slopes of the Rockall Trough and Porcupine Bank. *Journal of Fish Biology* **60(3):** 501-514.

Copley, J. T. P., Tyler, P. A., Sheader, M., Murton, B. J., & German, C. R. (1996) Megafauna from sublittoral to abyssal depths along the Mid-Atlantic Ridge south of Iceland. *Oceanologica Acta* **19:** 549–559.

Davies, A.J., Roberts, J.M. & Hall-Spencer, J., (2007) Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management. Biological Conservation 138: 299-312.

Deng, R., Dichmont, C., Milton, D., Haywood, M., Vance, D., Hall, N. & Die, D. (2005) Can vessel monitoring system data also be used to study trawling intensity and population depletion? The example of Australia's northern prawn fishery. Canadian Journal of Fisheries and Aquatic Sciences 62 (3): 611-622.

Devine, J.A., Baker, K.D. & Haedrich, R.L. (2006) Deep-sea fish qualify as endangered. *Nature* 439: 29.

Dilman, A.B. (2008) Asteroid fauna of the northern Mid-Atlantic Ridge with description of a new species Hymenasterides mironovi sp. nov. Marine Biology Research **4:** 131 – 151.

Dinter, W.P. (2001) Biogeography of the OSPAR Maritime Area – A Synopsis and Synthesis of Biogeographical Distribution Patterns described for the North-East Atlantic. Bundesamt für Naturschutz, Bonn, Germany pp 167.

Doksæter, L., Olsen, E., Nøttestad, L. & Fernö, A. (2008) Distribution and feeding ecology of dolphins along the Mid-Atlantic Ridge between Iceland and the Azores. *Deep-Sea Research II* **55:** 243 – 253.

Doyle, T.K. (2007) Leatherback sea turtles (*Dermochelys coriacea*) in Irish waters. *Irish Wildlife Manuals,* No. 32. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Doyle, T.K., Houghton, J.D.R., O'Súilleabháin, P.F., Hobson, V.J., Marnell, F., Davenport, J. & Hays, G.C. (2008) Leatherback turtles satellite-tagged in European waters. *Endangered Species Research* **4:** 23 – 31.

Duncan, C. and Roberts, J.M. (2001) Darwin mounds: deep-sea biodiversity hotspots'. *Marine Conservation* **5:** 12-13

Dyb, J.E. & Bergstad, O.A. (2004) MAR-ECO: the cruise with M/S Loran Summer 2004, Cruise Report. Rapporter Møreforsking Ålesund No. 0418, 98pp, ISNN 0804-5380.

Eckert, S.A. (2006) High-use oceanic areas for Atlantic leatherback sea turtles (*Dermochelys coriacea*) as identified using satellite telemetered location and dive information. *Marine Biology* **149:** 1257 – 1267.

Epp, D. & Smoot, N.D. (1989) Distribution of seamounts in the North Atlantic. *Nature* **337:** 254 – 257.

Falkowski, P.G., Barber, R.T. & Smetacek, V. (1998) Biogeochemical controls and feedbacks on ocean primary production. *Science* **281:** 200 – 206.

FAO (2007) Draft International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. FAO TC:DSF/2008/2.

Félix, F., Haase, B., Davis, J.W., Chiluiza, D. & Amador, P. (1997) A note on recent stranding and bycatches of Sperm Whales (*Physeter macrocephalus*) and humpback whales (*Megaptera novaeangliae*) in Ecuador. *Report of the International Whaling Commission* (Special Issue) **15:** 917 – 919.

Felley, J.D., Vecchione, M. &Wilson Jr., R.R. (2008) Small-scale distribution of deep-sea demersal nekton and other megafauna in the Charlie-Gibbs Fracture Zone of the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 153 – 160.

Ferraroli, S., Georges, J-Y., Gasparll, P. & Le Maho, Y. (2004) Where leatherback turtles meet fisheries: conservation efforts should focus on hotspots frequented by these ancient reptiles. *Nature* **429:** 521.

Figueiredo, I., Bordalo-Machado, P., Reis, S., Sena-Carvalho, D., Blasdale, T., Newton, A. & Gordo, L.S. (2003) Observations on the reproductive cycle of the black scabbardfish *Aphanopus carbo* Lowe, 1839) in the NE Atlantic. *ICES Journal of Marine Science* **60:** 774 – 779.

Fock, H. & John, H.-Chr. (2006) Fish larval patterns across the Reykjanes Ridge. *Marine Biological Research* **2:** 191 – 199.

Fock, H., Pusch, C. & Ehrich, S. (2004) Structure of deep-pelagic fish assemblages in relation to the Mid-Atlantic Ridge (45^{o} – 50^{o}N). *Deep-Sea Research I* **51:** 953

Fosså, J.H., Mortensen, P.B. & Furevik, D.M. (2002) The deepwater coral *Lophelia pertusa* in Norwegian waters: distribution and fishery impacts. *Hydrobiologia*, **471**, 1-12.

Fosså, J. H. (2005) Discovering deepwater sponges. ICES Marine World.

Fossen, I. & Bergstad, O.A. (2006) Distribution and biology of blue hake, *Antimora rostrata* (Pisces: Moridae), along the Mid-Atlantic Ridge and off Greenland. *Fisheries Research* **82:** 19 – 29.

Fossen, I., Cotton, C.F., Bergstad, O.A. & Dyb, J.E. (2008) Species composition and distribution patterns of fishes captured by longlines on the Mid-Atlantic Ridge. *Deep-*

Sea Research II **55:** 203 – 217.
Francis, R. and M. R. Clark. 1998. Inferring spawning migrations of orange roughy (*Hoplostethus atlanticus*) from spawning ogives. Mar. Freshwater. Res. **49**(2). 103-108.
Fratantoni, D.M. (2001) North Atlantic surface circulation during the 1990s observed with satellite-tracked drifters. *Journal of Geophysical Research* **101(C12):** 22067 – 22094.
Freese, J.L., Auster, P.J., Heifetz, J. & Wing, B.L. (1999) Effects of trawling on seafloor habitat and associated invertebrate taxa in the Gulf of Alaska. *Marine EcologyProgress Series* **182:** 119 – 126.
Freese, J.L. (2001) Trawl-induced damage to sponges observed from a research submersible. *Marine Fisheries Review* **63:** 7 – 13.
Froese, R. & Pauly, D. (eds) (2007) FishBase. World Wide Web Electronic Publications www.fishbase.org . Last accessed 22/02/08
Gaard, E., Gislason, A., Falkenhaug, T., Søiland, H., Musaeva, E., Vereshchaka, A. & Vinogradov, G. (2008) Horizontal and vertical copepod distribution and abundance on the Mid-Atlantic Ridge in June 2004. *Deep-Sea Research II* **55:** 59 – 71.
Gallienne, C.P., Robins, D.B. & Woodd-Walker, R.S. (2001) Abundance, distribution and size structure of zooplankton along a 20°W meridional transect of the Northeast Atlantic Ocean in July. *Deep-Sea Research II* **48:** 925 – 949.
Gebruk, A.V. (2008) Holothurians (Holothuroidea, Echinodermata) of the northern Mid-Atlantic Ridge collected by the *G.O. Sars* MAR-ECO expedition with descriptions of four new species. *Marine Biology Research* **4:** 48 – 60.
Gebruk, A.V., Fenchal, T. & Uiblein, F. (2008) Benthic fauna of the northern Mid-Atlantic Ridge: results of the MAR-ECO expedition. *Marine Biology Research* **4:** 1 –2
Genin, A., Dayton, P.K., Lonsdale, P.F. & Speiss, F.N. (1986) Corals on seamount peaks provide evidence of current acceleration over deep-sea topography. *Nature* **322**: 59–61.
Gislasson, A., Gaard, E., Debes, H. & Faulkenhaug, T. (2008) Abundance, feeding and reproduction of *Calanus finmarchicus* in the Irminger Sea and on the northern Mid-Atlantic Ridge in June. *Deep-Sea Research II* **55:** 72 – 82.
Glowka, L. (2003) Putting marine scientific research on a sustainable footing at hydrothermal vents. *Marine Policy* **27(4):** 303 -312.
Gordon, J.D.M., Bergstad, O.A., Figueiredo, I. & Menezes, G. (2003) Deepwater fisheries of the Northeast Atlantic: I. Description and current trends *Journal of the Northwest Atlantic Fisheries Science* **31:** 137 – 150.
Grigg, R. W. (1997) Benthic communities on Loíhi submarine volcano reflect high-disturbance environment. *Pacific Science* **51:** 209-220.
Gubbay, S. (2003) Seamounts of the North East Atlantic. OASIS, Hamburg and WWF, Germany, Frankfurt am Main, November 2003.
Haedrich, R.L. & Merrett, N.R. (1988) Summary atlas of deep-living fishes in the North Atlantic. *Journal of Natural History* **22:** 1325 – 1362.
Hall-Spencer, J.M. & Moore, P.G. (2000) Scallop dredging has profound long-term impacts on maerl beds. *ICES Journal of Marine Science* **57:** 1407 – 1415.
Hall-Spencer, J., Allain, V. & Fosså, J.H. (2002) Trawling damage to Northeast Atlantic ancient coral reefs. *Proceedings of the Royal Society, London: B Biological Sciences* **269 (1490):** 507 – 511.
Hareide, N.-R. & Garnes, G. (2001) The distribution and catch rates of deepwater fish along the Mid-Atlantic Ridge from 43 to 61°N. *Fisheries Research* **51:** 297 – 310.
Hareide N-R., Garnes G., Rihan D., Mulligan M., Tyndall P., Clark M., Connolly P., Misund R., McMullen, P., Furevik D., Humborstad O.B., Høydal K. & T. Blasdale (2005). A preliminary Investigation on Shelf Edge and Deep-sea Fixed Net Fisheries to the West and North of Great Britain, Ireland, around Rockall and Hatton Bank. Bord Iascaigh Mhara, Fiskeridirecktoratet, NEAFC, Sea Fish Industry Authority, Joint Nature Conservation Committee, Marine Institute Foras na Mara.
Hays, G.C., Houghton, J.D.R. & Myers, A.E. (2004) Pan-Atlantic leatherback turtle movements. *Nature* **429:** 522.

Hays, G.C., Hobson, V.J., Metcalfe, J.D., Righton, D. & Sims, D.W. (2006) Flexible foraging movements of leatherback turtles across the north Atlantic Ocean. *Ecology* **87(10):** 2647 – 2656.

Heger, A., Ieno, E.N., King, N.J., Morris, K.J., Bagley, P.M. & Priede, I.G. (2008) Deep-sea pelagic bioluminescence over the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 126 – 136.

Herndon, A.P. & Burgess, G.H. (2006) *Etmopterus princeps*. In: IUCN 2007. *2007 IUCN RedList of Threatened Species*. www.iucnredlist.org. Downloaded on March 10th 2008.

Holland, N.D., Clague, D.A., Gordon, D.P., Gebruk, A., Pawson, D.L. & Vecchione, M. (2005) Lophenteropneust hypothesis refuted by collection and photos of new deep-sea hemichordates. *Nature* **434(7031):** 374 – 376.

Hosia, A., Stemmann, L. & Youngbluth, M. (2008) Distribution of net-collected planktonic cnidarians along the northern Mid-Atlantic Ridge and their associations with the main water masses. *Deep-Sea Research II* **55:** 106 –118.

Husebø, Å., Nøttestad, L., Fosså, J.H., Furevik, D.M. & Jørgensen, S.B. (2002) Distribution and abundance of fish in deep sea coral habitat. *Hydrobiologia* **471:** 91 – 99.

ICES (2002) Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources. Horta, The Azores, Portugal. 4 – 10 April, 2002. ICES CM 2002/ACFM:16 Ref. G.

ICES (2005) Advice on threats to, and decline of, communities associated with seamounts. ICES ACE Report 2005, submitted to OSPAR MASH (MASH 05/3/9), 41 pp.

ICES (2005) Report of the Working Group on Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP), ICES CM 2006/ACFM:07

ICES (2006) Report of the Working Group for Regional Ecosystem Description(WGRED), ICES CM 2006/ACE:03

ICES (2007a) Report of the Working Group on Deepwater Ecology (WGDEC), 26 – 28 February 2007. ICES CM 2007/ACE:01 Ref. LRC. 61 pp.

ICES (2007b) Report of the Working Group on Elasmobranch Fishes (WGEF), 22 – 28 June 2007, Galway, Ireland. ICES CM 2007/ACFM: 27. 318pp.

ICES (2007c) Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP), 8 - 15 May 2007, ICES Headquarters. ICES CM2007/ACFM:20.478 pp.

James, M.C., Ottensmeyer, C.A. & Myers, R.A. (2005) Identification of high-use habitat and threats to leatherback turtles in northern waters: new directions for conservation. *Ecology Letters* **8:** 195 – 201.

Joubin, M.L. (1922) Les coraux de mer profonde. Nuisibles aux chalutiers. *Notes et Mémoires* No. 18: 5-16. Office Scientifique et Technique des Pêches Maritimes, Paris.

King, N., Bagley, P.M. & Priede, I.G. (2006) Depth zonation and latitudinal distribution of deep sea scavenging demersal fishes of the Mid-Atlantic Ridge, 42°-53°N. *Marine Ecology Progress Series* **319:** 263 – 274.

Klitgaard, A. B. & Tendal, O.S. (2004) Distribution and species composition of mass occurrences of large-sized sponges in the northeast Atlantic. *Progress in Oceanography* **61:** 57-98

Kourti, N., Shepherd, I., Schwartz, G. & Pavlakis, P. (2001) Integrating spaceborne SAR imagery into operational systems for fisheries monitoring. *Canadian Journal of Remote Sensing* **27 (4):** 291-305.

Kourti, N., Shepherd, I., Greidanus, H., Alvarez, M., Aresu, E., Bauna, T., Chesworth, J., Lemoine, G., Schwartz, G. (2005) Integrating remote sensing in fisheries control. Fisheries Management and Ecology 12 (5), 295-307.

Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B., and Williams, A. (2001) Seamount benthic macrofauna off southern Tasmania: community structure and impacts of trawling. *Marine Ecology Progress Series* 213: 111-125.

Kukuev, E.I. (2004) 20 years of ichthyofauna research on seamounts of the North Atlantic Ridge and adjacent areas. A review. *Archive of Fishery Marine Research* **51(1-3):** 215 -232.

Kyne, P.M., Sherrill-Mix, S.A. & Burgess, G.H. (2006) *Somniosus microcephalus*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species*. www.iucnredlist.org Downloaded on 10th March 2008.
Kyne, P.M. & Simpendorfer, C.A. (2007) A collation and summarization of available data on deepwater chondrichthyans: biodiversity, life history and fisheries. A report prepared by the IUCN SSC Shark Specialist Group for the Marine Conservation Biology Institute. February 2007. pp 137.
Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. & Podesta, M. (2001) Collisions between ships and whales. *Marine Mammal Science* **17:** 35 – 75.
Le Goff-Vitry, M., Pybus, O.G. & Rogers, A.D. (2004) Genetic structure of the deep-sea coral *Lophelia pertusa* in the North East Atlantic revealed by microsatellites and ITS sequences. *Molecular Ecology* **13:** 537 – 549.
Magnússon, J. & Magnússon, J.V. (1995b) Oceanic redfish (*Sebastes mentella*) in the Irminger Sea and adjacent waters. *Scientia Marina* **59(3-4):** 241 – 254.
Magalhães, M.C., Santos, R.S. & Hamer, K.C. (in press) Dual-foraging of Cory's shearwaters: feeding locations, behaviour at sea and implications for food provisioning of chicks. *Marine Ecology Progress Series.*
Marr, S. & Hall-Spencer, J.M. (2002) UK coral reefs. The Ecologist **32 (4):** 36-37.
Martynov, A.V. & Litvinova, N.M. (2008) Deepwater Ophiuroidea of the Northern Atlantic with descriptions of three new species and taxonomic remarks on certain genera and species. *Marine Biology Research* **4:** 76 – 111.
Mironov, A.N. (2008) Pourtalesiid sea urchins (Echinodermata: Echinoidea) of the northern Mid-Atlantic Ridge. *Marine Biology Research* **4:** 3 – 24.
Mironov, A. & Gebruk, A. (2002) Deep-sea benthos of the Reykjanes Ridge: biogeographic analysis of the fauna living below 1000 m. Report on preliminary phase of the project MAR-ECO.23 pp.
Mironov, A. N. & Gebruk, A. (2006) Biogeography of the Reykjanes Ridge, the northern Atlantic. In: Mironov, A. N., A. V. Gebruk, A.J. Southward. Biogeography of the North Atlantic Seamounts. KMK Scientific Press, Moscow, 6-22
Molodtsova, T.N., Sanamyan, N.P.& Keller, N.B.(2008) Anthozoa from the northern Mid-Atlantic Ridge and the Charlie-Gibbs Fracture Zone. *Marine Biology Research* **4:** 112 - 130.
Morato, T., Clark, M. R. (2007) Seamount fishes: ecology and life history. In: Pitcher, T., Morato, T., Hart, P., Clark, M., Haggan, N., Santos, R. (Eds.) (2007) Seamounts. Ecology, Fisheries & Conservation. Blackwell Publishing, 170-188.
Mortensen, P.B. (2001) Aquarium observations on the deepwater coral *Lophelia pertusa* (L. 1758) (Scleractinaria) and selected associated invertebrates. *Ophelia* **54:** 83 – 104.
Mortensen, P.B. & Buhl-Mortensen, L. (2005) Morphology and growth of the deepwater gorgonians *Primnoa resedaeformis* and *Paragorgia arborea*. *Marine Biology* **147:** 775 – 788.
Mortensen, P.B., Buhl-Mortensen, L., Gebruk, A.V. & Krylova, E.M. (2008) Occurrence of deepwater corals on the Mid-Atlantic Ridge based on MAR-ECO data. *Deep-Sea Research II* **55:** 142 – 152.
Murawski, S.A., Wigley, S.E., Fogarty, M.J., Rago, P.J. & Mountain, D.G. (2005) Effort distribution and catch patterns adjacent to temperate MPAs. ICES Journal Of Marine Science **62 (6):** 1150-1167.
Murina, V.V. (2008) New records of Echiura and Sipuncula in the North Atlantic Ocean, with the description of a new species of *Jacobia*. *Marine Biology Research* **4:** 152 – 156.NEAFC (2008) North East Atlantic Fisheries Commission, Recommendation VII: 2008. For the protection of vulnerable deepwater habitats in the NEAFC area.
Nøttestad, L., Olsen, E. & Skov, H. (2004) Observations of marine mammals and seabirds along the Mid-Atlantic Ridge 6 June – 2 July 2004 . MAR-ECO PN3 G.O.Sars 2004 cruise report., 42 pp.
Nøttestad, L., Kleivane, L.E., Budgell, P., Prieto, R., Silva, M. & Ølen, N. (2005) Intelligent migration of the sei whale from the Azores to the Labrador Sea in April to June 2005.

Poster presentation at the16th Biennial Conference on the Biology of Marine Mammals, San Diego, 11-16 December 2005

OSPAR Commission (2003). Initial OSPAR List of Threatened and/or Declining Species and Habitats. OSPAR Commission ISBN 1-904426-12-3

OSPAR Commission (2007) Annual Report of the OSPAR Commission 2006/2007. OSPAR Commission ISBN 1-905859-84-9

Olsen, E., Nøttestad, L. Kleivane, L. Budgell, P., Prieto, R., Silva, M., Ølen, N. (2005) Intelligent migration of a sei whale from the Azores to the Labrador Sea in April to June 2005. Poster presented at the16th Biennial Conference on the Biology of Marine Mammals, San Diego, 11-16 December 2005

Opdal, A.F., Godø, O.R., Bergstad, O.A. & Fiksen, Ø. (2008) Distribution, identity, and possible processes sustaining meso-bathypelagic scattering layers on the northern Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 45 – 58.

Paul, L. & Fowler, S. (2003) *Chlamydoselachus anguineuis*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species*. www.iucnredlist.org. Downloaded 10th March 2008.

Pechenik, L.N. and F.M. Troyanovskii. (1971) *Trawling Resources on the North-Atlantic Continental Slope*. Israel Program for Scientific Translations, Jerusalem.

Petursdottir, H., Gislason, A., Falk-Petersen, S., Hop, H. & Svavarsson, J. (2008) Trophic interactions of the pelagic ecosystem over the Reykjanes Ridge as evaluated by fatty acid and stable isotope analyses*. Deep Sea Research II* **55:** 83 - 93.

Piatkowski, U., Vecchione, M. & Young, R.E. (2006) Community and species diversity of deepwater cephalopods along the northern Mid-Atlantic Ridge. ICES CM/D:16 (Poster)

Pitcher, T. Morato, T. Hart, P., Clark, M., Haggan, N., Santos, R. (Eds.) (2007) Seamounts. Ecology, Fisheries & Conservation. Blackwell Publishing, 536 pp.

Priede, I.G., Froese, R., Bailey, D.M., Bergstad, O.A., Collins, M.A., Dyb, J.E., Henriques, C., Jones, *E.G.* & King, N. (2006) The absence of sharks from abyssal regions of the world's oceans. *Proceedings of the Royal Society B: Biological Sciences* **273:** 1435 – 1441.

Probert, P.K., McKnight, D.G., and Grove, S.L. (1997) Benthic invertebrate bycatch from a deepwater trawl fishery, Chatham Rise, New Zealand. *Aquatic Conservation: Marine and Freshwater Ecosystems* **7:** 27-49.

Reeves, R.R., Smith, B.D., Crespo, E.A. & di Sciara, G.N. (compilers) (2003) Dolphins, Whales and Porpoises: 2002 – 2010 Conservation Action Plan for the World's Cetaceans. *IUCN/SSC Cetacean Specialist Group*. IUCN, Gland, Switzerland and Cambridge, UK.

Reeves R.R., Smith T.D., Josephson E.A., Clapham P.J. and Woolmer G. (2004). Historical observations of humpback and blue whales in the North Atlantic ocean: clues to migratory routes and possibly additional feeding grounds. Mar. Mamm. Sci. 20(4):774-786.

Richer de Forges, B. *et al.* (2000) Diversity and endemism of the benthic seamount fauna in the southwest Pacific. *Nature* **405:** 944-947

Risk, M.J. *et al.* (1998) Conservation of cold and warm water seafans: threatened ancient gorgonian groves. *Ocean Voice International*, *Sea Wind* **12:** 2-21

Roberts, C.M. (2002) Deep impact: the rising toll of fishing in the deep sea. *Trends in Ecology and Evolution* **17(5):** 242 – 245.

Roberts, C.M. (2007) The Unnatural History of the Sea. Island Press. Washington D.C., 465pp.

Roberts, J.M., Harvey, S.M., Lamont, P.A., Gage, J.D. & Humphrey, J.D. (2000) Seabed photography, environmental assessment and evidence for deepwater trawling on the continental margin west of the Hebrides. *Hydrobiologia* **441(1-3):** 173 – 183.

Roberts, J.M., Long, D., Wilson, J.B., Mortensen, P.B. & Gage, J.D. (2003) The cold-water coral *Lophelia pertusa* (Scleractinia) and enigmatic seabed mounds along the north-east Atlantic margin: are they related? *Marine Pollution Bulletin* **46(1):** 7 – 20.

Roberts, J.M., Wheeler, A.J. & Freiwald, A. (2006) Reefs of the deep: the Biology and Geology of Cold-Water Coral Ecosystems. *Science* **312:** 543 – 547.

Rogan, E. & Mackey, M. (2007) Megafauna bycatch in the drift nets for albacore tuna (*Thunnus alalunga*) in the NE Atlantic. *Fisheries Research* **86:** 6 – 14.

Rogers, A.D., Clark, M.C., Hall-Spencer, J.M. & Gjerde, K.M. (2008) The Science Behind the Guidelines: A Scientific Guide to the FAO Draft International Guidelines (December 2007) For the Management of Deep-Sea Fisheries in the High Seas and Examples of How the Guidelines can be Practically Implemented. IUCN, Switzerland, 2008.

Rossby, T. (1999) On gyre interactions. *Deep-Sea Research II* **46:**139 – 164.

Sanamyan, K.E. & Sanamyan, N.P. (2005) Deepwater ascidians from the North Atlantic (R.V. *Academic Keldysh*, cruise 46 and 49). *Journal of Natural History* **39(22):** 2005 – 2021.

Sarti Martinez, A.L. (2000) *Dermochelys coriacea* In: IUCN 2007. *2007 IUCN Red List of Threatened Species*. www.iucnredlist.org Downloaded on March 3rd 2008.

Schröder-Ritzau, A., Freiwald, A. & Mangini, A. (2005) U/Th dating of deepwater corals from the eastern North Atlantic and the western Mediterranean Sea. In: Freiwald, A. & Roberts, J.M. (eds) Cold-Water Corals and Ecosystems, Springer-Verlag, Berlin-Heidelberg, pp1151 – 1169.

Shibanov, V. N., Vinnichenko, V. I. & Pedchenko, A. P. 2002. Census of Marine Life: Turning Concept into Reality. Russian investigations and fishing in the northern part of Mid-Atlantic Ridge. ICES CM 2002/L:35 Poster

Sigur∂sson, Th., Jónsson, G. & Pálsson, J. (2002) Deep scattering layer over Reykjanes Ridge and in the Irminger Sea. ICES CM 2002/M:09

Sigurjónsson, J., Gunnlaugsson, T., Ensor, P., Newcomer, M. & Vikingsson, G. (1991) North Atlantic sighting survey 1989 (NASS-89): Shipboard surveys in Icelandic and adjacent waters July-August 1989. *Report on International Whale Communication* **41**: 559 – 572.

Skov, H., Gunnlaugsson, T., Budgell, W.P., Horne, J., Nøttestad, L., Olsen, E., Søiland, H., Víkingsson, G. & Waring, G. (2008) Small-scale spatial variability of sperm and sei whales in relation to oceanographic and topographic features along the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 254 – 268.

Smith, P. J. Robertson, S. G., Horna, P. L., Bulla, B., Andersona, O. F., Stantona B. R., Oke, C. S. (2001). Multiple techniques for determining stock relationships between orange roughy, Hoplostethus atlanticus, fisheries in the eastern Tasman Sea. Fish. Res. 58 (2), 119-140.

Smith, P.J. (2006) Issues, status and trends in deep-sea fishery genetic resources. In: Workshop on Status and Trends in Aquatic Genetic Resources. A basis for international policy. Eds.: Bartley, D. M., Harvey, B. J., Pullin, R. S. V., 8–10 May 200,6 Victoria, British Columbia, Canada pp. 81-108. (http://www.fao.org/docrep/010/a1337e/a1337e00.HTM)

Søiland, H., Budgell, W.P. & Knutsen, Ø. (2008) The physical oceanographic conditions long the Mid-Atlantic Ridge north of the Azores in June-July 2004. *Deep-Sea Research II* **55:** 29 – 44.

Stefanni, S. & Knutsen, H. (2007) Phylogeography and demographic history of the deep-sea fish *Aphanopus carbo* (Lowe, 1839) in the NE Atlantic: Vicariance followed by secondary contact or speciation? *Molecular Phylogenetics and Evolution* **42:** 38 – 46.

Stemmann, L., Hosia, A., Youngbluth, M.J., Søiland, H., Picheral, M. & Gorsky, G. (2008) Vertical distribution (0–1000 m) of macrozooplankton, estimated using the Underwater Video Profiler, in different hydrographic regimes along the northern portion of the Mid-Atlantic Ridge. *Deep Sea Research II*, **55**: 94 - 105.

Stevens, J. & Correla, J.P.S. (2003) *Centroscymnus coelolepis*. In IUCN 2007. *2007 IUCN Red List of Threatened Species* www.iucnredlist.org. Downloaded 10th March 2008.

Sutton, T., Porteiro, F.M., Heino, M., Byrkjedal, I., Langhelle, G., Anderson, C.I.H., Horne, J.P., Søiland, H., Falkenhaug, T., Godø, O.R. & Bergstad, O.A. (2008) Vertical structure, biomass and topographic association of deep-pelagic fishes in relation to a mid-ocean ridge system. *Deep-Sea Research II* **55:** 161 – 184.

Synnes, M. (2007) Bioprospecting of organisms from the deep-sea: scientific and environmental aspects. *Clean Technologies and Environmental Policy* **9(1):** 53 – 59.

Tabachnick, K.R. & Collins, A.G. (2008) Glass sponges (Porifera, Hexactinellidae) of the northern Mid-Atlantic Ridge. *Marine Biology Research* **4:** 25 – 47.

Townsend, C.H. (1935) The distribution of certain whales as shown by logbook records of American whaleships. Zoologica 19, No. 1:1-50, 4 charts.

Troyanovsky, F.M. & Lisovsky, S.F. (1995) Russian (USSR) fisheries research in deepwaters (below 500m) in the North Atlantic. In: Hopper, A.G. (Ed.), Deepwater Fisheries of the North Atlantic Oceanic Slope. Kluwer Academic Publishers, Dordrecht, The Netherlands, pp. 357 – 366.

Turner, S.J., Thrush, S.F., Hewitt, J.E., Cummings, V.J. & Funnell, G. (1999) Fishing impacts and the degradation or loss of habitat structure. *Fisheries Management and Ecology* **6:** 401 – 420.

UNEP (2007) Report of the Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection. Azores, Portugal, 2-4 October 2007. UNEP/CBD/EWS.MPA/1/2

Vecchione, M. & Young, R.E. (2006) The squid family Magnapinnidae (Mollusca: Cephalopoda) in the Atlantic Ocean, with a description of a new species. *Proceedings of the Biological Society of Washington* **119(3):** 365 – 372.

Vinnichenko, V.I., (2002). Prospects of fisheries on the seamounts. ICES C.M. 2002/M:32, Poster.

Vinnichenko, V. I. & Khlivnoy V. N. (2004) Distribution and biological characteristics of young roundnose grenadier (*Coryphaenoides rupestris*) in the northeast Atlantic (by data of Russian investigations in 2003). ICES Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources Working Document, 2004

Vinogradov, G.M. (2005) Vertical distribution of macroplankton at the Charlie-Gibbs Fracture Zone (North Atlantic), as observed from the manned submersible "Mir-1". *Marine Biology* **146:** 325 – 331.

Waller, R., Watling, L., Auster, P. & Shank, T. (2007) Anthropogenic impacts on the Corner Rise Seamounts, north-west Atlantic Ocean. *Journal of the Marine Biological Association of the UK* **87:** 1075 – 1076.

White, W.T. (2003) *Centrophorus squamosus*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species* www.iucnredlist.org . Downloaded 10th March 2008.

Whitehead, H., Christal, J. & Dufault, S. (1997) Past and distant whaling and the rapid decline of Sperm Whales off the Galàpogas Islands. *Conservation Biology* **11:** 1387 – 1396.

Whitehead, H. & Weilgart, L. (2000) The Sperm Whale: social females and roving males. In: J. Mann, R.C., Connor, P.L. Tyack & H. Whitehead (eds) Cetacean Societies: Field Studies of Dolphins & Whales, pp 154 – 172. University of Chicago Press, Chicago.

Witt, M.J., Broderick, A.C., Johns, D.J., Martin, C., Penrose, R., Hoogmoed, M.S. & Godley, B.J. (2007) Prey landscapes help identify potential foraging habitats for leatherback turtles in the NE Atlantic. *Marine Ecology Progress Series* **337:** 231 – 243.

Young, R.E., Vecchione, M. & Piatkowski, U. (2006a) *Promachoteuthis sloani*, a new species of the squid family Promachoteuthidae (Mollusca: Cephalopoda). *Proceedings of the Biological Society of Washington* **119(2):** 287 – 292.

Young, R.E., Vecchione, M., Piatkowskie, U. & Roper, C.F.E. (2006b) A redescription of *Planctotethis levimana* (Lönnberg, 1896) (Mollusca: Cephalopoda), with a brief review of the genus. *Proceedings of the Biological Society of Washingtion* **119(4):** 581 – 586.

Youngbluth, M., Sørnes, T., Hosia, A. & Stemmann, L. (2008) Vertical distribution and relative abundance of gelatinous zooplankton, *in situ* observations near the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 119 – 125.

Zezina, O.N. (2008) Notes on brachiopods from the North Atlantic. *Marine Biology Research* **4:** 157 – 159.

Annex 1

Species and habitats of special interest for the proposed CGFZ-MPA

A. Habitats

Threatened and/or declining Habitats[11]

- Seamounts
- Deep Sea Sponge Aggregations
- *Lophelia pertusa* Reefs
- Coral Gardens

Other features of interest

- Deepwater and epipelagic ecosystems, including their function for migratory species
- Habitats associated with ridge 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
- The meandering sub-polar frontal ecosystem

B. Species

Threatened and/or declining Species

- Orange roughy (Hoplostethus *atlanticus*)
- Blue whale (*Balaenoptera musculus*)
- Leatherback turtle (*Dermochelys coriacea*)
- Portuguese dogfish (*Centroscymnus coelolepis*)
- Gulper shark (*Centrophorus granulosus*)
- Leafscale gulper shark (*Centrophorus squamosus*)

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

OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic

Meeting of the OSPAR Commission

Brussels (European Commission): 22-26 June 2009

Nomination Proformas for 6 proposed Marine Protected Areas (MPAs) in Areas beyond National Jurisdiction (ABNJ)

Presented by Germany as lead country of ICG-MPA

This document invites OSPAR to examine six nomination proformas for proposed Marine Protected Areas in Areas beyond National Jurisdiction in the North-East Atlantic that have been identified and developed by the Intersessional Correspondence Group on Marine Protected Areas (ICG-MPA).

OSPAR is invited to agree in principle that these areas should be included as components to the OSPAR Network of MPAs and that consultation with other competent authorities regarding these proposals shall be initiated.

Background

1. The HELCOM/OSPAR Joint Ministerial Statement (Bremen Statement 2003) included the commitment to establish by 2010 an ecologically coherent network of well-managed Marine Protected Areas in the North-East Atlantic. In order to encompass the variety of ecosystems in the OSPAR Maritime Area the Network of MPAs has to extent to Areas beyond National Jurisdiction (ABNJ). However, until today no MPA has yet been established in ABNJ of the North-East Atlantic.

2. OSPAR 2008 has in principle agreed to the proposal to protect the Charlie-Gibbs Fracture Zone (CGFZ) on the Mid-Atlantic Ridge as a component of the OSPAR Network of MPAs. This proposal is being presented in a separate submission to OSPAR 2009.

3. Along with the CGFZ proposal, a set of ecologically significant and/or vulnerable areas that are representative for diverse ecosystems in ABNJ of the North-East Atlantic has been identified under a scientific contract by the University of York on behalf of ICG-MPA and with financial support provided by Germany. The identified areas are:

I. Reykjanes Ridge

II. Southern Mid-Atlantic Ridge (north of the Azores)

III. Altair Seamount

IV. Antialtair Seamount

V. Josephine Seamount

VI. Milne Seamount

[VII. Rockall and Hatton Banks; see § 10.]

4. For the ecologically significant and/or vulnerable areas mentioned under I-VI, nomination proformas have been compiled and subsequently reviewed and elaborated further the by ICG-MPA (April and October 2008, February 2009), MASH 2008 and BDC 2009. During this process, the outcome and specific suggestions that have resulted from the ICES peer review of these proposals in 2008 (ICES Advice 2008, Book 1, 1.5.5.18; MASH 08/05/08 have been considered and incorporated into the nomination proformas.

5. BDC 2009 agreed that there was broad support (e.g. by the UK, Belgium, The Netherlands, Germany, Sweden and France) for these six proposals to be forwarded to OSPAR 2009 for nomination in principle as proposed MPAs.

6. Since BDC 2009, the following amendments have been made by the ICG-MPA Secretariat on the nomination proformas:

(a) Revision of the geographical coordinates for the proposed boundaries of the Southern Mid-Atlantic Ridge MPA to be consistent with the map (Section 6. Location);

(b) Addition of the sixth coordinate for the proposed boundary of the Josephine Seamount MPA to be consistent with the map (Section 6. Location);

(c) Correction of the coordinate "59.91^{o}N/30.62^{o}W" to "56.91^{o}N/30.62^{o}W" for the proposed boundary of the Reykjanes Ridge MPA to be consistent with the map (Section 6. Location);

(d) New text in Section 3 (Status of the Location) for those proposed MPAs that seem to be affected by national claims for an extended continental shelf recently submitted to UN CLCS; and

(e) Deletion of the originally last paragraph in Annex I of all the nomination proformas to be consistent with the agreement reached during BDC 09 on the Charlie-Gibbs MPA proposal.

Recent Developments since BDC 09

7. **NEAFC closures of fisheries in the North-East Atlantic** – Subsequent to the meeting of NEAFC Heads of Delegations (24-27 March 09, London), NEAFC has adopted in a postal vote measures that close five areas on the Mid-Atlantic Ridge to bottom fisheries. These closures, originally proposed by Norway, overlap to a large extent with the proposed OSPAR MPAs on the Mid-Atlantic Ridge. These areas are shown in the map provided as Addendum 1 to this document.

8. **Submissions to the UN Commission on the Limits of the Continental Shelf (UN CLCS) of national claims for extended continental shelves in the North-East Atlantic** – A number of OSPAR Contracting Parties have recently submitted to the UN CLCS national claims for an extended continental shelf. Particularly the claims forwarded so far by Iceland (29 April 09) and Portugal (11 May 09) would – if approved by the Commission – encompass the areas of 5 of the 6 proposed OSPAR MPAs (IS: Reykjanes Ridge; PO: Southern MAR, and the Seamounts Josephine, Altair and Antialtair). These claims are shown in the map provided as Addendum 1 to this document.

9. These developments underline the need for OSPAR to continue to seek for adequate consultation with Contracting Parties and concerned competent authorities (e.g. NEAFC, ISA) regarding the establishment and management of any of the proposed MPAs in ABNJ of the OSPAR Maritime Area.

10. Considering that another original proposal, to nominate the "Rockall and Hatton Banks" as a component to the OSPAR Network of MPAs, has been set aside at MASH 2008 with a justification that this proposed MPA would likely overlap with the EEZ and/or claims for extended continental shelves of a number of OSPAR CPs (i.e. UK, Ireland, Iceland, Faroes Islands/Denmark), in the light of recent developments, it may be worthwhile to reassess if this proposal could be revived and aligned with the other proposals presented here. In any event, the question in conjunction with the overlaps between proposed MPAs and claims for extended continental shelves has to be discussed and solved in more general terms.

Action Requested

11. OSPAR is invited:

a. to examine the six nomination proformas for proposed MPAs in ABNJ of the OSPAR Maritime Area (presented as addenda 2-7 to this document) including the amendments made since BDC 2009;

b. to agree in principle that these areas should be included as components of the OSPAR Network of MPAs;

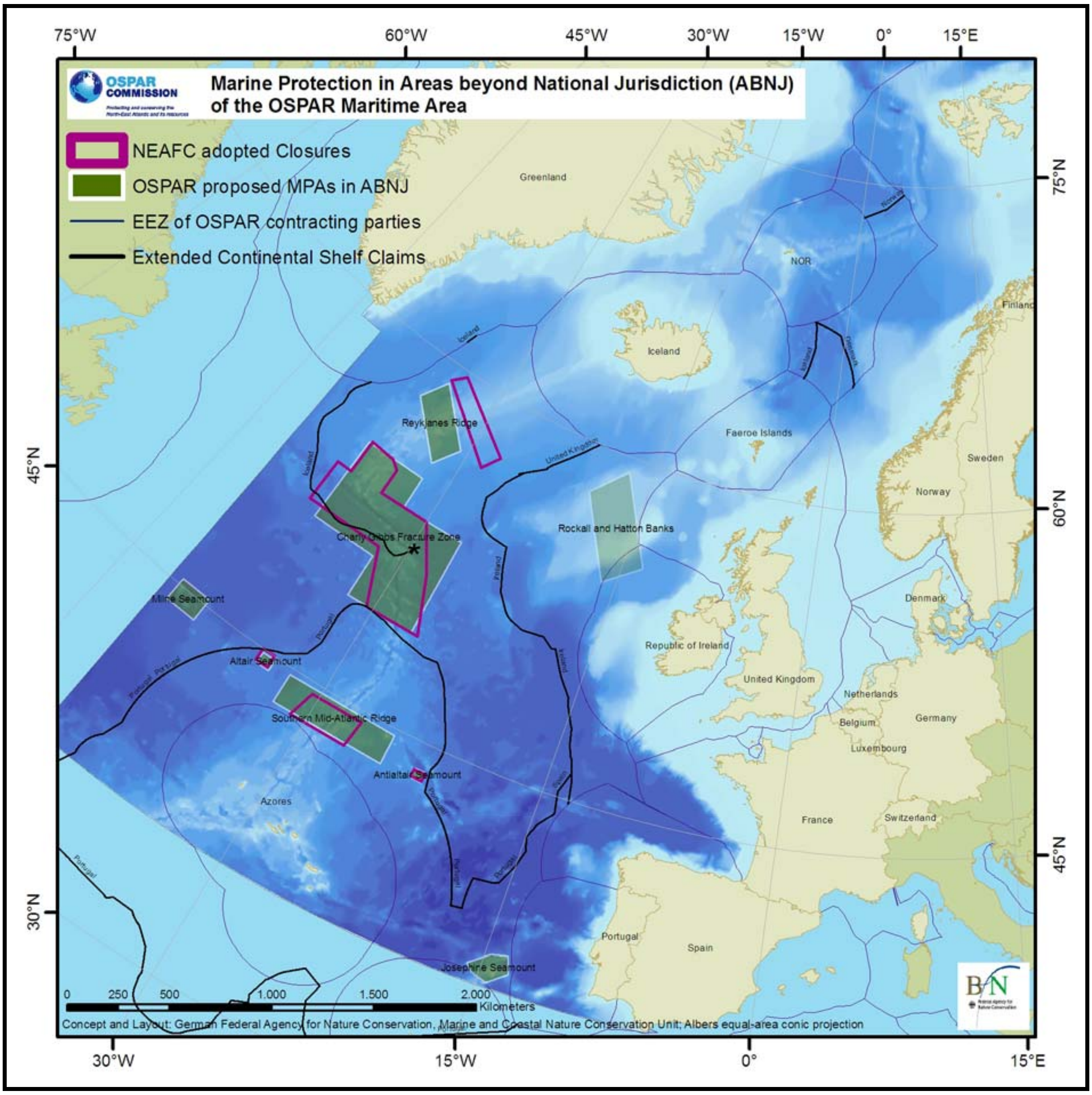
c. to agree that consultation with other competent authorities regarding these proposals may be initiated;

d. with particular consideration of the recent developments outlined in § 7 and § 8, to advise on potential legal and/or technical issues that have to be clarified with a view to enable a final adoption of these proposed MPAs at the OSPAR Ministerial Meeting in 2010; and

e. to consider in the light of recent development the original proposal to include the "Rockall and Hatton Banks" as a component of the OSPAR Network of MPAs.

Addendum 1

Illustration of the proposed OSPAR MPAs in ABNJ of the OSPAR Maritime Area shown together with the recently adopted NEAFC closed areas for bottom fishing and the claims of CPs for an extended continental shelf



Addendum 2

Proposed OSPAR Marine Protected Area

Reykjanes Ridge

A. General Information

1. Proposed name of MPA

Reykjanes Ridge

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 Reykjanes Ridge 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 Reykjanes Ridge 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.

(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.

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[1] The conservation vision describes a desired long-term conservation condition and function for the ecosystems in the entire Reykjanes Ridge 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 Reykjanes Ridge 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.

(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 harvested **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

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, deep-sea sponge aggregations, *Lophelia pertusa* reefs and coral gardens.

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

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

2.3.4 **Habitats and species of specific concern**

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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).

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

3. Status of the location

The proposed area has been designed to be located beyond the limits of national jurisdiction of the coastal states in the OSPAR Maritime Area.

However, on 29 April 2009 the Republic of Iceland submitted to the Commission on the Limits of the Continental Shelf (UN CLCS), information on the limits of the Icelandic continental shelf beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured in the Ægir Basin area and in western and southern parts of Reykjanes Ridge, in accordance with Article 76, paragraph 8, of the Convention of the Law of the Sea.

These claims submitted by Iceland – if approved by the UN CLCS - would encompass the seabed in the area of the proposed Reykjanes Ridge MPA.

The international legal regime that is applicable to the site 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.

5. Biogeographic Region

Atlantic deep-sea Subregion; Cool temperate waters province; South-Iceland Faeroe Shelf.

6. Location

OSPAR Marine Region V

The co-ordinates proposed for the boundaries of the marine protected area are:

Latitude	Longitude
59.10°N	34.54°W
56.91°N	30.62°W
55.78°N	32.08°W
57.90°N	35.93°W

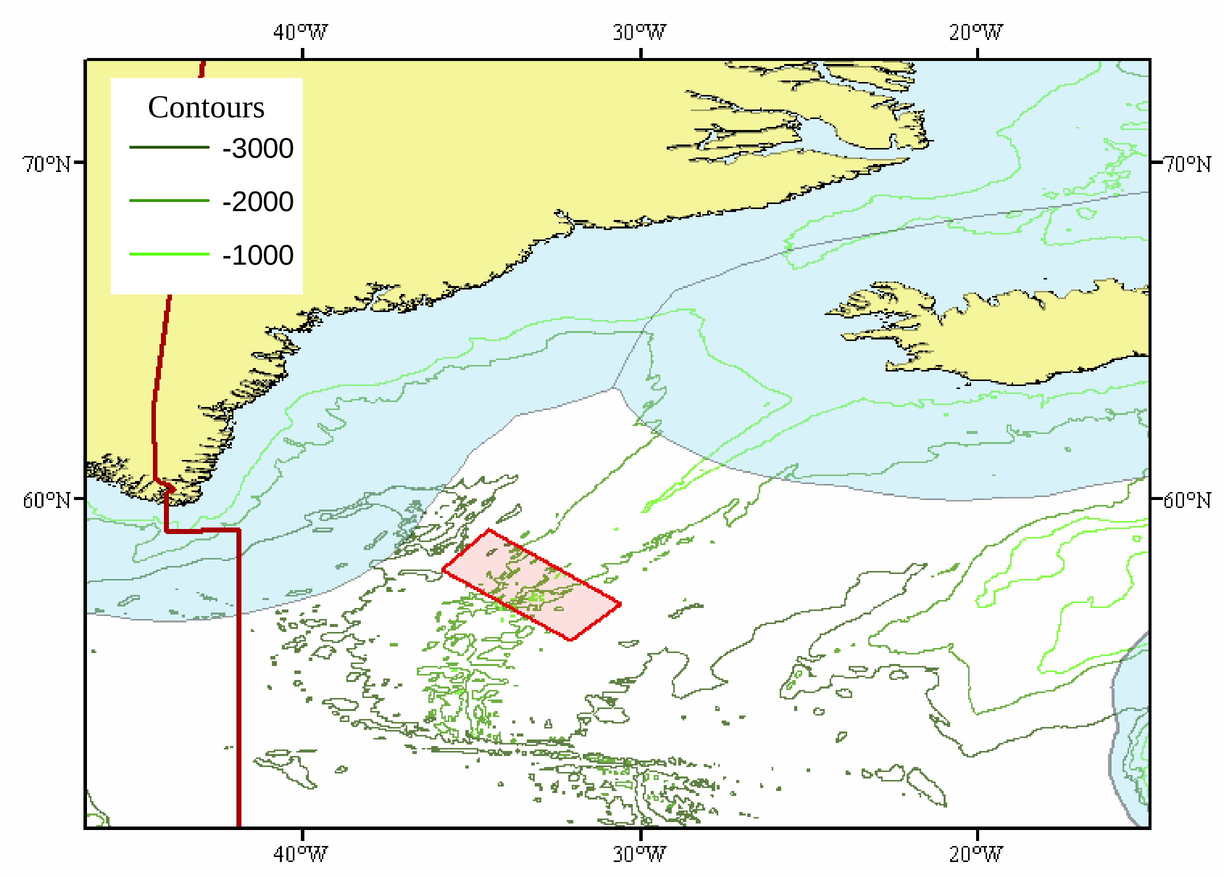

Figure 1. *Proposed location of the marine protected area on the Reykjanes Ridge. Light blue shaded areas indicate the Exclusive Economic Zones of nearby countries. The dark red line running north to south is the western boundary of the OSPAR Maritime area.*

This proposed marine protected area, along with the southern Mid-Atlantic Ridge proposal, is intended to complement an existing proposal for a marine protected area around the Charlie-Gibbs Fracture Zone on the Mid-Atlantic Ridge. Following ICG-MPA 2008 it was agreed that such proposals would together represent the different biogeographical regions found over the Mid-Atlantic Ridge in Areas Beyond National Jurisdiction. The boundaries proposed for this northern site cover the central portion of the Reykjanes Ridge, south of Iceland (Figures 1 and 2). These boundaries were chosen to incorporate a range of depths from approximately 1500m to 2500m in order to cover a range of bathymetric complexity and thus a wide variety of habitats on both east and west flanks of the ridge. The boundaries enclose an area of habitat important to a wide variety of species living from the seabed to the surface layers.

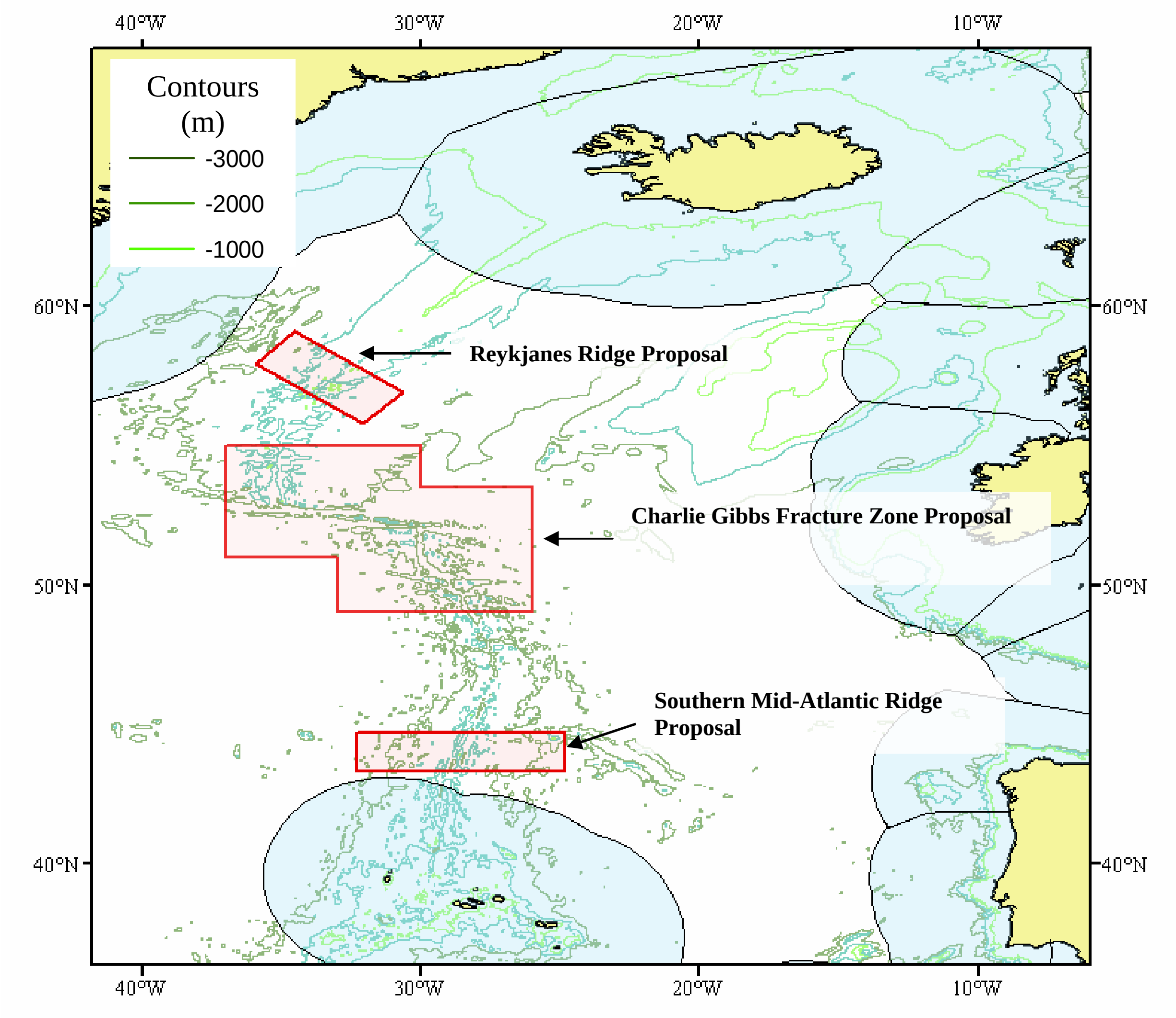

Figure 2. *The three areas of the Mid-Atlantic Ridge within the OSPAR Maritime area proposed as marine protected areas representing the three main biogeographical regions found during the MAR-ECO investigations. Light blue shaded areas represent the Exclusive Economic Zones of coastal states.*

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7. Size

50,876 km^2

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8. Characteristics of the area

The Reykjanes Ridge forms the northernmost part of the Mid-Atlantic Ridge, a sub-marine mountain system which stretches from Iceland to the South Atlantic (Fock and John 2006). The Mid-Atlantic Ridge is the major topographic feature running the entire length of the Atlantic Ocean, dividing the ocean floor 'symmetrically' with an average summit/crest depth of approximately 2,500m (Dinter, 2001; Heger *et al*, 2008; Hosia *et al*, 2008). Within the OSPAR area the Mid-Atlantic Ridge separates the Newfoundland and Labrador basins from the West-European basin and the Irminger from the Iceland basins (Dinter, 2001). It has a profound role in the circulation of the water masses in the North Atlantic (Rossby, 1999; Bower *et al*, 2002; Heger *et al*, 2008; Søiland *et al*, 2008). The complex hydrographic setting and the presence of the Ridge leads to enhanced vertical mixing and turbulence resulting in areas of increased productivity over the Ridge (Falkowski *et al*, 1998; Heger *et al*, 2008).

The Reykjanes Ridge is tectonically active, with a relatively low spreading rate of a few centimetres a year (Mironov and Gebruk, 2006). Volcanic activity is thought to be high, shown by the growth of lava domes, the development of extended volcanic chains and regular infilling of cracks with basaltic material (Sbortshikov and Rudenko, 1990; Mironov and Gebruk, 2006). There is one site north of the proposed area that has been shown to have hydrothermal activity, Steinaholl vent field at $63^{o}06'$N (Olaffson *et al*, 1991; German *et al*, 1994; Mironov and Gebruk, 2006). No other hydrothermal activity has been detected along the Reykjanes Ridge, despite intensive sampling (German *et al*, 1994; German and Parsons, 1998). The crests of the Mid-Atlantic Ridge consist mostly of hard volcanic rock whereas the flanks are covered with expanding thicknesses of soft sediments with increasing distance from the crests (Dinter, 2001). The Reykjanes Ridge is characterised by high sedimentation rates, which are related to the high biological productivity in the mixing zone of different water masses (Mironov and Gebruk, 2006).

Over the Mid-Atlantic Ridge within the OSPAR area there are three main water masses in the upper ocean, the one found within the proposed area is often termed Modified North Atlantic Water (Søiland *et al*, 2008). The surface current system of the North Atlantic is dominated by the warm North Atlantic Drift, which is a continuation of the Gulf Stream (Mironov and Gebruk, 2006). The northern boundary of this forms the characteristic Sub-Polar Front, which acts to separate the warm and cold water masses and is usually found between 52 – 53^{o}N (Mironov and Gerbuk, 2006; Søiland *et al*, 2008). After the North Atlantic Drift crosses the Mid-Atlantic Ridge at approximately 50 – 52^{o}N it flows north (Mironov and Gebruk, 2006). Some of this current enters the Norwegian Sea east of Iceland and some turns and flows westward (called the Irminger Current) over the Reykjanes Ridge at between 53^{o}N and 60^{o}N, into the Irminger Basin (Mironov and Gebruk, 2006). This is the major current within the proposed area. The proposed area lies over the southern section of the Reykjanes Ridge where it is deeper, with an approximate water temperature of 2 – 4^{o}C (Mironov and Gerbuk, 2006).

The Reykjanes Ridge is characterised by sharp gradients in environmental conditions, which has allowed the area to be invaded by benthic fauna from very remote regions (Mironov and Gebruk, 2006). For example, species have been found whose distributions extend to the Antarctic, North Pacific and the Indo-West Pacific (Mironov and Gebruk, 2006). Within the area of the Icelandic Shelf and the Reykjanes Ridge the Arctic fauna is replaced by a boreal one, the European fauna by American and the autochthonous deep-sea fauna is replaced by an allochthonous one (Mironov and Gebruk, 2006). The composition of deep-sea benthic fauna on the deep southern section of the Reykjanes Ridge is not very well known in comparison to adjacent areas (Mironov and Gebruk, 2006). As Mironov and Gebruk (2006) state, this is well illustrated by the fact that the 4^{th} cruise of the “Akademik Mstislav Keldysh” (1982) sampled many species which were recorded on the Ridge for the first time. This cruise yielded an extensive collection of deep-sea fauna and since then other research cruises have focused on the Reykjanes Ridge (Mironov and Gebruk, 2006).

The northern part of Mid-Atlantic Ridge has been subject to recent scientific investigations as part of the Census of Marine Life (Bergstad *et al*, 2008a). The project was designed by a consortium of transatlantic scientists and named ‘Patterns and Processes of the Ecosystem of the Northern mid-Atlantic’ (MAR-ECO, Bergstad *et al*, 2008a). Many scientific papers have been published in the years since the project’s inception that span ecological zones and taxonomical ranges (see Scientific Value criterion for a full description) (Bergstad *et al*, 2008a). Numerous new species have also been discovered, data has been derived that has allowed taxonomic revisions and species that were not known to exist in this region have been uncovered (Gebruk *et al*, 2008). Much of the information used in this proposal is from recently published papers from the MAR-ECO project.

The boundaries for the proposed marine protected area were chosen to incorporate those areas that are most vulnerable to fishing in terms of depth. On the Mid-Atlantic Ridge two thousand metres represents the maximum depth limit of past and present fishing activity. However, the majority of fishing activity occurs shallower than one thousand metres (O.A. Bergstad pers. comm.). In other areas of the high seas depths up to three thousand metres can be fished using longlines, gillnets, midwater trawls and, with more difficulty, by bottom trawls. These areas may become more intensively targeted on the Mid-Atlantic Ridge in the future.

B Selection Criteria

a. Ecological criteria/considerations

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1. Threatened and declining species and habitats

The proposed area includes deep-sea sponge aggregations, seamount habitats and potentially *Lophelia pertusa* reefs, which are listed as priority threatened or declining habitats by OSPAR (OSPAR Commission 2003). It includes cold water coral and sponge reefs and seamount 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 coral and sponge aggregations, 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).

Lophelia pertusa

Cold-water corals within the proposed marine protected area have not been studied in great detail. Most recently Mortensen *et al* (2008) investigated the Mid-Atlantic Ridge using video surveys between 42^o and 53^o N (south of the proposed marine protected area) and found cold-water corals at every sample station. Corals were observed at depths between 800 and 2400m, however were commonly found shallower than 1400m (Mortensen *et al*, 2008). Many coral taxa were observed during these research dives, with species richness being very high (approximately 40 different species) (Mortensen *et al*, 2008). Living *L. pertusa* was repeatedly observed on the seamounts sampled, however no major reef structures were recorded, with the maximum colony size approximately 0.5m in diameter (Mortensen *et al*, 2008). The number of coral taxa was strongly correlated with the percentage cover of hard bottom substrate (Mortensen *et al*, 2008), indicating the importance of the Mid-Atlantic Ridge for cold-water corals. The diversity of other megafauna was higher in areas with coral than those without. Whether this was directly in relation to the coral or simply the presence of hard bottom substrate suitable for colonisation remains unknown (Mortensen *et al*, 2008). Hareide and Garnes (2001) conducted experimental long-line surveys between 60^o and 61^{o}N on the Reykjanes Ridge. At depths of approximately 1600m the largest catches were made on and in the vicinity of corals, with coral-free areas having extremely small catches by comparison (Hareide and Garnes, 2001). These two studies both indicate that cold-water corals are present within the proposed area and that they may be *L. pertusa* reefs or other cold-water coral species, which are similarly vulnerable. They also both clearly demonstrate that there is an increase in other megafaunal species in the vicinity of these cold-water corals, as has been found in many other studies in the North-East Atlantic (Jensen and Frederiksen, 1992;

Mortensen *et al*, 1995; Rogers, 1999; Freiwald, 2002; Hall-Spencer *et al*, 2002; Husebø *et al*, 2002; Costello *et al*, 2005; Henry and Roberts, 2007).

Deep-sea sponge aggregations

Magnússon and Magnússon (1995) reported that the Reykjanes Ridge was very difficult for bottom trawling mainly due its irregular bottom topography with numerous peaks and rifts. On both sides of the Ridge huge quantities of sponges were found in some places, whilst in others the area was dominated by loose mud (Magnússon and Magnússon, 1995). The 4th cruise of "Akademik Mstislav Keldysh" (1982), in the area between 58°03'N and 58°52'N, and between 24°09'W and 31°52'N, yielded an extensive collection of benthic fauna (Mironov and Gebruk, 2006). The mud recovered during sampling was full of sponge spicules (Kuznetsov and Detinova, 2001; Mironov and Gebruk 2006), which along with the sponges themselves have been shown to be related to increases in the abundance and richness of macro and megafauna in other parts of the deep North East Atlantic (Rice *et al*, 1990; Bett and Rice, 1992). Sponges were also observed from a submersible in high densities, particularly *Geodia* species, reaching 20 – 30 specimens per m^2, with an estimated biomass of 1.0 and 1.5 kg/m^2 (Kuznetsov and Detinova, 2001).

South of the proposed area rich hexactinellid sponge communities or 'gardens' have been observed on the Mid-Atlantic Ridge around the Charlie Gibbs Fracture Zone and the associated seamounts (Felley *et al*, 2008; ICES, 2007a; Tabachnick and Collins, 2008). The sampling of sponges throughout this project was done just south of the proposed area (approximately 53°N) near the Charlie-Gibbs Fracture Zone (Tabachnick and Collins, 2008). The findings suggested a relatively rich hexactinellid fauna, with several novel findings, for this part of the Mid-Atlantic Ridge and indicate that this fauna has been poorly investigated in the past (Tabachnick and Collins, 2008). The presence of rich sponge fauna south of the area proposed here combined with the reports of large quantities of sponge within the proposed area suggest that there may be similarities in terms of species richness of deep-sea sponges. Clearly there is a paucity of information. However, given what is known about the rest of the proposed area's ecosystem, application of protection through the precautionary principle is warranted.

Seamount Communities

Seamounts have been recognised in many different fora as being vulnerable and threatened ecosystems (e.g. UNEP, FAO, NEAFC, OSPAR, UN, NAFO). The Mid-Atlantic Ridge is often termed as a chain of seamounts, however it is more than that and should be considered as a mid-ocean ridge with numerous geomorphological features (O.A. Bergstad pers. comm.) The definition of a seamount is customarily as a feature rising 1000m or more from the adjacent seafloor. As such few hills of the Mid-Atlantic Ridge can be considered as isolated seamounts. However, repeatedly within the literature, Reykjanes Ridge seamounts are referred to (see for e.g. Hareide *et al*, 2001; Zaferman and Shestopal, 1996). Indeed given that boom and bust fisheries have been reported on the seamounts of the Reykjanes Ridge (Hareide *et al*, 2001) it can be concluded that seamounts do indeed exist and that they are vulnerable habitats that require protection.

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2. Important species and habitats

The proposed area includes deep sea sponge aggregations and seamount habitats listed as priority threatened or declining habitats by OSPAR (OSPAR Commission 2003). It includes cold water coral and sponge reefs and seamount 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 coral and sponge aggregations 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).

The Reykjanes Ridge acts to retain two populations of the planktonic copepod *Calanus finmarchicus* which is thought to form the basis of many food webs within the North-East Atlantic (Gislason *et al*, 2007). *C. finmarchicus* is considered to be one of the most important components of the zooplankton in the waters around Iceland, where it is usually by far the most abundant in terms of biomass (Speirs *et al*, 2005; Gislason *et al*, 2007). It has a widespread distribution over the North Atlantic and its highest population densities occur in the Norwegian Sea gyre and the Labrador/Irminger Sea gyre (Speirs *et al*, 2005). As such in these areas this copepod forms a critical part of the diet of the larval stages of many important commercial fish stocks (Speirs *et al*, 2005).

Hareide and Garnes (2001) found that the dominant fish species caught by longlines at depths between 500 and 1000 metres, between 60 and 61^{o}N on the Reykjanes Ridge, were *Sebastes marinus* (Giant redfish), *Brosme brosme* (Tusk) and *Centroscyllium fabricii* (Black dogfish). *S. marinus* was the dominant seamount species in the area and was also found closely associated with coral formations (Hareide and Garnes, 2001). A change in the species composition occurred between 900m and 1200m and at depths greater than 1000m the dominant species found were *Reinhardtius hippoglossoides* (Greenland halibut), *Macrourus berglax* (onion-eyed grenadier) and *Antimora rostrata* (Blue hake) (Hareide and Garnes, 2001). Other species recorded were *Bathyraja pallida* (Pale ray) and *B. richardsoni* (Richardson’s ray). Both the latter species had never been recorded before in this area (Hareide and Garnes, 2001). *Etmopterus princeps* (Great lanternshark) and *Anarhichas denticulatus* (Northern wolffish) were the only two species recorded throughout the entire depth range in this area (Hareide and Garnes, 2001).

In addition to the above listed species, bathymetric conditions along the Reykjanes Ridge may also be suitable for a wide range of commercially important species such as: *Sebastes mentella* (Oceanic redfish); *Coryphaenoides rupestris* (Roundnose grenadier); *Hoplostethus atlanticus* (Orange roughy); *Aphanopus carbo* (Black scabbardfish); *Molva dypterygia* (Blue ling); *Beryx decadactylus* (Broad alfonsino); *Helicolenus dactylopterus* (Blackbelly rosefish); *Conger conger* (European conger); *Centrophorus squamosus* (Leafscale gulper shark).

The Reykjanes Ridge forms a hard-bottomed substrate, rising up from the abyssal plain, which acts to provide a wide range of benthic habitats and is colonised by a variety of erect megafauna (e.g. gorgonians, sponges and cold-water corals) (Copley *et al*. 1996). The recent MAR-ECO project (see *Scientific Value* criterion) cruise completed video surveys along the Mid-Atlantic Ridge from approximately 42^{o}N to 53^{o}N and found cold-water corals at all sites (Mortensen *et al*. 2008). It can therefore be inferred that cold-water corals occur along the Reykjanes Ridge providing further support to past studies (e.g. Copley *et al*. 1996). There is also evidence from experimental trawling of the Reykjanes Ridge that sponge communities inhabit the flanks and summits of the Ridge (Magnússon and Magnússon, 1995).

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3. Ecological Significance

Biological productivity at mid-ocean ridges is generally thought to be enhanced in comparison with adjacent oligotrophic ocean basins (Fossen *et al*, 2008). The lack of terrigenous nutrient input to the open ocean means that productivity is generally low and the deep-sea fauna found there are reliant on the limited local surface water primary production. Therefore areas with high biological productivity may have a greater abundance and diversity of fauna (Sutton *et al*, 2008). Mid-ocean ridges have a greater biological productivity primarily because oceanographic currents are influenced by topography, therefore nutrient rich deep-water can be forced towards the surface layers of the ocean (Fossen *et al*, 2008).

The Reykjanes Ridge acts to separate the warmer waters of the Iceland Basin from the cooler waters of the Irminger Basin forming a hydrographic boundary in the mesopelagic realm (Fock and John 2006) The presence of the ridge has a profound influence on the oceanic currents southwest of Iceland and has been shown to strongly control the large cyclonic gyres found within the Iceland and Irminger basins (e.g. Schmitz Jr. and McCartney, 1993; Hansen and Østerhus, 2000). There is a strong relationship between larval fish communities and hydrography and topography, which is largely determined by the Reykjanes Ridge (Fock and John 2006). Larvae are retained above the Ridge by a branching current from the North Atlantic Current due to the Coriolis effect (Fock and John 2006).

In addition, as noted above, the Reykjanes Ridge also acts to separate and retain two populations of the planktonic copepod *C. finmarchicus* which over-winter in the Iceland and Irminger Basins (Heath *et al*. 2000; Gislason *et al*. 2007). *C. finmarchicus* is one of the most important components of zooplankton in the NE Atlantic (Gislason *et al*. 2007) and are a major prey of the larval stages of many commercially important demersal (e.g. haddock), pelagic (e.g. redfish) fish (Speirs *et al*. 2005) and baleen whales (Kann and Wishner, 1995; Baumgartner *et al*. 2003). Amongst the highest population densities in the north east Atlantic occur in the Irminger Sea as a result of the hydrographic conditions created by the presence of the Reykjanes Ridge (Speirs *et al*. 2005). Rates of survival over winter may significantly influence the production of *C. finmarchicus* in the spring and summer (Gislason *et al*. 2007) which will ultimately affect higher trophic levels. The influence that the Reykjanes Ridge has in retaining the two populations of *C. finmarchicus* in suitable conditions is therefore of direct importance to the food webs of this area.

Oceanic Redfish (*Sebastes mentella*), a commercially important species, inhabit the entire oceanic area of the Irminger Sea (Magnússon and Magnússon 1995). The oceanographic conditions brought about by the Reykjanes Ridge acts as the boundary for the distribution of *S. mentella* to the east (Magnússon and Magnússon 1995). The production of larvae by *S. mentella* however takes place in the eastern part of the Irminger Sea extending southwards from 65°N and eastwards from 32°W along the Reykjanes Ridge (Magnússon and Magnússon 1995), and part of this area is included within the proposed boundaries. Spawning occurs between April and May (Magnússon and Magnússon 1995). The Reykjanes Ridge is therefore vital in maintaining conditions suitable for the survival of larval fish and maintenance of adult fish abundances (Fock and John 2006) and important copepod populations (Speirs *et al*. 2005; Gislason *et al*. 2007) as well as acting as a spawning site for the commercially important redfish, *S. mentella* (Magnússon and Magnússon 1995).

The proposed area may also encompass the asteroid *Benthopecten spinosissimus*, previously only recorded on Ascension Island indicating that the ridge may provide important habitat for disrupted range species (Dilman, 2006). 32 species of asteroid have currently been recorded along the Reykjanes Ridge (north of 53°N) (Dilman, 2006) including *Hymenasterides mironovi*, a new species to science (Dilman, 2008). In addition, the pycnogonid *Nymphon laneum* is known as yet only from the Reykjanes Ridge (Turpaeva, 2006).

4. High natural biological diversity

Species richness of pelagic fauna has been shown to increase over Reykjanes Ridge although with smaller total abundances than nearby sites (Fock and John 2006). The site also supports a high diversity and number of copepod genera (Gaard *et al*. 2008). As is detailed above (see *Threatened and/or Declining Species/Habitats* criterion) the presence of cold-water corals and deep-sea sponge aggregations act to increase the benthic structural complexity. This increased complexity provides habitat for a wide variety of different species (Costello *et al*, 2005). Evidence is available from the Reykjanes Ridge to support this theory, where increases in megafaunal species and fish catches have been found in association with cold water corals (Hareide and Garnes, 2001;Mortensen *et al*, 2008).

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5. Representativity

The fauna found on the shelves off southern Iceland and the Azores occupy different biogeographical subdivisions (Mironov and Gebruk, 2006). The Mid-Atlantic Ridge between these two shelf regions is considered to have different biogeographic regions, the northern, the southern and the transition zone around the Charlie-Gibbs Fracture Zone (O.A. Bergstad, pers. comm.). The proposed area forms part of one of the northernmost sections of the Mid-Atlantic Ridge. It is being proposed for MPA protection in addition to a similar area in the southern section of the Mid-Atlantic Ridge, south of the Charlie-Gibbs Fracture Zone and an existing proposal for the Charlie-Gibbs Fracture Zone. Taken together these three sites are thought to represent the different biogeographic areas of the Mid-Atlantic Ridge: the northern ridge (this proposal), the transition zone between north and south (Charlie-Gibbs Fracture Zone) and the Southern ridge (the Mid-Atlantic Ridge north of the Azores). The proposed protected area therefore is a representative example of the northern sub-polar communities of the Mid-Atlantic Ridge.

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6. Sensitivity

Benthic Habitat

The entire Reykjanes Ridge forms a hard-bottomed substrate, rising up from the abyssal plain, which acts to provide a wide range of benthic habitats and is colonised by a variety of erect megafauna (e.g. gorgonians, sponges and cold-water corals) (Copley *et al*. 1996). Such cold-water deep-sea corals and other associated permanently attached benthic fauna are vulnerable because they have a low capacity to recover from disturbance (Rogers *et al*, 2008). Growth rates for such structural species are slow (a few millimetres per year) and some patches of *L. pertusa* have been estimated to be 200 – 366 years old (Rogers *et al*, 2008). For the extensive *L. pertusa* reefs seen around Norway, estimates indicate they are up to 10,000 years old (Schröder-Ritzau *et al*, 2005; Rogers *et al*, 2008). Fecundity of deep-sea corals varies and *L. pertusa* is known to have a relatively high fecundity. However most recruitment probably occurs from larvae produced at the same site. Therefore damage to a site may have long-lasting effects on population replenishment (Le Goff-Vitry *et al*, 2004; Rogers *et al*, 2008). Any exploration of the area with bottom towing gear will have a habitat impact (Hall-Spencer *et al*, 2002; Gage *et al*, 2005; Grehan *et al*, 2005).

Magnússon and Magnússon (1995a) reported that on both sides of the Reykjanes Ridge huge quantities of sponges can be encountered in some places. Structural sponge habitat is also extremely vulnerable to trawling, suffering immediate declines through direct removal of sponges and further reductions in population densities due to delayed mortalities (Freese, 2001; ICES, 2007a). Experimental trawling of sponge communities in the Gulf of Alaska showed similar results to those found for coral communities. After one year no damaged sponges showed signs of repair or regrowth and there was no sign of recovery of the community (Freese *et al*, 1999).

The Mid-Atlantic Ridge is largely isolated from the continental slope and it is probable that stocks associated with the ridge habitat are isolated from others in the North Atlantic (ICES, 2008). Endemism, particularly amongst benthic species, may possibly be significant and consequently particularly vulnerable to anthropogenic activities (ICES, 2008)

The high financial cost of investigating the deep-sea limits our understanding of the impacts of deep-sea fishing (Hall-Spencer *et al*, 2002). However, evidence of trawl marks in the deep-sea region (200 – 1400m depth) of the European continental margin indicates that the potential impact of towed gears on deep-water corals is high (Hall-Spencer *et al*, 2002). Towed gear has had long-lasting detrimental effects on shallow biogenic reefs in European waters (Hall-Spencer and Moore, 2000) and has caused extensive damage to deep-water reefs in other parts of the world, including off the coasts of Norway, Australia, USA and Canada, among many other nations (Hall-Spencer *et al*, 2002; Roberts 2006). Fosså *et al*. (2002) estimated that 30-50% of Norwegian *Lophelia* reefs had been seriously damaged or destroyed by trawls. The scars of trawl passes have been widely reported in deep water (Roberts *et al*. 2000, 2003 and references therein) and trawls are responsible for destroying many of the Darwin Mounds, deepwater coral habitats off the North West Coast of Scotland which were given protection from bottom trawling by the EU in 2004 (Duncan and Roberts 2001). There is great concern over the potential damage caused to corals that have built up over centuries and millennia (Hall-Spencer *et al*, 2002), with growth rates for *L. pertusa* in the North Atlantic estimated as being between 2 and 25mm yr^{-1}, the build up of reefs is slow (Mortensen, 2001; Hall-Spencer *et al*, 2002). As yet there is no clear evidence of recruitment of new coral individuals to sites damaged by trawling (Waller *et al*, 2007; Rogers *et al*, 2008).

The *C. rupestris* fishery that began on the northern Mid-Atlantic Ridge in 1973 by USSR trawlers targeted up to thirty commercially exploitable seamounts in the region from 46 to 62^{o}N, using both pelagic and bottom trawls (ICES, 2007b; ICES, 2008). High bycatch of deepwater corals and associated organisms has also been reported from seamount fisheries for Orange Roughy in New Zealand (Probert *et al*, 1997; Anderson and Clark 2003). Similar findings of extreme damage by bottom trawls have been made from the Corner Rise seamounts in the North Atlantic (Waller *et al*, 2007). Koslow *et al*, (2001) compared invertebrate assemblages on pristine, unexploited seamounts in Tasmanian waters with nearby seamounts that had been fished by trawlers targeting Orange roughy (*H. atlanticus*). They found dense, species rich assemblages of bottom living invertebrates on unfished seamounts. By contrast, trawling operations had removed these communities from exploited seamounts. The corals and coral aggregate had been scraped off or crushed. Unfished seamounts supported on average twice the biomass of bottom living invertebrates and supported 46% more species per sample. The bare rock, rubble and sand characteristic of trawled seamounts was not seen on any of the unexploited seamounts.

Exploration and early fisheries in the area are likely to have contributed to declines in fish catches experienced in the region through a reduction in suitable benthic habitat for the targeted species (Gordon *et al*, 2003). This region is therefore unlikely to support sustainable fisheries unless gear restrictions and fishing effort in the area can be tightly controlled, including the provision of large-scale protected areas (Roberts 2002). Closure of the mid-section of the Reykjanes Ridge will preserve bottom habitats, protect stocks of exploited species and their spawning sites, and safeguard ecosystem services potentially benefiting any surrounding fisheries.

Fish Species

Much of the information about fish species on the Reykjanes Ridge comes from literature that focuses on their exploitation. As mentioned above the Roundnose grenadier (*C. rupestris*) fishery began along the northern Mid-Atlantic Ridge on seamounts between 46 and 62°N in 1973 by USSR trawlers (ICES, 2007b; ICES, 2008). This fishery declined after the dissolution of the Soviet Union in 1992 and since that time there has been a sporadic fishery by Russia, Latvia, Poland and Lithuania (ICES, 2007b; ICES, 2008). Trawl and longline fisheries over the northern Mid-Atlantic Ridge have also been conducted sporadically by Faroese and Spanish vessels although catches overall have tailed off in recent years (Figure 3) (ICES, 2008) indicating either declining fishing effort or declining biomass. During the period 1988 – 2006 the catch of *C. rupestris* from the northern Mid-Atlantic Ridge (mostly ICES Sub-area XII) amounted to more than 232,000 t (ICES, 2008). Recent Russian trawl acoustic surveys have indicated that this species' distribution over the northern Mid-Atlantic Ridge has changed considerably since the 1970s and 1980s, the biomass of the pelagic component of the grenadier being much smaller than previously found (ICES, 2007b).

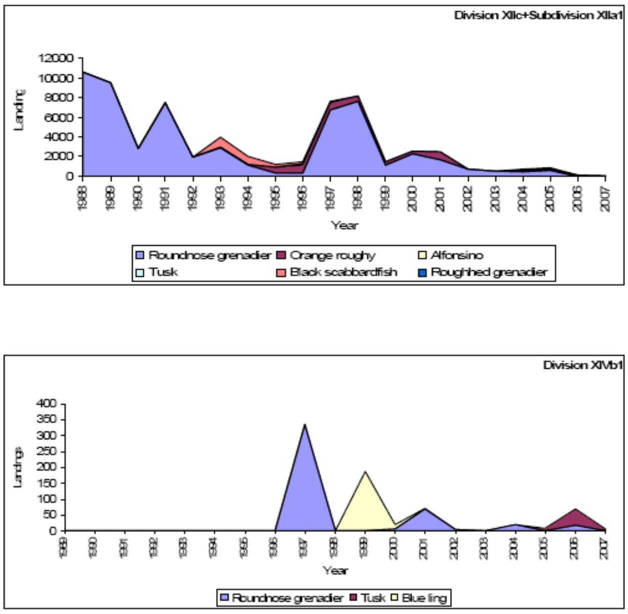

Figure 3: Annual catch of major deep-water species on the Mid-Atlantic Ridge in 1988 – 2007 (ICES, 2008).

Deep water fisheries off Iceland usually occur on the continental slopes. However French trawlers found a small seamount on the Reykjanes Ridge and fishing there for blue ling (*M. dypterygia*) in 1993, but catch declined sharply and no further reporting from French vessels is recorded (ICES, 2007b; ICES, 2008). The fishery on the seamount resumed in the 2000s, with the biggest catch being 1000t (ICES, 2007b; ICES, 2008). Orange roughy (*H. atlanticus*) is also known to occur in restricted areas of the Reykjanes Ridge, where it can be abundant on the tops and the slopes of underwater peaks (ICES, 2007b; ICES, 2008). In 1992 the Faroe Islands began an exploratory fishery for *H. atlanticus* in international waters and exploitable concentrations were found in 1994 and 1995 (ICES, 2007b; ICES 2008). Catches peaked in 1995-1998 between 570 and 802 t and only one vessel has managed to maintain a viable fishery with catches generally less than 300 t (ICES, 2007b; ICES, 2008). In 1996 a small fleet of Norwegian longliners began a fishery for Giant redfish (*Sebastes marinus)* and Tusk (*B. brosme*) on Reykjanes Ridge mainly on the summits of seamounts (ICES, 2006; ICES, 2007b; ICES, 2008). The fishery ended by 1998 after experiencing an 84% decline in CPUE and was restarted by Russian longliners in 2005/2006 (ICES, 2007b; ICES 2008).

Deep-water fish species are known to be highly vulnerable to human disturbances as a result of their life history characteristics, i.e. long-lived, slow growing and low fecundity (e.g. Hall-Spencer *et al*, 2002; Devine *et al*, 2006; Fossen *et al*, 2008). ICES has ranked seamount fish species in order of their vulnerability to fishing based on their longevity and Orange roughy was ranked as the most vulnerable (ICES, 2002). As inshore fish stocks are depleted and technological advances are made with fishing gear, fisheries will begin to explore new grounds, even those that have previously been considered unfishable. Importantly, scientific investigation lags behind the collapse of deep-sea fisheries and few deep-sea fish species have not even been evaluated by the World Conservation Union (IUCN) (Devine *et al*, 2006). A recent study by Devine *et al* (2006) took catch data from Canadian waters over 1978 – 94. They studied several deep-water fish species including *A. rostrata* and *M. berglax*, which have both been found to be the dominant species within the proposed area (Hareide and Garnes, 2001). According to IUCN criteria, the declines seen in both of these species over Northwest Atlantic continental slopes qualify them as critically endangered for this area (Devine *et al*, 2006). Not only did abundance decline, but there was a decline in the mean size of both species over the 17-year period of between 25-57% (Devine *et al*, 2006).

Shark and Ray Species

The seamounts of the northern Mid-Atlantic Ridge were surveyed between 43^o and 57^{o}N by Kukuev (2004), which is just outside the proposed boundaries. The species that were sampled by Kukuev (2004) consisted of approximately 20 elasmobranch species including Frilled shark (*Chlamydoselachus anguineus),* Greenland shark (*Somniosus microcephalus*), Leafscale gulper shark (*Centrophorus squamosus*), Great lanternshark (*E. princeps*) and the Portuguese dogfish (*Centroscymnus coelolepis*). Kukuev (2004) also reports two species, which are potential endemics to the northern Mid-Atlantic Ridge, the White ray (*Raja kukujevi*) and the Azores dogfish (*Scymnodalatias garricki*). In addition to this Hareide and Garnes (2001) reported catching *R. pallida* and *B. richardsoni*, for both of which few records exist. (see Important Species and Habitats criterion).

Chondrichthyan fishes, including deep-water sharks and rays, have life history characteristics that include slow-growth, late maturity and a low reproductive output (Kyne and Simpfendorfer, 2007). In recognition of their sensitivity to human impact *C. squamosus, C. coelolepis* and *Centrophorus granulosus* (Gulper shark, not recorded in the proposed area) have all been accepted by OSPAR for inclusion on the OSPAR list of Threatened and/or Declining Species and Habitats by BDC/MASH 2007. Trade and landings data for deep-water sharks in general, is lacking and many deepwater species are taken as bycatch, often discarded or landed under generic species codes such as 'shark' or 'other', making investigations about the status of stocks difficult at best (Kyne and Simpfendorfer, 2007).

C. anguineus, *S. microcephalus* and *C. coelolepis* are listed as near threatened on the IUCN Red List (Paul and Fowler, 2003; Kyne *et al*, 2006; Stevens and Correla, 2003). *S. microcephalus* is an extremely long-lived and slow-growing deep water species of shark that was historically targeted for its liver oil by Norway, Iceland and Greenland (Kyne *et al*, 2006). In the 1910s catches for this species reached 32,000 sharks per year by Greenland alone and these fisheries are thought to have had a significant impact on this species (Kyne *et al*, 2006). *C. sanguineus* and *C. coelolepis* are both mainly caught as bycatch by trawl, longline and gillnet fisheries and there is concern that the expansion of deepwater fisheries (both geographically and in depth range) will increase the rate of bycatch (Paul and Fowler, 2003; Stevens and Correla, 2003). Concern is especially high for *C. anguineus* as this species is generally one of the more uncommon deepwater shark species, which is only found in a few localities (Paul and Fowler, 2003). There are insufficient data to categorise *E. princeps* on the Red List, however it is known to be a small deepwater lanternshark found in North and

Eastern Central Atlantic whose biology is essentially unknown (Herndon and Burgess, 2006). This species is caught as bycatch by deepwater trawlers over much of its range and may be under considerable fishing pressure. However, specific information is unavailable (Herndon and Burgess, 2006).

The three rare ray species that have been reported for the northern Mid-Atlantic Ridge (Hareide and Garnes, 2001; Kukuev, 2004) come from two families. *B. richardsoni* and *B. pallida* belong to the Family Arhynchobatidae (Softnose Skates) and *R. kukujevi* and belongs to the Family Rajidae (Hardnose Skates) (Kyne and Simpfendorfer, 2007). There is a high species diversity within the Arhynchobatidae Family. However, relatively little is known about their biology mainly due to their scattered distributions, deep occurrences (this family includes some of the deepest occurring chondrichthyans), taxonomic uncertainty and limited material, meaning some species, such as those found in and near to the proposed area, are virtually unknown (Kyne and Simpfendorfer, 2007). Estimates from the limited information about Softnose skates suggests they can live up to 29 years and reach maturity at about 10 years (Kyne and Simpfendorfer, 2007), making them highly vulnerable to any human induced exploitation. There is considerably more information available about the Rajidae family than the Arhynchobatidae family, which is the most speciose of chondrichthyans, and contains the deepest occurring chondrichthyan species. However, the overall knowledge about this family is poor (Kyne and Simpfendorfer, 2007). The family on the whole conforms to the general life history traits of chondrichthyan species and therefore will also be highly vulnerable to exploitation. Both *B. pallida* and *B. richardsoni* are listed on the IUCN Red List of Threatened Species as being of least concern, due to their very deep depth ranges, which remain out of the range of most deep-water fishing activity (Kulka *et al*, 2007; Orlov, 2007). However, both were caught during experimental fishing along the Mid-Atlantic Ridge and therefore they can be considered vulnerable to deep-water fishing in the area. Indeed the whole of their depth range is now reachable with longline gear. *R. kukujevi* is not listed on the IUCN Red List.

7. Naturalness

Hareide and Garnes (2001) described the section of the Mid-Atlantic Ridge between Iceland and the Azores as being relatively unexploited and therefore one of the few nearly pristine ecosystems shallower than 2000m in the North Atlantic. Magnússon and Magnússon (1995) also described a lot of the Reykjanes Ridge as being unfishable due to its highly variable topography. Mironov and Gebruk (2006) describe the Reykjanes Ridge within the proposed area as being of rougher topography than the Ridge north of approximately 58^{o}N. However, the northern Mid-Atlantic Ridge has been targeted by fisheries since 1973 (ICES, 2007b, ICES 2008), therefore these descriptions may not be entirely accurate. It is likely that the majority of the fishable seamount peaks along the Mid-Atlantic Ridge have been exploited with associated impacts on the pelagic and deep-water communities of this area, especially those on and around the shallower seamounts.

The Mid-Atlantic Ridge has also been subject to scientific research, which has included trawling and other extractive methods since the beginning of the first field phase of the MAR-ECO project in 2003, although these impacts cover a very small area relative to the expanse of the habitat.

b. Practical criteria/considerations

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1. Potential for restoration

It is unknown to what degree anthropogenic activities have impacted this part of Reykjanes Ridge. Past fisheries may have altered trophic levels and species dominances within the ecosystem. Indeed recent acoustic trawl surveys of a previously targeted species *C. rupestris* indicate that this species now aggregates much deeper than was found in the 1970s and 1980s (ICES, 2007b). However, the potential overall causes and effects of this are unknown. While some evidence of fishing impacts has been found in sections of the Mid-Atlantic Ridge south of the proposed area, this comprised lost long-lines rather than trawl marks on the seabed, which have been seen for areas of the European continental margin (Hall-Spencer *et al,* 2002; Mortensen *et al*, 2008). The establishment of a protected area here would help prevent further damage and potentially allow deep-sea species to recover before more extensive human impacts begin to be felt.

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2. Degree of acceptance

As noted earlier, the proposed area includes deep-sea sponge aggregations and seamount habitats listed as priority threatened or declining habitats by OSPAR (OSPAR Commission 2003). It includes cold water coral and sponge reefs and seamount 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 coral and sponge aggregation 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 warranting protection of the area.

Fisheries have occurred around the Reykjanes Ridge for at least thirty years. However, evidence shows that any new fisheries that develop are not likely to be economically viable for long because of unpredictable catches rates and high fishing costs (e.g. Haeride and Garnes, 2001; ICES, 2007b; ICES, 2008). The combination of the important ecological role of this site and the recorded low commercial species abundances are likely to increase the acceptability of this site becoming a protected area. An example of the unsustainable nature of deep-sea fisheries within the northern Mid-Atlantic Ridge is the Russian redfish fishery that began in the 1990s. After one year the fishery collapsed because catches (and therefore populations) became too low to make the endeavour economically viable (Haeride and Garnes, 2001). In addition, fishing effort on the Reykjanes Ridge is likely to be low as several authors have commented on the difficulty of fishing experimentally over the rough bottom topography (even with rock hopper trawls) (Magnússon and Magnússon, 1995a; Bergstad *et al*, 2008). The implementation of this protected area is unlikely to result in significant displacement of fishing effort or activities to other sites. As a result of the presently low commercial interest and the site's biological and ecological importance, the degree of acceptance to the proposed protected area may be high. Saying this however, the Mid-Atlantic Ridge has been described as one of the "key deep-water fishing areas in international waters" (ICES 2006) and this is therefore likely to lead to some opposition to closing areas along the ridge.

One aspect to consider is the relatively recent North East Atlantic Fisheries Commission (NEAFC) closures further south of the proposed area (http://www.neafc.org/measures/current_measures/7_deep-water_habitats_2008.html). It is possible that fishing effort in these places prior to the closure may have been shifted further up the Mid-Atlantic Ridge into the area proposed. No data are available to determine whether this is the case. There is also the possibility that as inshore stocks are depleted and technological advances are made with fishing gear, new fishing grounds will be exploited, such as this area (See also *Potential damage to the area by human activities* criterion below).

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3. Potential for success of management measures

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 are 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). The challenge will be to bring illegal and unregulated fishing under control, which is known to take place around seamounts north and south of the Azores (Morato *et al*, 2001), and possibly further north in the vicinity of the Reykjanes Ridge.

Any management or enforcement of fisheries will be the responsibility of NEAFC, and their cooperation will be needed. There is evidence that fishers have ignored, or deliberately targeted protected areas once closed within the North East Atlantic (ICES, 2007a). An analysis of VMS data relating to the current NEAFC closures showed that while the Altair seamount was not previously targeted, bottom fishing effort was recorded subsequent to its closure in 2005 (ICES, 2007a). In addition, effort was shown to increase after the closures on the Faraday and Antialtair seamounts (ICES, 2007a). However, over the current Reykjanes Ridge closure no effort was observed through the entire year of 2005 indicating that the closure of the area was effective in proving protection from fishing activities (ICES, 2007a). This indicates that while effective enforcement must be carried out, high seas, marine protected areas can offer significant protection to areas and have been successful near to the proposed area.

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4. Potential damage to the area by human activities

The most damaging industry operating in the high seas region of the North East Atlantic is deep-sea fishing (OSPAR, 2000). Recent underwater video footage of the area was collected during the 2004 MAR-ECO cruise of the Mid-Atlantic Ridge. Mortensen *et al* (2008) recorded evidence of fishing in the form of lost gear at two stations during their sampling. Both of these areas were south of the proposed MPA site. No clear marks on the seabed from contact with heavy fishing gear such as trawl doors were seen at any of the locations surveyed (Mortensen *et al*, 2008). Lost longlines were also caught when fishing on hills of the Mid-Atlantic Ridge by the chartered longliner *MS Loran* (Dyb and Bergstad, 2004) that was operating as part of the MAR-ECO program at the same time and in the same areas as sampled by Mortensen *et al* (2008). Remains of former large *Lophelia* reefs were observed at several locations during the sampling undertaken by Mortensen *et al* (2008). The causality of the degradation of these reefs could not be ascertained. However, it was noted by the authors that there were no obvious natural causes that could account for such dramatic reductions in the extent of the reefs seen.
There has been commercial fishing activity on the Mid-Atlantic Ridge since the early 1970s, mainly targeting near-bottom species such as Roundnose grenadier (*C. rupestris*), Alfonsino (*Beryx splendens* and *B. decadactylus*), Orange roughy (*H. atlanticus*) and Redfish (*Sebastes*

spp.) (Troyanovsky and Lisovsky, 1995; Gordon *et al*, 2003; ICES, 2007b; Fossen *et al*, 2008; Mortensen *et al*, 2008). The primary gear used in this area has been the pelagic and bottom trawl, but longlines and gillnets have also been used (Mortensen *et al*, 2008). The true extent of fishing activity in the area is hard to document. However, Mortensen *et al* (2008) assumed that activity has declined in recent years following introduction of regulatory measures by the North East Atlantic Fisheries Commission (NEAFC). The closures relevant for this proposal are the closure of the Hecate and Faraday Seamounts and a part of the Reykjanes Ridge to all bottom trawling and fishing with static gears (NEAFC, 2008). Gordon *et al* (2003), however, attributed the reduction in activity over the Mid-Atlantic Ridge around the beginning of the 21st century as an indication that yields of commercially important species such as redfish, tusk and halibut, have dropped as opposed to the introduction of regulations. Many of the deep-water fish stocks in the entire North East Atlantic are heavily exploited and some are severely depleted (Anon, 2001; Gordon *et al*, 2003). The realisation of this led ICES in 2000 to provide the following management advice that recommended '*immediate reductions in these* (deep-water) *fisheries unless they can be shown to be sustainable*' (Gordon *et al*, 2003). Since then effort has been capped (at a higher level than recommended by ICES) and Total Allowable Catch (TAC) quotas have been introduced for several species in an attempt to move fisheries towards sustainability (ICES, 2007b). However, given the limited value of TACs in mixed fisheries, it seems unlikely that these measures will do much to achieve sustainability. Indeed, experience from shallow water fisheries in Europe points to the weakness of TAC restrictions in reducing fishing mortality. Instead, effort restrictions, including spatial closures, will be necessary to safeguard vulnerable species, like many of those inhabiting the ridge (Roberts, 2007).

The actual extent and severity of the impact that fishing and other human activities have had on Mid-Atlantic Ridge ecosystems is largely unquantified. Although Magnússon and Magnússon (1995a) reported that the Reykjanes Ridge is in general a very difficult area for bottom trawling because of its extremely irregular bottom topography, if the depletion of inshore stocks continues and fishing technology advances, deep-water habitats, such as the Reykjanes Ridge will become more threatened (Turner *et al*, 2001; Roberts, 2002). Given the vulnerable benthic habitats and deep-water species that are present on Reykjanes Ridge (see above criteria) such advances could be extremely detrimental to these communities.

There is no information regarding bioprospecting and the mining of minerals in the proposed area or for the Reykjanes Ridge as a whole. There are several un-named seamounts within the proposed area and seamounts may in the future be targeted by mining operations for their cobalt crusts (Probert, 1999). There is no information about the presence of such valuable minerals in the proposed protected area. The removal of habitat and release of sediment by mining can be expected to heavily impact the benthic fauna and their predators (Rogers, 2004). Currently bioprospecting of deep-ocean habitats is likely to focus on hydrothermal vent areas rather than seamounts (Glowka, 2003; Synnes, 2007) and cannot be categorised as a threat to the proposed areas at this time.

No tourist activity is reported for the area, and it is unlikely that a tourist industry will emerge in the near future.

Scientific research will continue along the Mid-Atlantic Ridge. Plans for further field stages of the MAR-ECO programme (see *Scientific Value* criterion below) are to be focused south of the proposed area around the Sub-Polar Front (Bergstad *et al*, 2008a). Protection of the area and the requirement for permits before research can be conducted may allow co-ordination of effort thereby conserving economic resources and vulnerable habitats that may be impacted by experimental trawling.
It is not envisaged that the proposed area would interfere with ship passage unless it is shown to be important as an aggregation area for endangered cetaceans that could be threatened by vessel strikes.

No information regarding cable laying operations in the area is available.

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5. Scientific value

Mid-ocean ridges are vast features of all oceans (Heger *et al*, 2008; Hosia *et al*, 2008). Despite their importance, their fauna and ecological significance remain poorly understood, mainly because ridge studies in the past have concentrated on chemosynthetic ecosystems (Bergstad *et al*, 2008a). The scientific value of the Mid-Atlantic Ridge within the OSPAR area is illustrated by the MAR-ECO project (Bergstad *et al*, 2008a). Many papers have been published, some early on in the project (Fock *et al*, 2004; Holland *et al*, 2005; Sanamyan and Sanamyan, 2005; Vinogradov, 2005; King *et al*, 2006; Fock and John, 2006; Fossen and Bergstad, 2006; Priede *et al*, 2006; Vecchione and Young, 2006; Young *et al*, 2006a, b), others, after substantial field research, were published recently in the journal Deep-Sea Research II (see reference list) and others have been published in Marine Biology Research in February of this year (Bergstad and Gebruk, 2008; Brandt and Andres, 2008; Dilman, 2008; Gebruk, 2008; Gebruk *et al*, 2008; Martynov and Litvinova, 2008; Mironov, 2008; Molodtsova *et al*, 2008; Murina, 2008; Tabachnick and Collins, 2008; Zezina, 2008). In that one issue of Marine Biology Research 15 new species and a new genus were described, which represented about 10% of the total number of benthic species sampled during the expedition (Gebruk *et al*, 2008). Some specimens were recorded in the North Atlantic for the first time (Dilman, 2008; Zezina, 2008), other added information to records of species only recorded a few times before (Molodtsova *et al*, 2008).

Our knowledge of mid-ocean ridges is sparse at best, even with the MAR-ECO project ongoing many questions remain unanswered or partially answered (Bergstad *et al*, 2008a). Ongoing monitoring and research is required, but as with any research is very expensive (Hall-Spencer *et al*, 2002). The vulnerability of the deep-sea to human impacts may mean that much of the diversity that is as yet unknown could be lost before we can catalogue it, unless protected areas, such as the one proposed, are established quickly (Roberts, 2002).

The seamounts present within the proposed area could also be studied under various other European programmes. For example the European Commission funded a fifth framework programme called OASIS (Oceanic Seamounts: An Integrated Study) that sponsored a series of expeditions to North Atlantic seamounts (primarily the Sedlo and Seine seamounts) (Brewin *et al*, 2007). The OASIS project concluded its fieldwork phase in 2005. However, a more recent programme has begun 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 open-access portal for seamount data (Brewin *et al*, 2007).

C. Proposed management and protection status

1. Proposed management

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):

- N/A Area beyond national jurisdiction

II Other international legal status (e.g., NATURA 2000, Ramsar): None

<u>Presented by</u>
Contracting Party:
Organisation:
Date:

References

Anderson, O.F. and Clark, M.R. (2003) Analysis of bycatch in the fishery for orange roughy (*Hoplostethus atlanticus*), on the South Tasman Rise. *Marine and Freshwater Research* **54(5):** 643 – 652.

Baumgartner, M.F., Cole, T.V.N., Campbell, R.G., Teegarden, G.J. and Durbin, E.G. (2003) Associations between North Atlantic right whales and their prey, Calanus finmarchicus, over diel and tidal time scales. *Marine Ecology Progress Series* **264**: 155 – 166.

Beaulieu, S.E. (2001) Life on glass houses: sponge stalk communities in the deep sea. *Marine Biology* **138(4):** 803 – 817.

Bergstad, O.A. and Gebruk, A.V. (2008) Approach and methods for sampling of benthic fauna on the 2004 MAR-ECO expedition to the Mid-Atlantic Ridge. *Marine Biology Research* **4:** 160 – 163.

Bergstad, O.A., Menezes, G. and Høines, Å.S. (2008) Demersal fish on a mid-ocean ridge: Distribution patterns and structuring factors. *Deep-Sea Research II* **55:** 185 – 202.

Bergstad, O.A., Falkenhaugh, T., Astthorsson, O.S., Byrkjedal, I., Gebruk, A.V., Piatkowski, U., Priede, I.G., Santos, R.S., Vecchione, M., Lorance, P. and Gordon, J.D.M. (2008a)
Towards improved understanding of the diversity and abundance patterns of the mid-ocean ridge macro- and megafauna. *Deep-Sea Research II* **55:** 1 – 5.

Bett, B.J. and Rice, A.L. The influence of hexactinellid sponge (*Pheronema carpenteri*) spicules on the patchy distribution of macrobenthos in the Porcupine Seabight (bathyal NE Atlantic) *Ophelia* **36(3):** 217 – 226.

Bower, A.S., Le Cann, B., Rossby, T., Zenk, W., Gould, J., Speer, K., Richardson, P.L., Prater, M.D. and Zhang, H.-M. (2002) Directly measured mid-depth circulation in the northeastern North Atlantic Ocean. *Nature* **419:** 603 – 607.

Brandt, A. and Andres, H.G. (2008) Description of *Aega sarsae* sp. nov. and redescription of *Syscenus atlanticus* Kononenko, 1988 (Crustacea, Isopoda, Aegidae) from the Mid-Atlantic Ridge. *Marine Biology Research* **4:** 61 – 75.

Clark, M.R., Tittensor, D., Rogers, A.D., Brewin, P., Schlacher, T., Rowden, A., Stocks, K. and Consalvey, M. (2006) *Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction*. UNEPWCMC, Cambridge, UK. [online] URL: www.unep-wcmc.org/resources/publications/ UNEP_WCMC_bio_series/

Copley JTP, Tyler PA, Sheader M, Murton BJ and German CR (1996). Megafauna from sublittoral to abyssal depths along the Mid-Atlantic Ridge south of Iceland. *Oceanologica Acta*, **19**: 549-559.

Costello, M.J., McCrea, M., Freiwald, A., Lundälv, T., Jonsson, L., Bett, B.J., Van Weering, T.C.E., De Haas, H., Roberts, J.M. and Allen, D. (2005) Role of cold-water *Lophelia pertusa* reefs as fish habitat in the NE Atlantic. In: Freiwald, A., Roberts, J.M. (Eds.), Cold-water Corals and Ecosystems. Springer-Verlag, Berlin Heidelberg, pp. 771-805.

Davies, A.J., Roberts, J.M. and Hall-Spencer, J., (2007) Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management. *Biological Conservation* **138:** 299-312.

Deng, R., Dichmont, C., Milton, D., Haywood, M., Vance, D., Hall, N. and Die, D. (2005) Can vessel monitoring system data also be used to study trawling intensity and population depletion? The example of Australia’s northern prawn fishery. *Canadian Journal of Fisheries and Aquatic Sciences* **62 (3):** 611-622.

Devine, J.A., Baker, K.D. and Haedrich, R.L. (2006) Deep-sea fish qualify as endangered. *Nature* **495:** 29.

Dilman, A.B. (2006) Asteroid fauna of the Reykjanes Ridge. In: Mironov, A.N., Gebruk, A.V., Southward, A.J. (eds.) Biogeography of the North Atlantic Seamounts. KMK Scientific Press, Moscow, 2006. pp 177 – 192.

Dilman, A.B. (2008) Asteroid fauna of the northern Mid-Atlantic Ridge with description of a new species *Hymenasterides mironovi* sp. nov. *Marine Biology Research* **4:** 131 – 151.

Dinter, W.P. (2001) Biogeography of the OSPAR Maritime Area – A Synopsis and Synthesis of Biogeographical Distribution Patterns described for the North-East Atlantic. Bundesamt für Naturschutz, Bonn, Germany pp 167.

Doksæter, L., Olsen, E., Nøttestad, L. and Fernö, A. (2008) Distribution and feeding ecology of dolphins along the Mid-Atlantic Ridge between Iceland and the Azores. *Deep-Sea Research II* **55:** 243 – 253.

Duineveld, G.C.A., Lavaleye, M.S.S., Berghuis, E.M., De Wilde, P.A.W.J., Van der Weele, J., Kok, A., Batten, S.D. and De Leeuw, J.W. (1997) Patterns of the benthic fauna and benthic respiration on the Celtic continental margin in relation to the distribution of photodetritus. *Hydrobiologia* **82(3):** 395 – 424.

Duncan, C. and Roberts, J.M. (2001) Darwin mounds: deep-sea biodiversity hotspots'. *Marine Conservation* **5:** 12-13

Dyb, J.E. and Bergstad, O.A. (2004) MAR-ECO: the cruise with M/S Loran Summer 2004, Cruise Report. Rapporter Møreforsking Ålesund No. 0418, 98pp, ISNN 0804-5380.

Falkowski, P.G., Barber, R.T. and Smetacek, V. (1998) Biogeochemical controls and feedbacks on ocean primary production. *Science* **281:** 200 – 206.

FAO (2007) Draft International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. FAO TC:DSF/2008/2.

Felley, J.D., Vecchione, M. andWilson Jr., R.R. (2008) Small-scale distribution of deep-sea demersal nekton and other megafauna in the Charlie-Gibbs Fracture Zone of the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 153 – 160.

Flach, E. and Thomsen, L. (1998). Do physical and chemical factors structure the macrobenthic community at a continental slope in the NE Atlantic?, In: Baden, S. *et al.* (Ed.) (1998). *Recruitment, Colonization, and Physical-Chemical Forcing in Marine Biological Systems: Proceedings of the 32nd European Marine Biology Symposium, held in Lysekil, Sweden, 16-22 August 1997. Developments in Hydrobiology,* 132: pp. 265-285

Fock, H., Pusch, C. and Ehrich, S. (2004) Structure of deep-pelagic fish assemblages in relation to the Mid-Atlantic Ridge (45° – 50°N). *Deep-Sea Research I* **51:** 953

Fock, H. and John, H-C. (2006) Fish larval patterns across the Reykjanes Ridge. *Marine Biology Research* **2**:191-199.

Fossen, I. and Bergstad, O.A. (2006) Distribution and biology of blue hake, *Antimora rostrata* (Pisces: Moridae), along the Mid-Atlantic Ridge and off Greenland. *Fisheries Research* **82:** 19 – 29.

Fossen, I., Cotton, C.F., Bergstad, O.A. and Dyb, J.E. (2008) Species composition and distribution patterns of fishes captured by longlines on the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 203 – 217.

Freese, J.L., Auster, P.J., Heifetz, J. and Wing, B.L. (1999) Effects of trawling on seafloor habitat and associated invertebrate taxa in the Gulf of Alaska. *Marine Ecology Progress Series* **182:** 119 – 126.

Freese, J.L. (2001) Trawl-induced damage to sponges observed from a research submersible. *Marine Fisheries Review* **63:** 7 – 13.

Freiwald, A., Huhnerbach, V., Lindberg, B., Wilson, J.B. and Campbell, J. (2002) The Sula Reef Complex, Norwegian shelf. *Facies* **47:** 179-200.

Gaard, E., Gislason, A., Falkenhaug, T., Søiland, H., Musaeva, E., Vereshchaka, A. and Vinogradov, G. (2008). Horizontal and vertical copepod distribution and abundance on the Mid-Atlantic Ridge in June 2004. **Deep-Sea Research II 55**:59-71.

Gebruk, A.V. (2008) Holothurians (Holothuroidea, Echinodermata) of the northern Mid-Atlantic Ridge collected by the *G.O. Sars* MAR-ECO expedition with descriptions of four new species. *Marine Biology Research* **4:** 48 – 60.

Gebruk, A.V., Fenchal, T. and Uiblein, F. (2008) Benthic fauna of the northern Mid-Atlantic

Ridge: results of the MAR-ECO expedition. *Marine Biology Research* **4:** 1 –2
German, C.R. and Parsons, L.M. (1998) Distributions of hydrothermal activity along the Mid-Atlantic Ridge: interplay of magmatic and tectonic controls. *Earth and Planetary Science Letters* **160:** 327 – 341
German, C.R., Briem, J., Chin, C., Danielsen, M., Holland, S., James, R., Jónsdottir, A., Ludford, E., Moser, C., Ólafsson, J., Palmer, M.R. and Rudnicki, M.D. (1994) Hydrothermal activity on the Reykjanes Ridge: the Steinahóll vent-field at 63°06'N. *Earth and Planetary Science Letters* **121:** 647 – 654.
Gislason, A., Eiane, K. and Reynisson, P. (2007) Vertical distribution and mortality of *Calanus finmarchicus* during overwintering in oceanic waters southwest of Iceland. *Marine Biology* **150**:1253-1263.
Gislason, A., Gaard, E., Debes, H. and Faulkenhaug, T. (2008) Abundance, feeding and reproduction of *Calanus finmarchicus* in the Irminger Sea and on the northern mid Atlantic Ridge in June. *Deep-Sea Research II* **55:** 72 – 82.
Glowka, L. (2003) Putting marine scientific research on a sustainable footing at hydrothermal vents. *Marine Policy* **27(4):** 303 -312.
Gordon, J.D.M., Bergstad, O.A., Figueiredo, I. and Menezes, G. (2003) Deep-water fisheries of the Northeast Atlantic: I. Description and current trends *Journal of the Northwest Atlantic Fisheries Science* **31:** 137 – 150.
Hall-Spencer, J.M. and Moore, P.G. (2000) Scallop dredging has profound long-term impacts on maerl beds. *ICES Journal of Marine Science* **57:** 1407 – 1415.
Hall-Spencer, J., Allain, V. and Fosså, J.H. (2002) Trawling damage to Northeast Atlantic ancient coral reefs. *Proceedings of the Royal Society, London: B Biological Sciences* **269 (1490):** 507 – 511.
Hansen, B., and Østerhus, S. (2000) North Atlantic – Nordic Seas exchanges. *Progress in Oceanography* **45 (2)**: 109 – 208.
Hareide, N-R. and Garnes, G. (2001) The distribution and catch rates of deep water fish along the Mid-Atlantic Ridge from 43 to 61°N. *Fisheries Research* **51**:297-310.
Hareide, N-R., Garnes, G. and Langedal, G. (2001) The boom and bust of the Norwegian longline fishery for redfish (*Sebastes marinus* 'Giant') on the Reykjanes Ridge. *NAFO SCR Document 01/126*, 13pp.
Heath, M.R., Fraser, J.G., Gislason, A., Hay, S.J., Jónasdóttir, S.H. and Richardson, K. (2000) Winter distribution of *Calanus finmarchicus* in the Northeast Atlantic. *ICES Journal of Marine Science* **57**:1628-1635.
Heger, A., Ieno, E.N., King, N.J., Morris, K.J., Bagley, P.M. and Priede, I.G. (2008) Deep-sea pelagic bioluminescence over the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 126 – 136.
Henry, L.-A. and Roberts, J.M. (2007) Biodiversity and ecological composition of macrobenthos on cold-water coral mounds and adjacent off-mound habitat in the bathyal Porcupine Seabight, NE Atlantic. *Deep Sea Research Part I: Oceanographic Research Papers* **54:** 654-672.
Holland, N.D., Clague, D.A., Gordon, D.P., Gebruk, A., Pawson, D.L. and Vecchione, M. (2005) Lophenteropneust hypothesis refuted by collection and photos of new deep-sea hemichordates. *Nature* **434:** 374 – 376.
Hosia, A., Stemmann, L. and Youngbluth, M. (2008) Distribution of net-collected planktonic cnidarians along the northern Mid-Atlantic Ridge and their associations with the main water masses. *Deep-Sea Research II* **55:** 106 – 118.
Hughes, D.J. and Gage, J.D. (2004) Benthic metazoan biomass, community structure and bioturbation at three contrasting deep-water sites on the northwest European continental margin. *Progress in Oceanography* **63(1-2):** 29 – 55.
Husebø, Å., Nøttestad, L., Fosså, J.H., Furevik, D.M. and Jørgensen, S.B. (2002) Distribution and abundance of fish in deep sea coral habitat. *Hydrobiologia* **471:** 91 – 99.
ICES (2006) Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP), 7 – 9 September 2005. ICES Headquarters. ICES CM 2006/ACFM:07. 202pp.

ICES (2007a) Report of the Working Group on Deep-Water Ecology (WGDEC), 26 – 28 February 2007. ICES CM 2007/ACE:01 Ref. LRC. 61 pp.
ICES (2007b) Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP), 8 - 15 May 2007, ICES Headquarters. ICES CM 2007/ACFM:20. 478 pp.
ICES (2008) Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP), 3 – 10 March 2008, ICES Headquarters. ICES CM 2008/ACOM:14. 531 pp.
Jensen, A. and Frederiksen, R. (1992) The fauna associated with the bank-forming deep-water coral *Lophelia pertusa* (Scleractinaria) on the Faroe Shelf. *Sarsia* **77 (1):** 53-69.
Kann, L.M. and Wishner, K. (1995) Spatial and temporal patterns of zooplankton on baleen whale feeding grounds in the southern Gulf of Maine. *Journal of Plankton Research* **17(2)**: 235 – 262.
King, N., Bagley, P.M. and Priede, I.G. (2006) Depth zonation and latitudinal distribution of deep sea scavenging demersal fishes of the Mid-Atlantic Ridge, 42^{o}-53^{o}N. *Marine Ecology Progress Series* **319:** 263 – 274.
Kourti, N., Shepherd, I., Schwartz, G. and Pavlakis, P. (2001) Integrating spaceborne SAR imagery into operational systems for fisheries monitoring. *Canadian Journal of Remote Sensing* **27 (4):** 291-305.
Kourti, N., Shepherd, I., Greidanus, H., Alvarez, M., Aresu, E., Bauna, T., Chesworth, J., Lemoine, G., Schwartz, G. (2005) Integrating remote sensing in fisheries control. Fisheries Management and Ecology 12 (5), 295-307.
Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B., and Williams, A. (2001) Seamount benthic macrofauna off southern Tasmania: community structure and impacts of trawling. *Marine Ecology Progress Series* 213: 111-125.
Kulka, D.W., Orlov, A. and Barker, A. 2007. *Bathyraja richardsoni*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 11 March 2008.
Kunze, E. and Llewellyn-Smith, S.G. (2004) The role of small scale topography in turbulent mixing of the global ocean. *Oceanography* **17(1):** 55 – 64.
Kuznetsov, A.P. and Detinova, N.N. (2001) Bottom fauna of the Reykjanes Ridge area. In: Kuznetsov, A.P., Zezina, O.N. (eds) Composition and structure of marine bottom biota, pp. 6 – 18. Moscow, VNIRO Publishing House.
Le Goff-Vitry, M., Pybus, O.G. and Rogers, A.D. (2004) Genetic structure of the deep-sea coral *Lophelia pertusa* in the North East Atlantic revealed by microsatellites and ITS sequences. *Molecular Ecology* **13:** 537 – 549.
Magnússon, J. and Magnússon, J.V. (1995) Oceanic redfish (Sebastes mentella) in the Irminger Sea and adjacent waters. *Scientia Marina* **59**(3-4):241-254.
Marr, S. and Hall-Spencer, J.M. (2002) UK coral reefs. The Ecologist **32 (4):** 36-37.
Martynov, A.V. and Litvinova, N.M. (2008) Deep-water Ophiuroidea of the Northern Atlantic with descriptions of three new species and taxonomic remarks on certain genera and species. *Marine Biology Research* **4:** 76 – 111.
Mironov, A.N. (2008) Pourtalesiid sea urchins (Echinodermata: Echinoidea) of the northern Mid-Atlantic Ridge. *Marine Biology Research* **4:** 3 – 24.
Mironov, A.N. and Gebruk, A.V. (2006) Biogeography of the Reykjanes Ridge, the northern Atlantic. In: Mironov, A.N., Gebruk, A.V., Southward, A.J. (eds.) Biogeography of the North Atlantic Seamounts. KMK Scientific Press, Moscow, 2006. pp 6 – 21.
Molodtsova, T.N., Sanamyan, N.P.and Keller, N.B.(2008) Anthozoa from the northern Mid-Atlantic Ridge and the Charlie-Gibbs Fracture Zone. *Marine Biology Research* **4:**12-30.
Morato, T., Guénette, S. and Pitcher, T.J. (2001) Fisheries of the Azores (Portugal) 1982-1999. Part III. 214-220. In: Zeller, D., Watson, R. and Pauly, D.(Eds). Fisheries Impacts on North Atlantic Ecosystems: Catch, Effort and National/Regional Data sets. Fisheries Centre Research Reports 9 (3),254 pp.
Mortensen, P.B. (2001) Aquarium observations on the deep-water coral *Lophelia pertusa* (L.

1758) (Scleractinaria) and selected associated invertebrates. *Ophelia* **54:** 83 – 104.
Mortensen, P.B., Hovland, M., Brattegard, T., Farestveit, R. (1995) Deep-water bioherms of the scleractinian coral *Lophelia pertusa* (L) at 64 degrees N on the Norwegian Shelf – Structure and associated megafauna. *Sarsia* **80 (2):** 145-158.
Mortensen, P.B., Buhl-Mortensen, L., Gebruk., A.V. and Krylova, E.M. (2008) Occurrence of deep-water corals on the Mid-Atlantic Ridge based on MAR-ECO data. *Deep-Sea Research II* **55**:142-152.
Murawski, S.A., Wigley, S.E., Fogarty, M.J., Rago, P.J. and Mountain, D.G. (2005) Effort distribution and catch patterns adjacent to temperate MPAs. ICES Journal Of Marine Science **62 (6):** 1150-1167.
Murina, V.V. (2008) New records of Echiura and Sipuncula in the North Atlantic Ocean, with the description of a new species of *Jacobia*. *Marine Biology Research* **4:** 152 – 156.
NEAFC (2008) North East Atlantic Fisheries Commission, Recommendation VII: 2008. For the protection of vulnerable deep-water habitats in the NEAFC area.
Opdal, A.F., Godø, O.R., Bergstad, O.A. and Fiksen, Ø. (2008) Distribution, identity, and possible processes sustaining meso-bathypelagic scattering layers on the northern Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 45 – 58.
Orlov, A. 2007. *Bathyraja pallida*. In: IUCN 2007. *2007 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on **11 March 2008**.
OSPAR Commission (2003). Initial OSPAR List of Threatened and/or Declining Species and Habitats. OSPAR Commission ISBN 1-904426-12-3
Porteiro, F.M. and Sutton, T. (2007) Midwater fish assemblages and seamounts, ***in***: Pitcher, T.J. *et al.* (Ed.) (2007). Seamounts: ecology, fisheries and conservation. Fish and Aquatic Resources Series, 12: pp. 101-116.
Priede, I.G., Froese, R., Bailey, D.M., Bergstad, O.A., Collins, M.A., Dyb, J.E., Henriques, C., Jones, E.G. and King, N. (2006) The absence of sharks from abyssal regions of the world's oceans. *Proceedings of the Royal Society B: Biological Sciences* **273:** 1435 – 1441.
Probert, P.K., McKnight, D.G., and Grove, S.L. (1999) Benthic invertebrate bycatch from a deep-water trawl fishery, Chatham Rise, New Zealand. *Aquatic Conservation: Marine and Freshwater Ecosystems* **7:** 27-49.
Rice, A.L., Thurstan, M.H. and New, A.L. (1990) Dense aggregations of a hexactinellid sponge (*Pheronoma carpenteri*) in the Porcupine Seabight (NE Atlantic) and possible causes. *Progress in Oceanography* **24(1-4):** 179 – 196.
Risk, M.J. *et al.* (1998) Conservation of cold and warm water seafans: threatened ancient gorgonian groves. *Ocean Voice International, Sea Wind* **12:** 2-21
Roberts, C.M. (2002) Deep impact: the rising toll of fishing in the deep sea. *Trends in Ecology and Evolution* **17(5):** 242 – 245.
Roberts, C.M. (2007) The Unnatural History of the Sea. Island Press, Washington DC.
Roberts, J.M., Harvey, S.M., Lamont, P.A., Gage, J.D. and Humphrey, J.D. (2000) Seabed photography, environmental assessment and evidence for deep-water trawling on the continental margin west of the Hebrides. *Hydrobiologia* **441(1-3):** 173 – 183.
Roberts, J.M., Long, D., Wilson, J.B., Mortensen, P.B. and Gage, J.D. (2003) The cold-water coral *Lophelia pertusa* (Scleractinia) and enigmatic seabed mounds along the north-east Atlantic margin: are they related? *Marine Pollution Bulletin* **46(1):** 7 – 20.
Roberts, J.M., Wheeler, A.J. and Freiwald, A. (2006) Reefs of the deep: the Biology and Geology of Cold-Water Coral Ecosystems. *Science* **312:** 543 – 547.
Rogers, A.D. (1994) The biology of seamounts. *Advances in Marine Biology* **30:** 305 – 350.
Rogers, A.D. (1999) The biology of *Lophelia pertusa* (Linnaeus 1758) and other deep-water reef-forming corals and impacts from human activities. International Review Of Hydrobiology **84 (4):** 315-406.
Rogers, A.D., Clark, M.C., Hall-Spencer, J.M. and Gjerde, K.M. (2008) The Science Behind the Guidelines: A Scientific Guide to the FAO Draft International Guidelines (December 2007) For the Management of Deep-Sea Fisheries in the High Seas and

Examples of How the Guidelines can be Practically Implemented. IUCN, Switzerland, 2008.
Rossby, T. (1999) On gyre interactions. *Deep-Sea Research II* **46:**139 – 164.
Sanamyan, K.E. and Sanamyan, N.P. (2005) Deep-water ascidians from the North Atlantic (R.V. *Academic Keldysh*, cruise 46 and 49). *Journal of Natural History* **39(22):** 2005 – 2021.
Sbortshikov, I.M. and Rudenko, M.V. (1990) Relief and tectonic structures of the Reykjanes Ridge axis zone. In: Almukhamedov, A.I., Bogdanov, Yu.A., Kuzmin, M.I. *et al* Reykjanes Ridge rift zone: tectonics, magmaism and conditions of sedimentology, pp 42 – 61. Moscow, Nauka.
Schmitz Jr., W.J. and McCartney, M.S. (1993) On the North Atlantic Circulation. *Reviews of Geophysics* **31 (1)**: 29 – 49.
Schröder-Ritzau, A., Freiwald, A. and Mangini, A. (2005) U/Th dating of deep-water corals from the eastern North Atlantic and the western Mediterranean Sea. In: Freiwald, A. and Roberts, J.M. (eds) Cold-Water Corals and Ecosystems, Springer-Verlag, Berlin-Heidelberg, pp1151 – 1169.
Skov, H., Gunnlaugsson, T., Budgell, W.P., Horne, J., Nøttestad, L., Olsen, E., Søiland, H., Víkingsson, G. and Waring, G. (2008) Small-scale spatial variability of sperm and sei whales in relation to oceanographic and topographic features along the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 254 – 268.
Søiland, H., Budgell, W.P. and Knutsen, Ø. (2008) The physical oceanographic conditions along the Mid-Atlantic Ridge north of the Azores in June-July 2004. *Deep-Sea Research II* **55:** 29 – 44.
Speirs. D.C., Gurney, W.S.C., Heath, M.R., and Wood, S. (2005) Modelling the basin-scale demography of *Calanus finmarchicus* in the north-east Atlantic. *Fisheries Oceanography* **14**(5):333-358.
Sutton, T., Porteiro, F.M., Heino, M., Byrkjedal, I., Langhelle, G., Anderson, C.I.H., Horne, J.P., Søiland, H., Falkenhaug, T., Godø, O.R. and Bergstad, O.A. (2008) Vertical structure, biomass and topographic association of deep-pelagic fishes in relation to a mid-ocean ridge system. *Deep-Sea Research II* **55:** 161 – 184.
Synnes, M. (2007) Bioprospecting of organisms from the deep-sea: scientific and environmental aspects. *Clean Technologies and Environmental Policy* **9(1):** 53 – 59.
Tabachnick, K.R. and Collins, A.G. (2008) Glass sponges (Porifera, Hexactinellidae) of the northern Mid-Atlantic Ridge. *Marine Biology Research* **4:** 25 – 47.
Troyanovsky, F.M. and Lisovsky, S.F. (1995) Russian (USSR) fisheries research in deep waters (below 500m) in the North Atlantic. In: Hopper, A.G. (Ed.), Deep-Water Fisheries of the North Atlantic Oceanic Slope. Kluwer Academic Publishers, Dordrecht, The Netherlands, pp. 357 – 366.
Turner, S.J., Thrush, S.F., Hewitt, J.E., Cummings, V.J. and Funnell, G. (1999) Fishing impacts and the degradation or loss of habitat structure. *Fisheries Management and Ecology* **6:** 401 – 420.
Turpaeva, E.P. (2006) Pycnogonida of the Reykjanes Ridge. In: Mironov, A.N., Gebruk, A.V., Southward, A.J. (eds.) Biogeography of the North Atlantic Seamounts. KMK Scientific Press, Moscow, 2006. pp 134 – 140.
UNEP (2007) Report of the Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection. Azores, Portugal, 2-4 October 2007. UNEP/CBD/EWS.MPA/1/2
Vecchione, M. and Young, R.E. (2006) The squid family Magnapinnidae (Mollusca: Cephalopoda) in the Atlantic Ocean, with a description of a new species. *Proceedings of the Biological Society of Washington* **119(3):** 365 – 372.
Vinogradov, G.M. (2005) Vertical distribution of macroplankton at the Charlie-Gibbs Fracture Zone (North Atlantic), as observed from the manned submersible “Mir-1”. *Marine Biology* **146:** 325 – 331.
Waller, R., Watling, L., Auster, P. and Shank, T. (2007) Anthropogenic impacts on the Corner Rise Seamounts, north-west Atlantic Ocean. *Journal of the Marine Biological*

Association of the UK **87:** 1075 – 1076.

White, M.; Mohn, C.; de Stigter, H.and Mottram, G. (2005). Deep-water coral development as a function of hydrodynamics and surface productivity around the submarine banks of the Rockall Trough, NE Atlantic, in: Freiwald, A.; Roberts, J.M. (Ed.) (2005). Cold-water corals and ecosystems. Erlangen Earth Conference Series, : pp. 503-514.

Wishner, K., Levin, L., Gowin, M. and Mullineaux, L. (1990) Involvement of the oxygen minimum in benthic zonation on a deep seamount. *Nature* **346:** 57 – 59.

Young, R.E., Vecchione, M. and Piatkowski, U. (2006a) *Promachoteuthis sloani*, a new species of the squid family Promachoteuthidae (Mollusca: Cephalopoda). *Proceedings of the Biological Society of Washington* **119(2):** 287 – 292.

Young, R.E., Vecchione, M., Piatkowskie, U. and Roper, C.F.E. (2006b) A redescription of *Planctotethis levimana* (Lönnberg, 1896) (Mollusca: Cephalopoda), with a brief review of the genus. *Proceedings of the Biological Society of Washingtion* **119(4):** 581 – 586.

Youngbluth, M., Sørnes, T., Hosia, A. and Stemmann, L. (2008) Vertical distribution and relative abundance of gelatinous zooplankton, *in situ* observations near the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 119 – 125.

Zaferman, M.L. and Shestopal, I.P (1996) Estimation of tusk abundance on the sea mounts of the North Atlantic from the underwater observation data and long-lining. *Instrumental Methods of Fishery Investigations*, pp 65 – 79 PNIRO, Murmansk (in Russian).

Zezina, O.N. (2008) Notes on brachiopods from the North Atlantic. *Marine Biology Research* **4:** 157 – 159.

Annex 1

Species and habitats of special interest for the Reykjanes Ridge-MPA

A. Habitats

Threatened and/or declining Habitats[9]

- Seamounts
- Deep Sea Sponge Aggregations
- *Lophelia pertusa* reefs
- Coral Gardens

Other Features of special concern

- Deepwater and epipelagic ecosystems, including their function for migratory species
- Habitats associated with ridge 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

- Orange roughy (*Hoplostethus atlanticus*)
- Blue whale (*Balaenoptera musculus*)
- Portuguese dogfish (*Centroscymnus coelolepis*)
- Leafscale gulper shark (*Centrophorus squamosus*)

Other Species of special concern

- Cetaceans
- Deep water sharks
- Mesopelagic and bathypelagic fish populations
- Oceanic seabirds

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

Addendum 3

Proposed OSPAR Marine Protected Area

Southern Mid Atlantic Ridge

A. General information

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1. Proposed name of MPA

Southern Mid-Atlantic Ridge (north of the Azores)

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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 Mid-Atlantic Ridge (north of the Azores) 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 Mid-Atlantic Ridge (north of the Azores) 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 Mid-Atlantic Ridge (north of the Azores) 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 Mid-Atlantic Ridge (north of the Azores) 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.

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:

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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).

a. The **epibenthos and its hard and soft sediment habitats,** including threatened and/or declining species and habitats such as seamounts, deep-sea sponge aggregations, *Lophelia pertusa* reefs[9] and coral gardens.

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

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

2.3.4 **Habitats and species of specific concern**

Those species and habitats of special interest for the Mid-Atlantic Ridge (north of the Azores)-MPA, which could also give an indication of specific management approaches, are listed at Annex 1.

3. Status of the location

The proposed area has been designed to be located beyond the limits of national jurisdiction of the coastal states in the OSPAR Maritime Area.

However, on 11 May 2009 the Portuguese Republic has 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. These claims submitted by Portugal – if approved by the UN CLCS - would encompass the seabed in the area of the proposed Southern Mid-Atlantic Ridge MPA.

The international legal regime that is applicable to the site 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 Marine Region V; Atlantic Ocean

5. Biogeographic region

Atlantic Subregion: North Atlantic province; Warm-temperate Waters

9 *Lophelia pertusa* is present, although reef structures have not yet been confirmed in the proposed area.

6. Location

The proposed marine protected area is located on the Mid-Atlantic Ridge within OSPAR Maritime Region V in the sub-tropical North Atlantic. It is situated south of the major biogeographic divide along the Mid-Atlantic Ridge, the Charlie-Gibbs Fracture Zone, and north of the Azores archipelago (Figure 1).

The co-ordinates proposed for the marine protected area boundaries are:

Latitude	Longitude
43.30°N	24.80°W
43.30°N	32.30°W
44.70°N	32.30°W
44.70°N	24.80°W

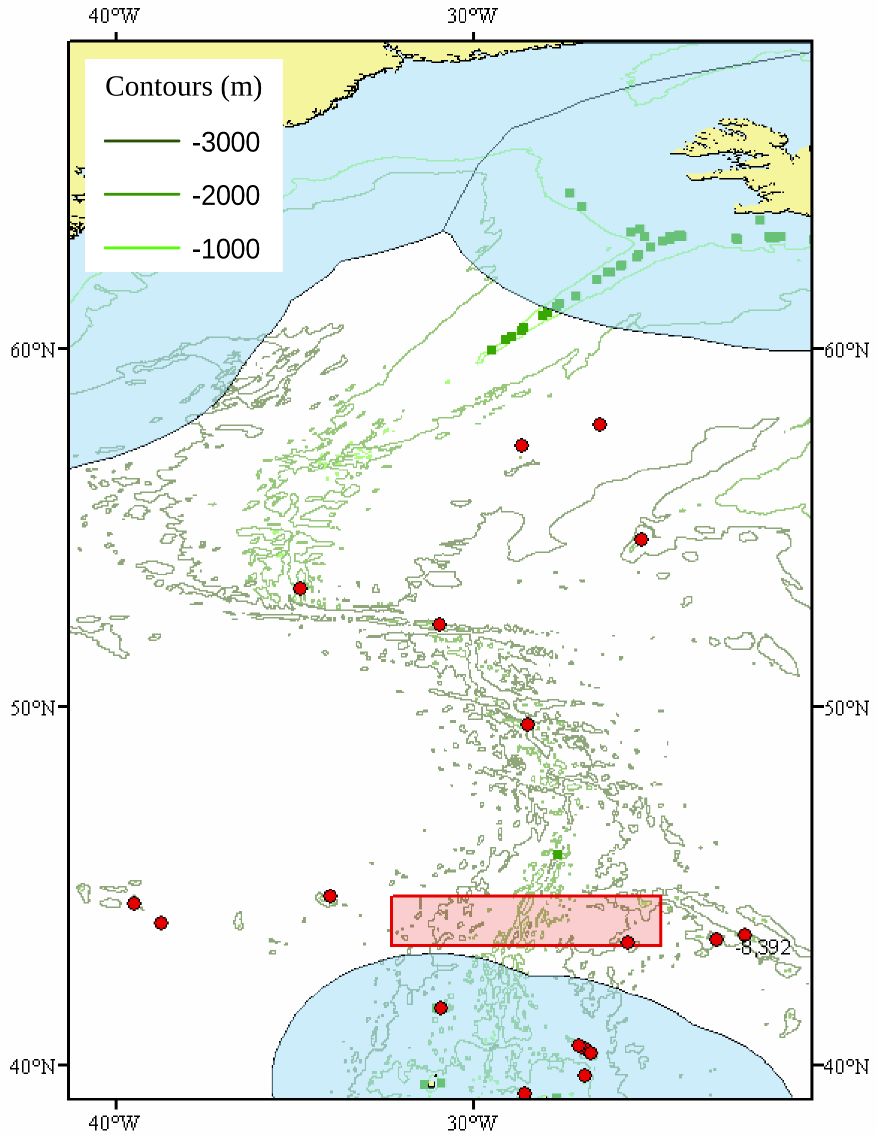

Figure 1. Proposed location of the marine protected area on the section of the Mid-Atlantic Ridge between the Azores and Charlie-Gibbs Fracture Zone. Light blue shaded areas represent the Exclusive Economic Zones of nearby coastal states. Red circles are the known locations of major seamounts in the OSPAR Maritime Area. Green squares are the current records for Lophelia pertusa.

This proposal is being made alongside a proposal for a marine protected area on Reykjanes Ridge. Together these two marine protected areas will complement existing proposals made by WWF, the Netherlands, Portugal and the University of York for a marine protected area around the Charlie-Gibbs Fracture Zone area of the Mid-Atlantic Ridge (Figure 2). Following a scientific meeting at ICG-MPA 2008 it was agreed that such proposals would represent the different biogeographic regions found over the Mid-Atlantic Ridge in Areas Beyond National Jurisdiction in the OSPAR area. The marine protected areas proposed are intended to represent the range of species and habitats across the Mid-Atlantic Ridge, and incorporates a range of depths from 1000m to approximately 2500m (Figure 1). The boundaries of these three candidate MPAs enclose areas of habitat important to a wide variety of species living from the seabed to the surface layers.

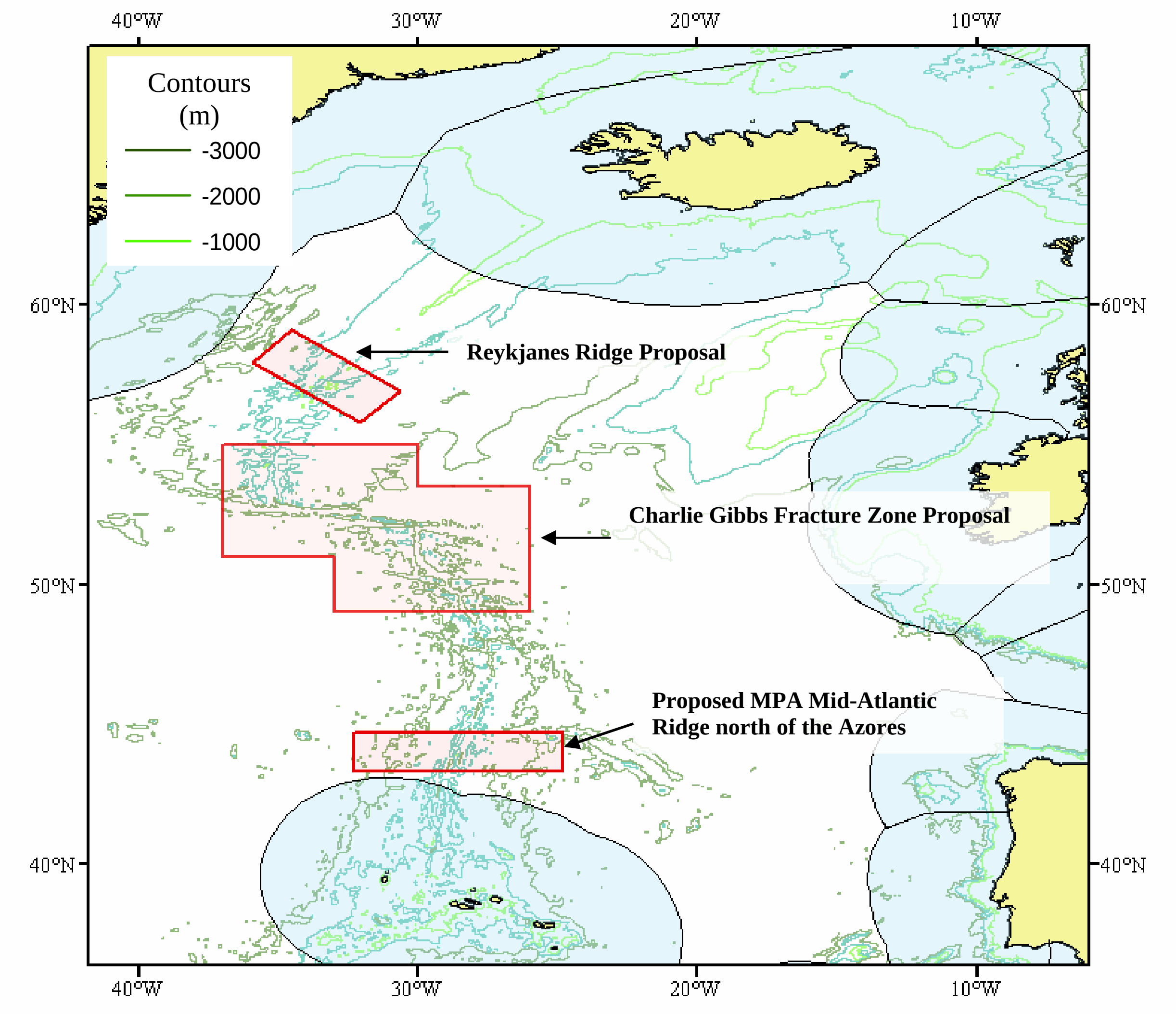

Figure 2. *The three areas of the Mid-Atlantic Ridge within the OSPAR Maritime area proposed as marine protected areas representing the three main biogeographical regions found during the MAR-ECO investigations. Light blue shaded areas represent the Exclusive Economic Zones of coastal states.*

7. Size

93,568km^2

8. Characteristics of the area

The Mid-Atlantic Ridge is a range of underwater mountains and valleys that separates the Eurasian from the American plate as an active seafloor spreading centre (Dinter 2001; Heger *et al* 2008). It stretches from Arctic waters through the entire length of the Atlantic Ocean, essentially dividing the Atlantic into two equal parts (Bergstad *et al* 2008a). Within the OSPAR maritime area it separates the Newfoundland and Labrador basins from the West-European basin, and the Irminger from the Iceland basins (Dinter 2001). The southern section of the Mid-Atlantic Ridge within the OSPAR area has no connection to a major land mass, unlike the Reykjanes Ridge, but the Azores archipelago constitutes a significantly more shallow area (Bergstad *et al* 2008b).

The dominant water masses over the Mid-Atlantic Ridge between Iceland and the Azores show three different hydrographic regimes (Pierrot-Bults, 2008; Søiland *et al* 2008). These regimes basically divide the pelagic environment into cold, sub-polar conditions north of the Sub-Polar Front; warm, sub-tropical conditions south of the Sub-Polar Front; and the frontal region itself which blends the characteristics of both areas (Søiland *et al* 2008). The Sub-Polar Front, is a mobile oceanographic feature which is usually found just south of the Charlie-Gibbs Fracture Zone (Søiland *et al* 2008). The faunal assemblages along the Mid-Atlantic Ridge from Iceland to the Azores appear to be determined by these major water masses. For example, Doksæter *et al* (2008) found that white-sided dolphins and to a certain degree pilot whales inhabited areas dominated by cold, sub-arctic water, whereas common and striped dolphins were found in the warmer, sub-tropical waters. Not only does species composition of dolphins change between these two water masses, but abrupt changes are also seen in fish, cephalopods and zooplankton (Hareide & Garnes, 2001, Bergstad *et al* 2008b, Doksæter *et al* 2008, Fossen *et al* 2008, Gaard *et al* 2008, Sutton *et al* 2008). This pattern suggests that the Sub-Polar Front acts as a barrier to many taxa at several trophic levels (Doksæter *et al* 2008).

The three different biogeographical regions of the Mid-Atlantic Ridge have been studied by the MAR-ECO project (see Scientific Value criterion for further information) in their field work, by targeting three clear areas in the northern, southern and Charlie-Gibbs Fracture Zone regions. Results from the MAR-ECO project have been presented in two special journal editions (Deep-Sea Research II and Marine Biology Research). A significant amount of new information has been gathered about the Mid-Atlantic Ridge through this project. For example, when the area between the Charlie-Gibbs Fracture Zone and the Azores was sampled, *Rajella pallida* (Pale ray) was caught, providing the first record of this species for this area (Orlov *et al* 2006). Two newly born individuals of *Rajella bigelowi* (Bigelow's ray) were also captured, indicating that the central Atlantic is part of their spawning ground (Orlov *et al* 2006). Fourteen specimens of *Amblyraja jensei* (Jensen's skate) were recovered, which until this study were not known in the open waters of the Atlantic, and with other new data has suggested a continuous distribution for this species across the Atlantic (Orlov *et al* 2006).

In terms of the benthic community, the Mid-Atlantic Ridge provides a significant amount of hard substrate in the open ocean of the OSPAR area (Dinter, 2001). In addition the hydrographic conditions over the Mid-Atlantic Ridge are thought to be favourable for sessile suspension feeders such as cold-water corals (Mortensen *et al* 2008). During ROV dives on an area of the Mid-Atlantic Ridge just south of the proposed MPA area, Mortensen *et al* (2008) observed 28 different coral taxa (including *Lophelia pertusa*). Of those, seven were unique to the area (*Madrepora oculata, Solenosmilia variabilis, Stephanocyathus moseleyanus, Scleroptilum grandiflorum,* and three *Radicipes* species), as compared to sample sites around and north of the Charlie-Gibbs Fracture Zone (Mortensen *et al* 2008). The number of megafaunal taxa was higher in areas with coral than those without, a finding common to other regions (Mortensen *et al* 2008). At one of the sampling stations, north of this proposed area a pelagic trawl was found lying over coral rubble, indicating that fishing has occurred and had an impact (Mortensen *et al* 2008). The data collected by Mortensen *et al* (2008) were too limited to draw firm conclusions about the geographical distribution of coral taxa on the Mid-Atlantic Ridge. However, it does suggest corals are present within the proposed area.

The Mid-Atlantic Ridge between the Charlie-Gibbs Fracture Zone and the Azores archipelago has the highest concentration of seamount features on the Mid-Atlantic Ridge (Epp & Smoot, 1989). Hareide & Garnes (2001) studied the summit living species of seamounts along the Mid-Atlantic Ridge, they found that the dominant deep water fish species changed with latitude. Sub-tropical species such as Golden-eye perch (*Beryx splendens*) and Cardinal fish (*Epigonus telescopus*) dominated the seamount summits in the area between the Azores and the Charlie-Gibbs Fracture Zone, and sub-polar species dominated those north of the Charlie-Gibbs Fracture Zone (Hareide & Garnes, 2001). Seamounts are recognised in many different fora as being vulnerable to the effects of fishing pressure (e.g. UN, OSPAR, FAO, NEAFC, NAFO, UNEP). The area here is proposed not on the basis of the presence of seamounts, but as a representative section of the Mid-Atlantic Ridge habitat between the Azores and the Charlie-Gibbs Fracture Zone. However, the presence of seamounts within the proposed area should also be considered significant in justifying protection for a particularly vulnerable ecosystem.

Fossen *et al* (2008) sampled the Mid-Atlantic Ridge between Iceland and the Azores in 2004 as part of the MAR-ECO expedition. In total 59 long-lines were set across the ridge axis at depths ranging from 400 to 4300 metres (Fossen *et al* 2008). Chondrichthyans (sharks, rays and chimaeras) dominated the catches overall, which was expected given the gear used (Fossen *et al* 2008). The southern sample station (in the vicinity of this proposed marine protected area) produced fish that were significantly larger than either of the other sample stations (Fossen *et al* 2008). The catches from here were mainly dominated by large chondrichthyans and at deeper stations, the large cusk eel (*Spectrunculus* spp.) (Fossen *et al* 2008). This pattern may indicate a more fundamental difference in production and biomass compared to other parts of the Mid-Atlantic Ridge, however the data available was not enough for a more detailed study (Fossen *et al* 2008).

Of the large shark species along the Mid-Atlantic Ridge *Centrophorus squamosus* and *Centroscymnus coelolepis* were both caught only in the area just north of the Azores (Fossen *et al* 2008). These two species have been recently accepted by OSPAR for inclusion on the OSPAR list of Threatened and/or Declining Species and Habitats by BDC/MASH 2007. The fact that this proposed marine protected area is the only part of the Mid-Atlantic Ridge in which these species were caught during the most recent investigations, indicates that it may be important as representative habitatin the OSPAR area. It is also likely that other deep-water shark species will be included on the OSPAR List of Threatened and/or Declining Species and Habitats in the future given their life-history characteristics and their vulnerability to fishing impacts. The World Conservation Union'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)

Among birds, Cory's shearwater (*Calonectris diomedea*) breeding in the Azores have been shown to forage over the region of the Mid-Atlantic Ridge proposed here (Magalhaes *et al*, 2008). This species performs a dual-foraging strategy that combines short and long foraging trips. The majority of short trips were confined to the Mid-Atlantic Ridge just north of the Azores (within about 300km) (Magalhaes *et al*, 2008). The core foraging areas for long-trips were areas of the Mid-Atlantic Ridge further north, including the proposed area (Figure 3.; Magalhaes *et al*, 2008). It appears that no birds make foraging trips south of the Azores, which Magalhaes *et al* (2008) suggest indicates that the Mid-Atlantic Ridge south of the Azores is less productive than that to the north. This section of the Mid-Atlantic Ridge, north of the Azores, is thought to have enhanced productivity in comparison to other open ocean areas, resulting from nutrient rich upwellings and eddies, particularly in the vicinity of seamounts. Seamounts as described above are found in high concentrations on the Mid-Atlantic Ridge between the Azores and Charlie-Gibbs Fracture Zone (Epp & Smoot, 1989; Gubbay, 2003; Magalhaes *et al* 2008). The breeding colony of Cory's shearwater found on the Azores represents more than 70% of the total breeding population of the Atlantic subspecies *C. diomedea borealis* (50,000 – 90,000 breeding pairs). There has been concern raised over the incidental mortality of adults in longline fisheries of the Mediterranean and Macaronesia, which consists of the Canary Islands, the Azores archipelago, and Madeira all found in the North-East Atlantic just to the west of the Straits of Gibraltar (Cooper *et al* 2003, Gonzales-Solis *et al* 2007, Magalhaes *et al* 2008). Therefore the breeding adults foraging over the Mid-Atlantic Ridge may interact with fisheries in this area and be vulnerable to long-line gear (Magalhaes *et al* 2008).

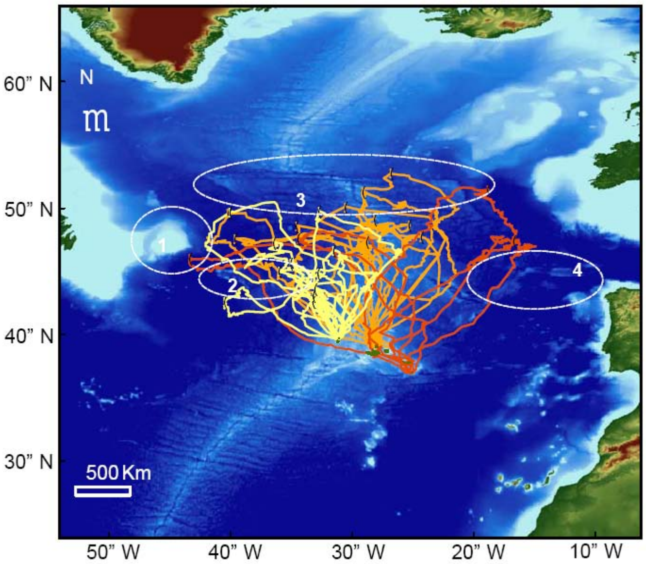

Figure 3. *Foraging ranges and destinations of long trips (5-18 days) of breeding Cory's shearwater (*C. diomedea*) from three islands in western (yellow), central (orange) and eastern (red) Azores. Circles mark maximum ranges for individual foraging trips. Oceanographic features: 1. Flemish Cap; 2. Milne Seamounts; 3. Charlie-Gibbs Fracture Zone; 4. Charcot Seamounts. Sea depths: pale <1000m; medium 1000 – 2000m; dark blue >2000m. Reproduced from Magalhaes et al (2008)*

B Selection criteria

a. Ecological criteria/considerations

1. Threatened and/or declining species and habitats

The proposed area includes seamount habitats and potentially *Lophelia pertusa* reefs, which are listed as priority threatened or declining habitats by OSPAR (OSPAR Commission 2003). It includes cold water coral and seamount 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 coral aggregations, 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).

In addition to the above listed habitats there are records of *Centrophorus squamosus* and *Centroscymnus coelolepis* being caught within the proposed marine protected area (Fossen *et al* 2008). Both of these shark species have been accepted by OSPAR for inclusion on the OSPAR list of Threatened and/or Declining Species and Habitats by BDC/MASH 2007.

2. Important species and habitats

As noted above, the proposed area includes habitats and species which are listed as priority threatened or declining habitats by OSPAR (OSPAR Commission 2003).

The Mid-Atlantic Ridge plays a pivotal role in circulation of water masses within the OSPAR Maritime Area and the whole North Atlantic (Rossby, 1999; Bower *et al* 2002; Heger *et al* 2008; Søiland *et al* 2008). The complex hydrographic setting around the Mid-Atlantic Ridge in general and the presence of the ridge itself leads to enhances vertical mixing and turbulence that results in areas of increased productivity over the Ridge (Falkowski *et al* 1998; Heger *et al* 2008; see also Ecological Significance (B3) criterion below). The Sub-Polar Front (usually found around the Charlie-Gibbs Fracture just south of 52^{o}N) acts to separate the turbulent, nutrient-rich, cool waters to the north and the stratified-nutrient-poor warm waters in the southern part of the North Atlantic (Richardson & Schoeman, 2004; Opdal *et al* 2008). Fish biomass on the section of the Ridge between the Azores and the Charlie-Gibbs Fracture Zone is thought to be sustained by zooplankton advection over the Ridge, rather than local nutrient enrichment and/or phytoplankton production (Rogers, 1994; Opdal *et al* 2008).

Ecologically the Mid-Atlantic Ridge (like all mid-ocean ridges) is fundamentally different from both isolated seamounts surrounded by deep-ocean and continental slopes where effects of coastal processes are pronounced (Opdal *et al* 2008). The Ridge provides the only extensive hard substrate habitat available for benthic suspension feeders off the continental shelves and the isolated seamounts provide suitable habitats for benthic or benthopelagic species. In addition the topography of the Ridge strongly shapes the habitat characteristics in the water column, through its effects on currents (see e.g. Opdal *et al* 2008).

The proposed marine protected area is in sub-tropical waters and the species present reflect this. The proposed MPA would offer protection to representatives of this distinctive group of species.

3. Ecological significance

Important Feeding Area

The proposed area is part of the Mid-Atlantic Ridge used as core foraging area by breeding Cory's shearwater (*C. diomedea*) from the Azores (see Fig 3; Magalhaes *et al* 2008). The breeding pairs found on the Azores make up >70% of the total breeding population of the Atlantic subspecies *C. diomedea borealis* (Magalhaes *et al* 2008). Therefore a significant amount of this population relies on the proposed area as foraging habitat. There is also concern over this species incidental mortality with longline fishing gear (Magalhaes *et al* 2008).

Biological Productivity

The complex hydrographic setting and the physical presence of the Mid-Atlantic Ridge leads to enhanced vertical mixing and turbulence (Falkowski *et al* 1998; Mauritzen *et al* 2002; Heger *et al* 2008), resulting in areas of increased natural biological productivity (Falkowski *et al* 1998; Heger *et al* 2008). Recent work as part of the MAR-ECO project found that the abundance of deep bioluminescence (indicative of high biomass of water column fauna) was significantly higher at a southern sample station (in the vicinity of the proposed area) as compared to a reference site (Sub-Polar Frontal Zone) (Heger *et al* 2008). The surface layers of the reference site exhibited lower abundance. This raised abundance seen in the deeper layers may be a result of a change in faunal composition south of the Sub-Polar Front (Heger *et al* 2008).

Observations from the MAR-ECO project showed that surface chlorophyll concentrations, zooplankton abundance and meso- and bathypelagic nekton density were considerably higher in the cool waters to the north of and in the frontal zone compares with the warmer southern waters (Bergstad *et al* 2008b, Sutton *et al* 2008, Gaard *et al* 2008, Opdal *et al* 2008). Therefore in comparison to the rest of the Mid-Atlantic Ridge the proposed area does not exhibit outstandingly high biological productivity. However, as a representative section of the Mid-Atlantic Ridge in warm temperate waters, with the presence of sub-tropical species assemblages it is likely to exhibit a higher biological productivity of these features than the surrounding open ocean.

Important Nursery/Juvenile/Spawning Area

The capture of two juvenile *R. bigelow* (Bigelow’s Ray) indicates that the central Atlantic is part of this species spawning ground (Orlov *et al* 2006). The specimens collected by Orlov *et al* (2006) were morphologically different from specimens from other areas, suggesting the possibility of a local population of this ray.

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4. High natural biological diversity

The Mid-Atlantic Ridge between the Azores and Iceland has until recently been relatively unexplored (Hareide & Garnes, 2001; Bergstad *et al* 2008a). However, since 2001 it has been subject to scientific investigation from a consortium of scientists in the form of the MAR-ECO project (Bergstad *et al* 2008). This has provided a great amount of new data about the ridge ecosystem and the species and habitats that occur there. However, the data are insufficient to make comparisons with other mid-ocean ridges or other areas such as isolated seamounts, continental slopes and island slopes. The Mid-Atlantic Ridge is the main hard substrate within the middle of the Atlantic and as such increases the diversity of habitats and niches available to be exploited. Demersal fish along the Mid-Atlantic Ridge show a concentration of biomass and numbers near the summit of the ridge, declining with depth, together with an associated depth-related change in species composition (Bergstad *et al.*, 2008). This indicates the importance of protecting a variety of depth zones to encompass as diverse species richness and biomass as possible. The proposed area incorporates examples of shallower ridge environments, surrounding abyssal plains, open ocean ecosystems and a seamount. Together these will enhance the variety of species that can be protected here.

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5. Representativity

The proposed area is considered to be representative of the area of the Mid-Atlantic Ridge south of the Sub-Polar Front. This area is described as being the warm sub-tropical section of the Mid-Atlantic Ridge within the OSPAR area (Bergstad *et al* 2008b, Søiland *et al* 2008). A previous proposal has focused on the Charlie-Gibbs Fracture Zone area, including the Sub-Polar Front as an area of high productivity and the area with the biogeographic divide between the northern and southern Mid-Atlantic Ridge populations (Figure 2). Alongside this proposal an area of the Reykjanes Ridge (i.e. the northern cold section of the Mid-Atlantic Ridge) is proposed (Figure 2). Combined these three proposals are thought to protect representative sections of all of the biological communities and oceanographic processes found on the Mid-Atlantic Ridge in the OSPAR area (Figure 2 and Important Species and Habitats criterion (B2)).

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6. Sensitivity

There is little direct information about the sensitivity of habitats and species in the area proposed. However, when sampling the Mid-Atlantic Ridge Mortensen *et al* (2008) found coral at every location sampled. Cold water corals are particularly vulnerable to damage by fishing gear such as trawl and longline (Koslow *et al*, 2001, Krieger, 2001, Fosså *et al* 2002, Mortensen *et al*, 2005, Mortensen *et al*, 2008). Their recovery from damage is expected to be slow given their extremely slow growth rates, often in the order of <2cm yr^{-1} (Wilson, 1979, Mortensen & Rapp, 1998, Andrews *et al* 2002, Risk *et al* 2002, Mortensen & Buhl-Mortensen, 2005, Gass & Roberts, 2006, Mortensen *et al* 2008).

Deep-water fish species are also known to be highly vulnerable to human exploitation as a result of their life history characteristics, i.e. long-lived, slow growing and low fecundity (e.g. Hall-Spencer *et al*, 2002; Devine *et al*, 2006; Fossen *et al*, 2008). This part of the Mid-Atlantic Ridge was once a significant fishing ground for *Beryx splendens* (alfonsino), a deepwater species, which is described as having a very high vulnerability to fishing by Froese & Pauly (2008). This species has been targeted since the late 1970s. However, in the mid-1990s Vinnichenko (1998) described the population in this area to be commercially extinct. Rapid declines like this, highlight, the vulnerability of such deep-water fish species to the effects of fishing over a relatively short-period of time and also the need to take action to prevent further declines. Some encouragement can be gained from Hariede & Garnes (2001), who reported dense schools of *B. splendens* close to the tops of seamounts within the proposed area, perhaps indicating the potential for recovery, or the presence of less exploited populations.

As inshore fish stocks are depleted and technological advances are made with fishing gear, fishers begin to explore new grounds, even those that have previously been considered unfishable (although recent rises in fuel costs may provide some de facto protection to isolated areas like the Mid-Atlantic Ridge). Importantly scientific investigation lags behind the collapse of deep-sea fisheries and few deep-sea fish species have been evaluated by the World Conservation Union (IUCN) (Devine *et al* 2006). A recent study by Devine *et al* (2006) took catch data from Canadian waters over 1978 – 94. They studied several deep-water fish species and found according to IUCN criteria, the declines seen in these species over Northwest Atlantic continental slopes qualify them as critically endangered for this area (Devine *et al*, 2006). Not only did abundance decline, but there was a decline in the mean size of all six species over the 17-year period of between 25-57% (Devine *et al*, 2006).

Recent investigations of this section of the Mid-Atlantic Ridge during the 2004 R.V. *G.O. Sars* expedition (as part of MAR-ECO) studied the distribution patterns of deep-water fish (Bergstad *et al* 2008b). The most abundant species caught included *Coryphaenoides armatus* (Abyssal grenadier), *C. leptolepis* (Ghostly grenadier), *C. mediterraneus* (Mediterranean grenadier), *Halosauropsis macrochir* (Abyssal halosaur), *Rouleina attrita* (Softskin smoothhead) and *Synaphobranchus affinus* (Grey cutthroat). All of these species are described by Froese & Pauly (2008) as deep-water species that have high to very high vulnerability to adverse impacts from exploitation based on their life-history traits.

Chondrichthyan fishes, including deep-water sharks and rays, have life history characteristics that include slow-growth, late maturity and a low reproductive output, all of which render them vulnerable to rapid population decline from exploitation (Kyne & Simpfendorfer, 2007). In recognition of their sensitivity to human impact *C. squamosus, C. coelolepis* and *Centrophorus granulosus* (Gulper shark, not recorded in the proposed area) have all been accepted by OSPAR for inclusion on the OSPAR list of Threatened and/or Declining Species and Habitats by BDC/MASH 2007. A recent assessment conducted by Gibson et al. (2008) states that 26% of chondrichthyan fishes known to occur within the North-east Atlantic are threatened ('Critically Endangered' - 8 species; 'Endangered' - 8 species; 'Vulnerable' - 14 species) while 20% are classed as being 'Near Threatened'. In addition, 31 species are defined as being 'Data Deficient' however this group may contain some of the most threatened chondrichthyans (Gibson et al., 2008). Of the 116 species found within the North-east Atlantic, several have a globally restricted range and nine are wholly endemic to the region (Gibson et al., 2008).

Few fisheries actively target commercially valuable chondrichthyans and all those that do are now in decline as a result of the reduced availability of stocks rather than falling market values (Gibson et al., 2008). However at present, two major types of fisheries conducted in the wider Atlantic take chondrichthyans including high seas pelagic and deep-water fisheries (Hareide et al. 2007). Until recently, the total landings of chondrichthyans in the North-east Atlantic have remained relatively stable, fluctuating around 100,000 t (Gibson et al., 2008). Since 2000 landings have significantly declined to ~51,000 t in 2006 (Gibson et al., 2008). There are currently no international catch limits for Northeast Atlantic chondrichthyans (Gibson et al., 2008) and consequently they are offered little protection from fishing activities.

Trade and landings data for deep-water sharks in general, are lacking and many deepwater species are taken as bycatch, often discarded or landed under generic species codes such as 'shark' or 'other', making investigations about the status of stocks difficult at best (Kyne & Simpfendorfer, 2007). However, both *C. squamosus* and *C. coelolepis* were caught using longlines within the proposed section of the Mid-Atlantic Ridge during the 2004 MAR-ECO field investigations (Fossen *et al* 2008). The dominant shark species caught within the proposed marine protected area was *Entmopterus princeps*, along with other squaliform shark species (Fossen *et al* 2008). As compared to parts of the Mid-Atlantic Ridge sampled further north of this proposed area was dominated by large chondrichthyans that were mainly caught at shallower stations (Fossen *et al* 2008). Therefore any fishing using long-lines within the area is likely to capture these vulnerable species.

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7. Naturalness

The deep-water fisheries of the wider Atlantic (OSPAR area V) are relatively poorly described (ICES, 2008b). The deep-water bottom-trawl fisheries are mainly concentrated around the Rockall and Hatton Bank, the Mid-Atlantic Ridge and to the west of the Azores, indicating the potential for the proposed area to be, if not already, targeted by fishers (ICES, 2008b). Gear damage can be high in many of these fisheries (ICES, 2008b) demonstrating the difficulty of fishing these areas even with rockhopper trawls due to the presence of structurally complex environments.

Fishing with bottom gears has been conducted on the Mid-Atlantic Ridge and adjacent seamounts since at least 1973. There have also been exploratory efforts made by a range of nations in the following decades (For example Pechenik & Troyanovskii, 1971; Danke, 1987; Magnusson & Magnusson, 1995; Draganik *et al* 1998; Vinnichenko, 1998; Magnusson *et al* 2000; Hareide & Garnes, 2001; Muňoz, 2001; Kukuev, 2004; Gerber *et al* 2006; ICES, 2007, 2008). The Mid-Atlantic Ridge just north of the Azores has over 20 seamounts with a depth less than 1000m, which have been intensively fished over the last three decades (Clark *et al* 2007; ICES, 2008a). It is likely that all fishable hills/peaks in this region with a summit depth of 1500m or less have been either explored or exploited commercially at some point in the last few decades (Clark *et al* 2007). However, bottom trawling on the Mid-Atlantic Ridge in this area has been described as 'difficult', with surveys indicating that that the area is unlikely to have been subjected to intensive bottom trawling in the past (Hareide & Garnes, 2001).

In addition there has also been pressure on some epi- and mesopelagic fish species that are associated with these seamounts (WGDEC 2008). Throughout the 1970s and 1980s tuna were regularly taken by Soviet research and exploratory vessels from seamounts between 43^{o} and 52^{o}N (WGDEC 2008). Albacore (*Thunnus alalunga*) was taken most frequently with catch rates as high as 20t/haul (Clark *et al* 2007; WGDEC 2008). Swordfish (*Xiphias gladius*) and Bluefin tuna (*Thunnus thynnus*) were also found (Clark *et al* 2007). In addition, Portuguese vessels operate surface longline fisheries targeting swordfish around the Azorean EEZ and are able to conduct trips of a month or longer as they have freezing capabilities on board (ICES, 2008b). However, as these fisheries have little impact on the benthic community the ICES Working Group on Deep Water Ecology (2008a) states that they 'are of little concern at present', at least to bottom living species in the deep sea.

The ICES Working Group on Ecosystem Effects of Fishing Activities lists the two most critical issues regarding the impact of fisheries as: 'trends in commercial fish stocks' and 'physical disturbance of the sea bottom and related impacts on benthic communities and habitats', although other impacts are detailed (ICES, 2008b). In the southern Mid-Atlantic Ridge populations of alfonsinos are known to have been significantly depleted in the 1970s (Vinnichenko, 1998; Froese & Pauly, 2008) although there is evidence indicating their recovery (Hariede & Garnes, 2001; ICES, 2008c). ICES (2008b) identifies that the primary priority within the wider Atlantic is to continue to improve the management of fisheries and to continue to investigate the area in order to identify vulnerable marine ecosystems.

In terms of the naturalness of the proposed area, it is clear that fishing activity has been ongoing for at least three decades. This may not have been at an intensity comparable to inshore fishing grounds, due to the high risk and running costs associated with offshore, deep-water fishing (Hareide & Garnes 2001; WGDEC 2008). However, it is certain to have had some impact on pelagic and deep-water communities of this area, especially those on and around the shallower seamounts. Therefore the area is by no means pristine, however given its location in the middle of the Atlantic it can be assumed that it is in a more natural state than ecosystems around populated coasts in terms of pollution and physical degradation.

b. Practical criteria/considerations

1. Potential for restoration

The effect of past anthropogenic disturbance has not been quantified, therefore it is difficult to determine the potential the proposed area has for restoration. Indeed it is not known what the ecosystem prior to any human disturbance was like giving no baseline to measure restoration against. What is known is that deep-water species tend to have life history characteristics that make their recovery slow (e.g. long-lived, slow growing, low fecundity). Therefore recovery of any depleted populations such as alfonsino or cold-water corals is likely to take a considerable amount of time (decades at least). The designation of a marine protected area in this location will help prevent any further damage to the ecosystem and also allow it to begin recovering from historical damage.

2. Degree of acceptance

Fisheries on the Mid-Atlantic Ridge have additional difficulties and increased commercial risk associated with them as compared to those on the continental shelf and slope (WGDEC 2008). Many of the seamounts that are targeted by fishing vessels are in offshore areas quite far from coastlines (WGDEC 2008). Therefore large fishing vessels with high running costs are required (WGDEC 2008). In addition to this catches and catch rates have shown large fluctuations and fishing operations can be hard because of rugged bottom topography, complex water circulation and the unpredictability of fish concentrations (Hareide & Garnes 2001; WGDEC 2008). This area of the Mid-Atlantic Ridge was once significant fishing ground for alfonsino until described as commercially extinct to ICES (Vinnichenko, 1998) However, fishing for alfonsino was resumed in 1999 – 2000 (ICES, 2008c) indicating that recovery is possible with a reduction in fishing effort. At present, it is thought to be unlikely that major fisheries occur in the proposed area. Recent work mapping existing fisheries areas in the NEAFC Regulatory Area supports this, indicating that no fishing activity from Russian or Icelandic vessels is currently occurring in the proposed area (Figure 4) (NEAFC, 2008). Consequently, the level of acceptance from the fishing community may be relatively high.

This MPA is proposed as a representative section of the Mid-Atlantic Ridge between the Azores and the Charlie-Gibbs Fracture Zone. It was agreed at ICG-MPA 2008 by scientists that have worked on the Mid-Atlantic Ridge and OSPAR contracting parties, that representing the biogeographic areas of the Mid-Atlantic Ridge by three separate marine protected areas was appropriate. As one of these marine protected areas the level of acceptance in the scientific community and by OSPAR contracting parties is also likely to be high.

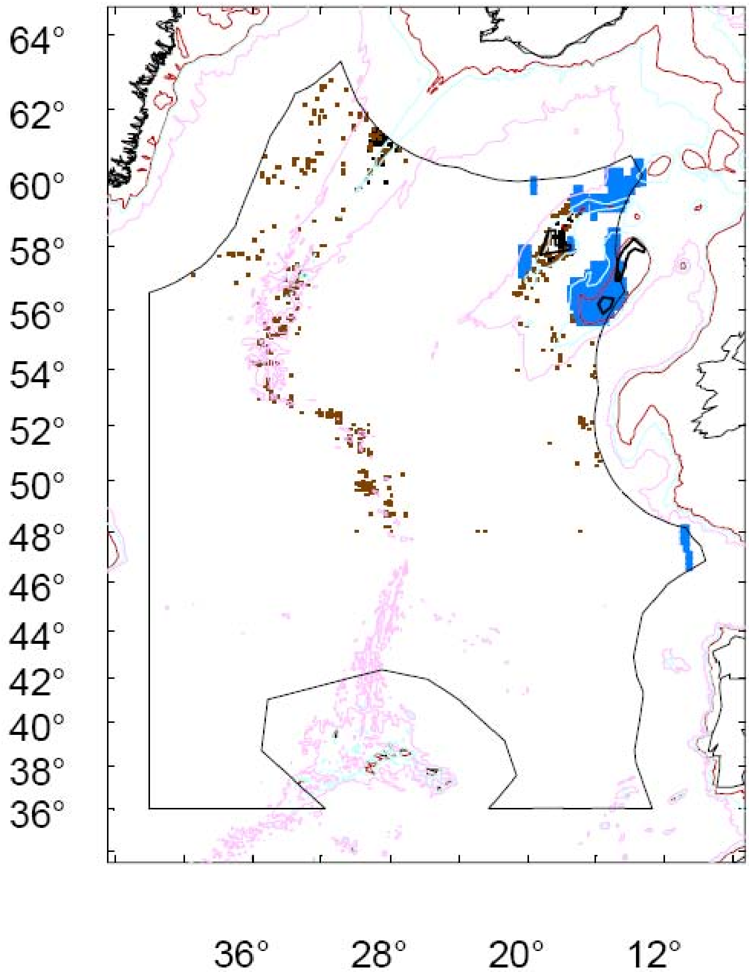

Figure 4. Existing fisheries areas in the NEAFC Regulatory Area based on Icelandic and Russian VMS data (1987 – 2007) and the NEAFC VMS database (2005 – 2007). Brown areas indicate Russian data (all gears), black refers to Icelandic data (all gears) and blue areas show the location of the main effort. Note that VMS data from the northern Reykjanes Ridge area are excluded. The deadline for submission of VMS data from all Contracting Parties is 1st September 2009 after which more comprehensive existing fishing areas will be mapped. Source: NEAFC (2008).

3. Potential for success of management measures

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 are 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). The challenge will be to bring illegal and unregulated fishing under control, which is known to take place around seamounts north and south of the Azores (Morato *et al*, 2001).

Any management or enforcement of fisheries will be the responsibility of NEAFC, and their cooperation will be needed. Existing NEAFC fisheries closures on the Altair, Faraday and Antialtair seamounts have failed to prevent fishing activity, with VMS data showing an increase in the level of bottom fishing effort (ICES, 2007a). However, in the subsequent year after the closure of part of the Reykjanes Ridge no effort was observed indicating that the closure of the area was effective in proving protection from fishing activities (ICES, 2007a). This indicates that while effective enforcement must be carried out, high seas marine protected areas can offer significant protection to areas.

4. Potential damage to the area by human activities

Bottom trawling on the Mid-Atlantic Ridge in this area has been described as difficult by Hareide & Garnes (2001). They found that in more than 90% of tows the trawling gear had to be freed from the seabed (Hareide & Garnes, 2001). This indicates that the area is unlikely to have been subjected to intensive bottom trawling in the past. However, seamount summits, particularly those shallower than 1000m within the vicinity of the proposed area have been targeted over the years. In addition other gear types (i.e. longline and pelagic trawl) may be used over the Ridge itself. Indeed Mortensen *et al* (2008) found a net probably from a pelagic trawl lying over coral rubble in an area just south of this proposed area, suggesting that fishing with pelagic gear has occurred. It is likely that as inshore fish stocks are depleted and technological advances are made with fishing gear, fishers will move to new grounds, even those that have previously been considered unfishable (although rises in fuel costs may provide some de facto protection to isolated areas like the Mid-Atlantic Ridge).

There is no information regarding bioprospecting and the mining of minerals in the proposed area. There are several un-named seamounts within the proposed area and seamounts may in the future be targeted by mining operations for their cobalt crusts (Probert, 1999). There is no information about the presence of such valuable minerals in the proposed protected area. The removal of habitat and release of sediment by mining can be expected to heavily impact the benthic fauna and their predators (Rogers, 2004). Currently bioprospecting of deep-ocean habitats is likely to focus on hydrothermal vent areas rather than seamounts (Glowka, 2003; Synnes, 2007) and cannot be categorised as a threat to the proposed areas at this time

No tourist activity is reported for the area, and it is unlikely that a tourist industry will emerge in the near future.

The Mid-Atlantic Ridge has also been subject to scientific research, which has included trawling and other extractive methods since the beginning of the first field phase of the MAR-ECO project in 2003. These impacts cover a very small area relative to the expanse of the habitat.

It is not envisaged that the proposed area would interfere with ship passage unless it is shown to be important as an aggregation area for endangered cetaceans that could be threatened by vessel strikes

No information regarding cable laying operations in the area is available.

5. Scientific value

Mid-ocean ridges are vast features of all oceans (Heger *et al*, 2008; Hosia *et al*, 2008). Despite their importance, their fauna and ecological significance remain poorly understood, mainly because ridge studies in the past have concentrated on chemosynthetic ecosystems (Bergstad *et al*, 2008a). The Mid-Atlantic Ridge between the Azores and Iceland has until recently been relatively unexplored (Hareide & Garnes, 2001; Bergstad *et al* 2008a). However, since 2001 it has been subject to scientific investigation from a consortium of scientists in the form of the MAR-ECO project (Bergstad *et al* 2008). This project falls under the remit of the Census of Marine Life (CoML) and has already undergone a field phase (2003 – 2005), which yielded major new data sets (Bergstad *et al* 2008a). Further research cruises have been conducted since this initial field phase and more still are planned. The continued research focusing on the whole of the Mid-Atlantic Ridge illustrates its scientific value.

Our knowledge of mid-ocean ridges is sparse at best, even with the MAR-ECO project ongoing many questions remain unanswered or partially answered (Bergstad *et al*, 2008a). Ongoing monitoring and research is required, but as with any research is very expensive (Hall-Spencer *et al*, 2002). The vulnerability of the deep-sea to human impacts may mean that much of the diversity that is as yet unknown could be lost before we can catalogue it, unless protected areas, such as the one proposed, are established quickly (Roberts, 2002).

C. Proposed management and protection status

1. Proposed management

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

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2. Any existing or proposed legal status

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

- N/A Area beyond national jurisdiction

II Other international legal status (e.g., NATURA 2000, Ramsar): None

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Presented by

Contracting Party:

Organisation:

Date:

References

Andrews, A.H., Cordes, E., Mahoney, M.M., Munk, K., Coale, K.H., Cailliet, G.M. & Heifetz, J. (2002) Age, growth and radiometric age validation of a deep-sea, habitat forming gorgonian (*Primnoa resedaeformis*) from the Gulf of Alaska. *Hydrobiologia* **471:** 101 – 110.

Bergstad, O.A., Falkenhaugh, T., Astthorsson, O.S., Byrkjedal, I., Gebruk, A.V., Piatkowski, U., Priede, I.G., Santos, R.S., Vecchione, M., Lorance, P. & Gordon, J.D.M. (2008a) Towards improved understanding of the diversity and abundance patterns of the mid-ocean ridge macro- and megafauna. *Deep-Sea Research II* **55:** 1 – 5.

Bergstad, O.A., Menezes, G. & Høines, Å. S. (2008b) Demersal fish on a mid-ocean ridge: Distribution patterns and structuring factors. *Deep-Sea Research II* **55:** 185 – 202.

Bower, A.S., Le Cann, B., Rossby, T., Zenk, W., Gould, J., Speer, K., Richardson, P.L., Prater, M.D. & Zhang, H.-M. (2002) Directly measured mid-depth circulation in the northeastern North Atlantic Ocean. *Nature* **419:** 603 – 607.

Clark, M.R., Tittensor, D., Rogers, A.D., Brewin, P., Schlacher, T., Rowden, A., Stocks, K. and Consalvey, M. (2006) *Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction*. UNEPWCMC, Cambridge, UK. [online] URL: www.unep-wcmc.org/resources/publications/ UNEP_WCMC_bio_series/

Clark, M.R., Vinnichencko, V.I., Gordon, J.D.M., Beck-Bulat, G.Z., Kukharev, N.N. and Kakora, A.F. (2007). Large-scale distant-water trawl fisheries on seamounts. In: Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) *Seamounts: Ecology, Conseration and Management.* Fish and Aquatic Resources Series, Blackwell, Oxford, UK. Chapter 17, pp. 361 – 399.

Colebrook, J.M. (1986) Continuous plankton records: the distribution and standing crop of the plankton of the shelf and ocean to the west of the British Isles. *Proceedings of the Royal Society of Edinburgh* **88b:** 221–237.

Conover, R.J. (1988) Comparative life histories in the genera Calanus and Neocalanus in high latitudes of the northern hemisphere. *Hydrobiologia* **167/168:** 127–142.

Cooper, J. Baccetti, N., Belda, E.J., Borg, J.J., Oro, D., Papconstantinou, C. & Sanchez, A. (2003) Seabird mortality from longline fishing in the Mediterranean Sea and Macaronesian waters: a review and way forward. *Scientia Marina* **67(S2):** 57 - 64

Danke, L. (1987) Some particularities of roundnose grenadier (*Coryphaenoides rupestris* Gunn.) in the North Mid-Atlantic Ridge region. *NAFO SCR Doc. 87/78*. 1-10.

Davies, A.J., Roberts, J.M. & Hall-Spencer, J., (2007) Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management. *Biological Conservation* **138:** 299-312.

Deng, R., Dichmont, C., Milton, D., Haywood, M., Vance, D., Hall, N. & Die, D. (2005) Can vessel monitoring system data also be used to study trawling intensity and population depletion? The example of Australia's northern prawn fishery. *Canadian Journal of Fisheries and Aquatic Sciences* **62 (3):** 611-622.

Devine, J.A., Baker, K.D. & Haedrich, R.L. (2006) Deep-sea fish qualify as endangered. *Nature* **495:** 29.

Dinter, W.P. (2001) Biogeography of the OSPAR Maritime Area – A Synopsis and Synthesis of Biogeographical Distribution Patterns described for the North-East Atlantic. Bundesamt für Naturschutz, Bonn, Germany pp 167.

Doksæter, L., Olsen, E., Nøttestad, L. & Fernö, A. (2008) Distribution and feeding ecology of dolphins along the Mid-Atlantic Ridge between Iceland and the Azores. *Deep-Sea Research II* **55:** 243 – 253.

Draganik, B., I. Psuty-Lipska, & J. Janusz. (1998) Ageing of roundnose grenadier (*Coryphaenoides rupestris* Gunn.) from otoliths. *ICES C.M. 1998/O:49*, 1-21.

Epp, D. & Smoot, N.C. (1989) Distribution of seamounts in the North Atlantic. *Nature* **337:** 254 – 257.

Falkowski, P.G., Barber, R.T. & Smetacek, V. (1998) Biogeochemical controls and feedbacks on ocean primary production. *Science* **281:** 200 – 206.

FAO (2007) Draft International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. FAO TC:DSF/2008/2.

Fosså, J.H., Mortensen, P.B. & Furevik, D.M. (2002) The deep-water coral *Lophelia pertusa* in Norwegian waters: distribution and fishery impacts. *Hydrobiologia* **471:** 1 – 12.

Fossen, I., Cotton, C.F., Bergstad, O.A. & Dyb, J.E. (2008) Species composition and distribution patterns of fish captured by longlines on the Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 203 – 217.

Froese, R. & D. Pauly. (Eds.) (2008) FishBase.World Wide Web electronic publication. www.fishbase.org, version (04/2008).

Gaard, E., Gislason, A., Falkenhaug, T., Søiland, H., Musaeva, E., Vereshchaka, A. and Vinogradov, G. (2008). Horizontal and vertical copepod distribution and abundance on the Mid-Atlantic Ridge in June 2004. **Deep-Sea Research II 55**:59-71.

Gass, S.E. & Roberts, J.M. (2006) The occurrence of the cold-water coral *Lophelia pertusa* (Scleractinia) on oil and gas platforms in the North Sea: Colony growth, recruitment and environmental controls on distribution. *Marine Pollution Bulletin* **52:** 549 – 559.

Gerber, Ye.M., S.N.Burykin, A.B.Zimin, A.B.Oleinik, & V.T.Soldat. (2006) Russian fishery researches in the mid-Atlantic Ridge area in 2003. *WDoc to ICES WGDEEP 2006*. 1-17.

Gibson, C., Valenti, S.V., Fordham, S.V. and Fowler, S.L. 2008. The Conservation of Northeast Atlantic Chondrichthyans: Report of the IUCN Shark Specialist Group Northeast Atlantic Red List Workshop. viii + 76pp.

Glowka, L. (2003) Putting marine scientific research on a sustainable footing at hydrothermal vents. *Marine Policy* **27(4):** 303 -312.

Gonzalez-Solis, J., Croxhall, J.P., Oro, D. & Ruiz, X. (2007) Trans-equatorial migration and mixing in the wintering areas of a pelagic seabird. *Frontiers in Ecology and Environment* **5:** 297 – 301.

Gubbay, S. (2003) *Seamounts of the North-East Atlantic*. OASIS & WWF, Frankfurt am Main. pp. 37.

Hall-Spencer, J., Allain, V. & Fosså, J.H. (2002) Trawling damage to Northeast Atlantic ancient coral reefs. *Proceedings of the Royal Society, London: B Biological Sciences* **269 (1490):** 507 – 511.

Hareide, N-R. and Garnes, G. (2001) The distribution and catch rates of deep water fish along the Mid-Atlantic Ridge from 43 to 61°N. *Fisheries Research* **51**:297-310.

Hareide, N.R., Carlson, J., Clarke, M., Clarke, S., Ellis, J., Fordham, S. Fowler, S., Pinho, M., Raymakers, C., Serena, F., Seret, B., and Polti. S. 2007. European Shark Fisheries: a preliminary investigation into fisheries, conversion factors, trade products, markets and management measures. European Elasmobranch Association.

Heger, A., Ieno, E.N., King, N.J., Morris, K.J., Bagley, P.M. & Priede, I.M. (2008) Deep-sea pelagic bioluminescence over the Mid-Atlantic Ridge. *Deep-Sea Research* **55:** 126 – 136.

ICES. (2007) Report of the Working Group on Deep-water Ecology (WGDEC), 26 – 28th February,. ICES CM 2007/ACE:01 Ref. LRC. 61pp.

ICES. (2008a) Report of the ICES-NAFO Joint Working Group on Deep Water Ecology (WGDEC), 10 – 14 March 2008, Copenhagen, Denmark. ICES CM 2008/ACOM:45. 126 pp

ICES. (2008b) Report of the Working Group on Ecosystem Effects of Fishing Activities (WGECO), 6 – 13 March 2008, Copenhagen, Denmark, ICES CM 2008/ACOM:41. 269 pp.

ICES. (2008c) Report of the Working Group on Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP), 3 – 10 March 2008, ICES Headquarters, Copenhagen, Denmark, ICES CM 2008/ACOM:14. 478 pp.

Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B. & Williams, A.

(2001) Seamount benthic macrofauna off southern Tasmania: community structure and impacts of trawling. *Marine Ecology Progress Series* **213:** 111 – 125.

Kourti, N., Shepherd, I., Schwartz, G. & Pavlakis, P. (2001) Integrating spaceborne SAR imagery into operational systems for fisheries monitoring. *Canadian Journal of Remote Sensing* **27 (4):** 291-305.

Kourti, N., Shepherd, I., Greidanus, H., Alvarez, M., Aresu, E., Bauna, T., Chesworth, J.,
Lemoine, G., Schwartz, G. (2005) Integrating remote sensing in fisheries control. Fisheries Management and Ecology 12 (5), 295-307.

Krieger, K.J. (2001) Coral (*Primnoa*) impacted by fishing gear in the Gulf of Alaska. In: Wilson, J.H.M., Hall, J., Gass, S.e., Kenchington, E.L.R., Butler, M. & Doherty, P. (Eds.) Proceedings of the First International Symposium on Deep-Sea Corals, pp. 106 – 116.

Kukuev, E.I., (2004) 20 years of ichthyofauna research on seamounts of the North Atlantic Ridge and adjacent areas. A review. *Archive of Fishery and Marine Research* **51:** 215-232.

Kyne, P.M. & Simpfendorfer, C.A. (2007) A collation and summarization of available data on deepwater chondrichthyans: biodiversity, life history and fisheries. A report prepared by the IUCN SSC Shark Specialist Group for the Marine Conservation Biology Institute. February 2007. pp 137.

Magalhaes, M.C., Santos, R.S. & Hamer, K.C. (2008) Dual-foraging of Cory’s shearwater in the Azores: feeding locations, behaviour at sea and implications for food provisioning of chicks. *Marine Ecology Progress Series* **359:** 283 - 293

Magnusson, J.V. & Magnusson, J., (1995) The distribution, relative abundance and biology of the deep-sea fishes of the Icelandic slope and Reykjanes ridge. in: Hopper, A.G. Deep-water fisheries of the North-Atlantic Oceanic Slope. *NATO ASI Series, Series E. Applied Sciences*, **296:** 161-200

Magnusson, J., J.V. Magnusson & K.B. Jakonsdóttir. (2000). Deep-sea fishes. Icelandic contributions to the deep water research project EC FAIR Project CT 95-0655, 1996-1999. Hafrannsóknastofnun fjölrit, nr. 76. 1-164.

Marr, S. & Hall-Spencer, J.M. (2002) UK coral reefs. The Ecologist **32 (4):** 36-37.

Matthews, J.B.L. (1969) Continuous Plankton Recorder: the geographical and seasonal distribution of *Calanus finmarchicus* in the North Atlantic *Bulletin of Marine Ecology* **6:** 251 – 263.

Mauritzen, C., Polzin, K.L., McCartney, M.S., Millard, R.C. & West-Mack, D.E. (2002) Evidence in hydrography and density fine structure for enhanced vertical mixing over the Mid-Atlantic Ridge in the western Atlantic. *Journal of Geophysical Research* **107 (C10):** 3147.

Menezes, G.M., Sigler, M.F., Silva, H.M. & Pinho, M.R. (2006) Structure and zonation of demersal fish assemblages off the Azores archipelago (Mid-Atlantic). *Marine Ecology Progress Series* **324:** 241 – 260.

Morato, T., Guénette, S. & Pitcher, T.J. (2001) Fisheries of the Azores (Portugal) 1982-1999. Part III. 214-220. In: Zeller, D., Watson, R. & Pauly, D.(Eds). Fisheries Impacts on North Atlantic Ecosystems: Catch, Effort and National/Regional Data sets. Fisheries Centre Research Reports 9 (3),254 pp.

Mortensen, P.B. & Buhl-Mortensen, L. (2005) Morphology and growth of the deep-water gorgonians *Primnoa resedaeformis* and *Paragorgia arborea. Marine Biology* **147:** 775 – 788.

Mortensen, P.B. & Rapp, H.T. (1998) Oxygen- and carbon isotope rations related t growth line patterns in skeletons of *Lophelia pertusa* (L) (Anthazoa: Scleractinia): Implications for the determination of linear extension rates. *Sarsia* **83:** 422 – 446.

Mortensen, P.B., Buhl-Mortensen, L., Gordon Jr., D.C., Fader, G.B., McKeown, D.M., & Fenton, D.G. (2005) Evidence of fisheries damage to deep-water gorgonians in the Northeast Channel, Nova Scotia. In: Thomas, J., Barnes, P. (Eds.) Proceedings from the Symposium on the Effects of Fishing Activities on Benthic Habitats: Linking Geology, Biology, Socioeconomics and Management. American Fisheries Society, FL, USA,

November 12 – 14, 2002.
Mortensen, P.B., Buhl-Mortensen, L., Gebruk, A.V. & Krylova, E.M. (2008) Occurrence of deep-water corals on the Mid-Atlantic Ridge based on MAR-ECO data. *Deep-Sea Research II* **55:** 142 – 152.
Muñoz, P.D. (2001) Results of spring deep-sea exploratory fishing in North Atlantic in 2000. WDoc for ICES WGDEEP 2001, p. 1-10.
Murawski, S.A., Wigley, S.E., Fogarty, M.J., Rago, P.J. & Mountain, D.G. (2005) Effort distribution and catch patterns adjacent to temperate MPAs. ICES Journal Of Marine Science **62 (6):** 1150-1167.
NEAFC. (2008) Report of the Permanent Committee on Management and Science (PECMAS) of the North-East Atlantic Fisheries Commission, 28 – 29 October 2008, NEAFC Headquarters, London. [online] http://www.neafc.org/reports/pecmas/docs/oct_08.pdf
Opdal, A.F., Godø, O.R., Bergstad, O.A. & Fiksen, Ø. (2008) Distribution, identity and possible processes sustaining meso- and bathypelagic scattering layers on the northern Mid-Atlantic Ridge. *Deep-Sea Research II* **55:** 45 – 58.
Orlov, A., Cottom, C. & Byrkjedal, I. (2006) Deepwater skates (Rajidae) collected during the 2004 cruises of R.V. "G.O. Sars" and M.S. "Loran" in the Mid-Atlantic Ridge area. *Cybium* **30(4):** 35 – 48.
OSPAR Commission (2003). Initial OSPAR List of Threatened and/or Declining Species and Habitats. OSPAR Commission ISBN 1-904426-12-3
Pechenik, L.N. and F.M. Troyanovskii. (1971). Trawling Resources on the North-Atlantic Continental Slope. Israel Program for Scientific Translations, Jerusalem.
Pierrot-Bults, A.C. (2008) A short note on the biogeographic patterns of the Chaetognatha fauna in the North Atlantic. *Deep-Sea Research II* **55:** 137 – 141.
Planque, B., Hays, G.C., Ibanez, F.& Gamble, J.C. (1997) Large scale spatial variation in the seasonal abundance of *Calanus finmarchicus*. *Deep-Sea Research* **44:** 315–326.
Probert, P.K., McKnight, D.G., and Grove, S.L. (1999) Benthic invertebrate bycatch from a deep-water trawl fishery, Chatham Rise, New Zealand. *Aquatic Conservation: Marine and Freshwater Ecosystems* **7:** 27-49.
Richardson, A.J. & Schoeman, D.S. (2004) Climate impact on plankton ecosystems in the Northeast Atlantic. *Science* **305:** 1609 – 1612.
Risk, M.J., Heikoop, J.M., Snow, M.G. & Beukens, R. (2002) Life-span and growth patterns of two deep-sea corals: *Primnoa reseadaformis* and *Desmophyllum cristagalli. Hydrobiologia* **471:** 125 – 131.
Roberts, C.M. (2002) Deep impact: the rising toll of fishing in the deep sea. *Trends in Ecology and Evolution* **17(5):** 242 – 245.
Rogers, A.D. (1994) The biology of seamounts. *Advances in Marine Biology* **30:** 305 – 350.
Rogers, A.D., Clark, M.C., Hall-Spencer, J.M. & Gjerde, K.M. (2008) The Science Behind the Guidelines: A Scientific Guide to the FAO Draft International Guidelines (December 2007) For the Management of Deep-Sea Fisheries in the High Seas and Examples of How the Guidelines can be Practically Implemented. IUCN, Switzerland, 2008.
Rossby, T. (1999) On gyre interactions. *Deep-Sea Research II* **46:**139 – 164.

Santos, R.S., Porteiro, F.M. & Barreiros, J.P. (1997) Marine fishes of the Azores: Annotated checklist and bibliography. Arquipélago. Life and Marine Sciences, Supplement 1, 244.
Søiland, H., Budgell, W.P. & Knutsen, Ø. (2008) The physical oceanographic conditions along the Mid-Atlantic Ridge north of the Azores in June-July 2004. *Deep-Sea Research II* **55:** 29 – 44.
Sutton, T., Porteiro, F.M., Heino, M., Byrkjedal, I., Langhelle, G., Anderson, C.I.H., Horne, J.P., Søiland, H., Falkenhaug, T., Godø, O.R. & Bergstad, O.A. (2008) Vertical structure, biomass and topographic association of deep-pelagic fishes in relation to a mid-ocean ridge system. *Deep-Sea Research II* **55:** 161 – 184.
Synnes, M. (2007) Bioprospecting of organisms from the deep-sea: scientific and

environmental aspects. *Clean Technologies and Environmental Policy* **9(1):** 53 – 59.
UNEP (2007) Report of the Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection. Azores, Portugal, 2-4 October 2007. UNEP/CBD/EWS.MPA/1/2
Wilson, J.B. (1979) 'Patch' development of the deep-water coral *Lophelia pertusa* (L.) on Rockall Bank. *Journal of the Marine Biological Association of the United Kingdom* **59:** 165 – 177.
Vinnichenko, V.I., (1998). Alfonsino (*Beryx splendens*) biology and fishery on the seamounts in the open North Atlantic. ICES C.M. 1998/O:13, 13 p.

Annex 1

Species and habitats of special interest for the Mid-Atlantic Ridge (north of the Azores)-MPA

A. Habitats

Threatened and/or declining Habitats[10]

- Seamounts
- Deep Sea Sponge Aggregations
- *Lophelia pertusa* Reefs[9]
- Coral Gardens

Other Features of special concern

- Deepwater and epipelagic ecosystems, including their function for migratory species
- Habitats associated with ridge 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*)
- Leafscale gulper shark (*Centrophorus squamosus*)

Other Species of special concern

- Cetaceans
- Deep water sharks
- Mesopelagic and bathypelagic fish stocks
- Oceanic seabirds like Cory Shearwater

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

Addendum 4

Proposed OSPAR Marine Protected Area

Altair Seamount

A. General information

1. Proposed name of MPA

Altair 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 Altair 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 Altair 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.

(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.

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1 The conservation vision describes a desired long-term conservation condition and function for the ecosystems in the entire Altair 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 Altair 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.

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 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:

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.

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 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.

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 Altair Seamount-MPA, which could also give an indication of specific management approaches, are listed at Annex 1.

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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).

3. Status of the location

The proposed area has been designed to be located beyond the limits of national jurisdiction of the coastal states in the OSPAR Maritime Area.

However, on 11 May 2009 the Portuguese Republic has 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. These claims submitted by Portugal – if approved by the UN CLCS - would encompass the seabed in the area of the proposed Altair Seamount MPA.

The international legal regime that is applicable to the site 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 Ocean

5. Biogeographic region

Atlantic Subregion; Warm-temperate waters

6. Location

The proposed marine protected area (Figure 1) incorporates and extends the existing NEAFC fishery closure over Altair Seamount.

Proposed boundary co-ordinates (subject to revision)

Latitude	Longitude
44.86°N	34.46°W
44.86°N	33.54°W
44.32°N	33.54°W
44.32°N	34.46°W

7. Size

4408.71km²

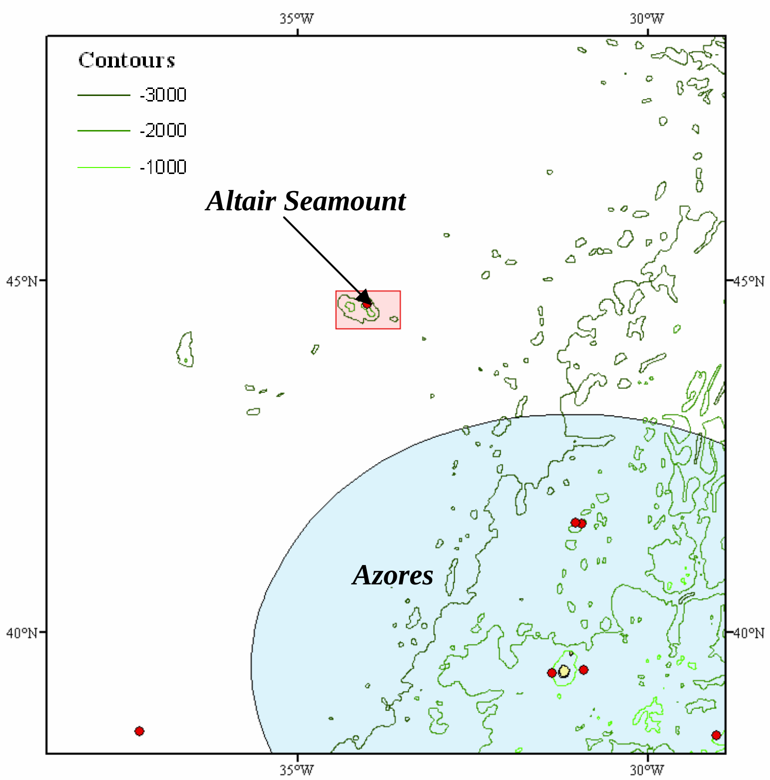

Figure 1. *The proposed marine protected area boundaries shown in shaded red. The shaded blue area is the Azores Exclusive Economic Zone and the red circles are known seamount location.*

8. Characteristics of the area

Altair seamount is found in the North Atlantic just north west of the Azores. It is located close to the Mid-Atlantic Ridge, which is the major topographical feature of the OSPAR maritime area (Dinter, 2001). The Mid-Atlantic Ridge is an active seafloor spreading centre (Dinter, 2001), therefore Altair seamount can be considered older than the seamounts found on the Mid-Atlantic Ridge and it is also a relatively isolated seamount. As such it is possible, although unproven, that biological community found on Altair has a greater abundance of endemics than the seamounts of the Mid-Atlantic Ridge.
Few scientific studies have been conducted on Altair, therefore very little is known about its biology. One study conducted using a Spanish freezer trawler did perform several experimental trawls over Altair (Durán Mufioz et al, 2000). Exploration of Altair seamount found that the bottom was very hard, with steep topography, and as such few areas were suitable for trawling (Durán Mufioz et al, 2000). The main fish species that were caught in just under 2 hours of trawling on Altair were Black scabbardfish (*Aphanopus carbo*) and Lantern shark (*Etmopterus princeps*) (Durán Mufioz et al, 2000). Both of which have been described as vulnerable to fishing pressure (Devine et al, 2006; Kyne & Simpfendorfer, 2007).

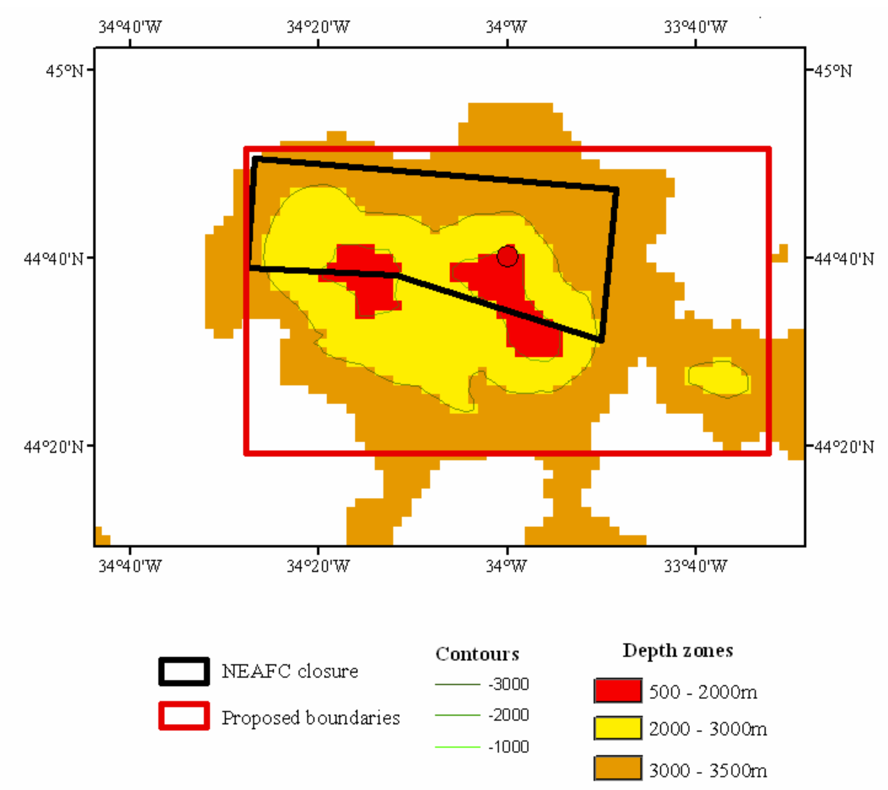

Figure 2. *Proposed marine protected area boundaries with the current NEAFC fishery closure and depth zones in the area around Altair seamount.*

Altair has had a NEAFC fishery closure in place since 2005 until at least the 31st December 2008 (ICES, 2007). The proposed marine protected area incorporates and extends this fishery closure (see Figure 2). There are two primary reasons for this, firstly to make the boundaries straighter so that compliance and management is easier. Secondly to include all of the depth zones in the area that are at present and may be in the future accessible to fishing. Given the sparse information available about Altair it seems prudent to apply the Precautionary Principle and protect a larger rather than a smaller area.

B Selection criteria

a. Ecological criteria/considerations

1. Threatened and/or declining species and habitats

The proposed area is seamount habitat, which is listed as priority threatened or declining habitat by OSPAR (OSPAR Commission, 2003). It includes seamount and potentially cold-water coral and sponge reef 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 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).

In addition to the above listed habitats, visual analysis of turtle tracks throughout the Azores Archipelago showed that Loggerhead turtles (*Caretta caretta*) are present at this seamount (Santos *et al* 2007). *C. caretta* is listed as a priority threatened and/or declining species by OSPAR (OSPAR Commission, 2003). The turtles found around this and other nearby seamounts are juveniles who have left their hatching grounds in the SE United States (Santos *et al* 2007). They spend between 6.5 and 11.5 years in this juvenile oceanic phase before returning to complete their juvenile development in Western Atlantic waters, not reaching sexual maturity until aged approximately 30 (Santos *et al* 2007). Tracked turtles appeared to move towards seamounts around the Azores Archipelago and increased their residence times once in their vicinity (Santos *et al* 2007). Of the seamounts sampled Altair had the highest residence time, indicating that it may be a hotspot for these juvenile turtles (Santos *et al* 2006; Santos *et al* 2007; Morato *et al* 2008).

2. Important species and habitats

In view of the limited scientific information about Altair seamount a precautionary approach to protection is recommended. The area has already been afforded temporary protection through NEAFC fishery closures, which will be in place till the 31st December 2008. Altair seamount is classified as seamount habitat, which is recognised as threatened or declining habitat by OSPAR (OSPAR Commission, 2003; see Threatened and/or declining species and habitats criterion above).

In addition to the habitats and species mentioned in the previous criterion one other vulnerable species has been found on Altair seamount, the Lantern shark (*Etmopterus princeps*) (Durán Muñoz *et al* 2000). *E. princeps* has been classified by ICES as vulnerable to fishing pressure due to it's relatively long recovery time (ICES, 2005b; 2008). *E. princeps* was the main species caught on Altair seamount (between 1001-1200m) during a 1999 experimental fishing study (Durán Muñoz *et al* 2000). Relatively little time was spent surveying Altair (1.8 hours trawling & 3 hauls on Altair as compared to 163.4 hours trawling and 34 hauls on the most studied site Hatton Bank) (Durán Muñoz *et al* 2000). Approximately a third (489kg) of the total amount of *E. princeps* was caught at Altair Seamount (the rest was mainly caught on Faraday Seamount on the Mid-Atlantic Ridge) (Durán Muñoz *et al* 2000). This suggests that Altair may be of some importance to this species within the OSPAR area.

3. Ecological significance

The nearest topographic feature to the Altair seamount is the section of the Mid-Atlantic Ridge between the Azores and Charlie-Gibbs Fracture Zone. This part of the Mid-Atlantic Ridge has the highest concentration of seamounts found in the north Atlantic (Epp & Smoot, 1989). The Mid-Atlantic Ridge is an active seafloor-spreading centre, separating the Eurasian and American plates (Epp & Smoot, 1989; Dinter, 2001). The Altair seamount is therefore older than the seamounts of the Mid-Atlantic Ridge and as such may potentially support more endemic species. In addition to this seamount communities in general have been identified as ecological significant marine areas according to criteria developed by the CBD for identifying candidate sites for protection on the high seas (UNEP, 2007).

4. High natural biological diversity

There is no site-specific information available about the biological diversity of Altair seamount. However, seamounts in general are known to support a large and diverse fish fauna, with as many as 798 species found 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, 2003; Clarke et al, 2006).

5. Representativity

There is no site-specific information available about the biology and ecology of Altair seamount. It is thought that this seamount is a representative example of seamounts of the OSPAR high seas area to the west of the Mid-Atlantic Ridge.

6. Sensitivity

Seamounts have been identified as both priority threatened or declining habitat by OSPAR and Vulnerable Marine Ecosystems in relation to high seas fisheries by the FAO (OSPAR Commission, 2003; FAO, 2007). In addition the sensitivity of Altair seamount has been recognised by NEAFC with the current temporary fishing closure. Although no site-specific information exists, it is likely that this site contains the sensitive habitats that are characteristic of seamounts in general. In view of the recognition of the vulnerability of seamounts by the UN, CBD, NEAFC and OSPAR it is recommended that the protection afforded Altair seamount is extended to marine protected area status.

7. Naturalness

In 2004 VMS data showed that Altair seamount was not targeted by fishing vessels (ICES, 2007). However, following the establishment of the NEAFC fishing closures in 2005 bottom fishing effort was observed over one of the protected seamounts in the Altair closure (ICES, 2007). This indicates that the area may have already been impacted by fishing activity and that the NEAFC closures are not entirely effective. However, Durán Muñoz *et al* (2000) found that few areas of Altair seamount were suitable to bottom trawl fishing, indicating there may still be a high degree of naturalness at this site.

b. Practical criteria/considerations

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 proposed area or their present condition. Given the evidence of a small amount of fishing activity at the proposed site (see Naturalness criterion), it is likely that any species that have been affected will take time to recover from past impacts. However, without habitat mapping and a better understanding of it's ecology it is impossible to evaluate the site's potential for restoration.

2. Degree of acceptance

As noted earlier, the proposed area includes seamount habitat, which is listed as priority threatened or declining habitat by OSPAR (OSPAR Commission 2003). Seamount habitat qualifies as a Vulnerable Marine Ecosystems in relation to high seas fisheries according to criteria developed by FAO (FAO 2007, Rogers et al, 2008). Seamount habitat is also 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). Therefore there are strong scientific grounds warranting protection of the area.

The proposed area incorporates an existing NEAFC fishery closure, which has been in effect since 2005 (ICES, 2007). Therefore it is more likely to be accepted by NEAFC and the fishing community than an area not currently closed to fishing.

3. Potential for success of management measures

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. The NEAFC fishery closure that exists in the area did not prevent bottom fishing activity within the closure in the year following its implementation (ICES, 2007). 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). The challenge will be to bring illegal and unregulated fishing under control although some progress is being made on this within the NEAFC region. Because the area incorporates the current NEAFC closures the management or at least enforcement of measures may be easier. If OSPAR protection is implemented that incorporates these closures, management measures may succeed better than if the areas were in addition to the NEAFC closures.

4. Potential damage to the area by human activities

For seamount habitats, the most damaging industry operating in 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). This is clearly shown by the fact that there is very little available information about the biology of Altair seamount. 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 (Roberts, 2002; Clark et al, 2007). There is also the consideration that as seamounts within the OSPAR area are closed to fishing, fishing effort will become concentrated on remaining unprotected seamounts (Hilborn et al, 2006; Shears et al, 2006). As there is evidence that fishing has occurred within the NEAFC fishery closure over Altair seamount, fishing still represents a threat to this seamount (ICES, 2007). Therefore Altair seamount warrants protection in the form of a marine protected area.

Bioprospecting on seamounts for possible sources of biotechnology (for example bacteria on hydrothermal vents) may occur in the future (Gubbay, 2003). However, no information is known about bioprospecting within the proposed area and it seems more likely that this will occur around hydrothermal vents in the near future (Synnes, 2007).

There is no information about mining within or near the proposed 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).

5. Scientific value

As has already been mentioned scientific research on seamounts often lags far behind their exploitation (Brewin et al, 2007). Scientific knowledge of seamounts in general is poorer than for many other marine habitats (Gubbay, 2003). At present there is no information about the biological community within the proposed marine protected area. As a seamount, which may potentially support more endemics than the younger seamounts of the Mid-Atlantic Ridge, this area has high scientific value. The severe lack of knowledge about the proposed area means that it 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.

Much of the current focus of seamount research in the OSPAR region is on the Mid-Atlantic Ridge in the form of the MAR-ECO project (see Bergstad et al, 2008 for a description). Other seamount research programmes include the European Commission 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).

C. Proposed management and protection status

1. Proposed management

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):

- N/A High seas area

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

- NEAFC Fishery Closure (until 31st December 2008)

Presented by

Contracting Party:

Organisation:

Date:

References

Bergstad, O.A., Falkenhaugh, T., Astthorsson, O.S., Byrkjedal, I., Gebruk, A.V., Piatkowski, U., Priede, I.G., Santos, R.S., Vecchione, M., Lorance, P. & Gordon, J.D.M. (2008) Towards improved understanding of the diversity and abundance patterns of the mid ocean ridge macro- and megafauna. *Deep-Sea Research II* **55:** 1 – 5.

Brewin, P.E., Stocks, K.I. & Menezes, G. (2007) A History of Seamount Research. Chapter 3. Pp 41-61. In Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Clark, M.R., Tittensor, D., Rogers, A.D., Brewin, P., Schlacher, T., Rowden, A., Stocks, K. & Consalvey, M. (2006). Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction. UNEPWCMC, Cambridge, UK.

Davies, A.J., Roberts, J.M. & Hall-Spencer, J., (2007) Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management. *Biological Conservation* **138:** 299-312.

Deng, R., Dichmont, C., Milton, D., Haywood, M., Vance, D., Hall, N. & Die, D. (2005) Can vessel monitoring system data also be used to study trawling intensity and population depletion? The example of Australia's northern prawn fishery. *Canadian Journal of Fisheries and Aquatic Sciences* **62 (3):** 611-622.

Devine, J.A., Baker, K.D. & Haedrich, R.L. (2006) Deep-sea fish qualify as endangered. *Nature* **495:** 29.

Dinter, W.P. (2001) Biogeography of the OSPAR Maritime Area. A synopsis and synthesis of biogeographical distribution patterns described for the North-East Atlantic. – Angewandte Landschaftsökologie Vol. 43, German Federal Agency for Nature Conservation, Bonn. 166 pp.

Epp, D. & Smoot, N.C. (1989) Distribution of seamounts in the North Atlantic. *Nature* **337:** 254 – 257.

FAO (2007) Draft International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. FAO TC:DSF/2008/2.

Gubbay, S. (2003) Seamounts of the North East Atlantic. OASIS, Hamburg and WWF, Germany, Frankfurt am Main, November 2003.

Hilborn, R., Micheli, F. & De Leo, G.A. (2006) Integrating marine protected areas with catch regulation. *Canadian Journal of Fisheries and Aquatic Sciences* **63(3):** 642 – 649.

ICES (2007) Report of the Working Group on Deep-water Ecology (WGDEC) , 26-28 February 2007, . ICES CM 2007/ACE:01 Ref. LRC. 61 pp.

Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B. & Williams, A. (2001). Seamount benthic macrofauna off southern Tasmania: community structure and impacts of trawling. *Marine Ecology Progress Series* **213:** 111-125.

Kourti, N., Shepherd, I., Schwartz, G. & Pavlakis, P. (2001) Integrating spaceborne SAR imagery into operational systems for fisheries monitoring. *Canadian Journal of Remote Sensing* **27 (4):** 291-305.

Kourti, N., Shepherd, I., Greidanus, H., Alvarez, M., Aresu, E., Bauna, T., Chesworth, J., Lemoine, G., Schwartz, G. (2005) Integrating remote sensing in fisheries control. *Fisheries Management and Ecology* **12 (5):** 295-307.

Kyne, P.M. & Simpfendorfer, C.A. (2007) A collation and summarization of available data on deepwater chondrichthyans: biodiversity, life history and fisheries. A report prepared by the IUCN SSC Shark Specialist Group for the Marine Conservation Biology Institute. February 2007. pp 137.

Lack, M., Short, K., & Willock, A. (2003). Managing risk and uncertainty in deep-sea fisheries: lessons from Orange Roughy. TRAFFIC Oceania and WWF Endangered Seas Programme, 73pp.

Marr, S. & Hall-Spencer, J.M. (2002) UK coral reefs. *The Ecologist* **32 (4):** 36-37.
Murawski, S.A., Wigley, S.E., Fogarty, M.J., Rago, P.J. & Mountain, D.G. (2005) Effort distribution and catch patterns adjacent to temperate MPAs. *ICES Journal Of Marine Science* **62 (6):** 1150-1167.
OSPAR Commission (2003). Initial OSPAR List of Threatened and/or Declining Species and Habitats. OSPAR Commission ISBN 1-904426-12-3
OSPAR Commission (2007) Annual Report of the OSPAR Commission 2006/2007. OSPAR Commission ISBN 1-905859-84-9
Probert P.K. (1999) Seamounts, sanctuaries and sustainability: moving towards deep-sea conservation. *Aquatic Conservation* **9**: 601-605
Roberts, C.M. (2002) Deep impact: the rising toll of fishing in the deep sea. *Trends in Ecology and Evolution* **17(5):** 242 – 245.
Rogers, A.D., Clark, M.R., Hall-Spencer, J.M. & Gjerde, K.M. (2008) The Science behind the Guidelines: A Scientific Guide to the FAO Draft International Guidelines (December 2007) for the Management of Deep-Sea Fisheries in the High Seas and Examples of How the Guidelines may be Practically Implemented. IUCN, Switzerland 2008.
Shears, N.T., Grace, R.V., Usmar, N.R., Kerr, V. & Babcock, R.C. (2006) Long-term trends in lobster populations in a partially protected vs. no-take Marine Park. *Biological Conservation* **132:** 222 – 231.
Synnes, M. (2007) Bioprospecting of organisms from the deep-sea: scientific and environmental aspects. *Clean Technologies and Environmental Policy* **9(1):** 53 – 59.
UNEP (2007) Report of the Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection. Azores, Portugal, 2-4 October 2007. UNEP/CBD/EWS.MPA/1/2
Worm, B., Lotze, H.K. & Myers, R.A. (2003). Predator diversity hotspots in the blue ocean. *Proceedings of the National Academy of Sciences, USA* **100:** 9884-9888.

Annex 1

Species and habitats of special interest for the proposed Altair 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[10]

Other Species of special concern

- Cetaceans
- Deep water sharks
- Oceanic seabirds like Cory's Shearwater

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

10 Based on their known geographic distributions and habitat associations, the presence of threatened species, including Orange roughy (*Hoplostethus atlanticus*), Leatherback turtle (*Dermochelys coriacea*), Loggerhead turtle (*Caretta caretta*), Portuguese dogfish (*Centroscymnus coelolepis*), Gulper shark (*Centrophorus granulosus*), and Leafscale gulper shark (*Centrophorus squamosus*), is strongly suspected, but remains to be proven by direct observation.

Addendum 5

Proposed OSPAR Marine Protected Area

Antialtair Seamount

A. General information

1. Proposed name of MPA

Antialtair 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 Antialtair 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 Antialtair 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.

(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.

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[1] The conservation vision describes a desired long-term conservation condition and function for the ecosystems in the entire Antialtair 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 Antialtair 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.

(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.

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.

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 Antialtair Seamount-MPA, which could also give an indication of specific management approaches, are listed at Annex 1.

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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).

3. Status of the location

The proposed area has been designed to be located beyond the limits of national jurisdiction of the coastal states in the OSPAR Maritime Area.

However, on 11 May 2009 the Portuguese Republic has 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. These claims submitted by Portugal – if approved by the UN CLCS - would encompass the seabed in the area of the proposed Antialtair Seamount MPA.

The international legal regime that is applicable to the site 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 Ocean

5. Biogeographic region

Atlantic Subregion; Warm-temperate waters

6. Location

The proposed marine protected area (Figure 1) incorporates and extends the existing NEAFC fishery closure over Antialtair Seamount.

Proposed boundary co-ordinates (subject to revision)

Latitude	Longitude
43.82°N	22.78°W
43.72°N	22.10°W
43.36°N	22.10°W
43.36°N	22.78°W

7. Size

2207.68km^2

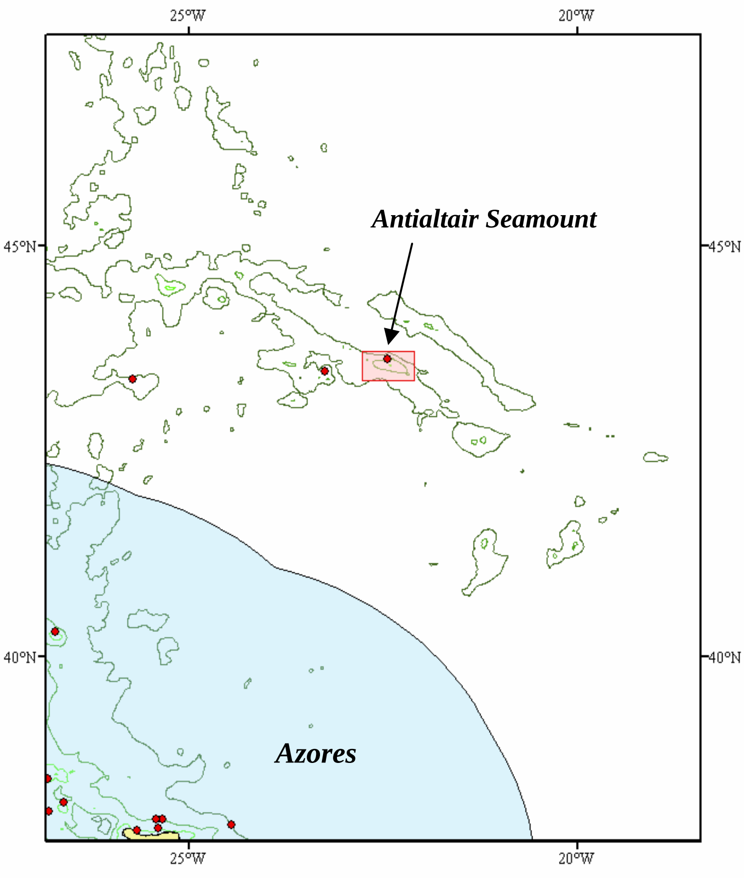

Figure 1. *Proposed marine protected area boundaries, shown in red and location. Red circles are known seamount locations and the blue shaded area is the Azores Exclusive Economic Zone.*

8. Characteristics of the area

Antialtair seamount is found in the North Atlantic just northeast of the Azores Exclusive Economic Zone. Very little information is available about this seamount and as is common with many seamounts scientific exploration has been sporadic (Brewin et al, 2007). One study conducted using a Spanish freezer trawler specially adapted for trawling along rough terrain, found that the main species caught over Antialtair was Orange roughy (*Hoplostethus atlanticus*) (Durán Mućoz et al, 2000). Nearby seamounts and banks trawled during the same investigation also found Orange roughy (*H. atlanticus*) to be the most common species caught (Durán Mućoz et al, 2000). It is therefore likely that Orange roughy is the summit-living species of Antialtair seamount, however further investigations are required to confirm this. Orange roughy (*H. atlanticus*) is known to be highly sensitive to the effects of fishing and has been described as threatened or declining by the OSPAR Commission (Hareide & Garnes, 2001). It is likely that the seamount community found on Antialtair is representative of those found on seamounts near the southern OSPAR boundary. Given that Antialtair is older than the seamounts of the Mid-Atlantic Ridge, which is still an active seafloor spreading centre (Epp & Smoot, 1989; Dinter, 2001), it is also possible that a greater number of endemic species will be present in comparison to Mid-Atlantic Ridge Seamounts.

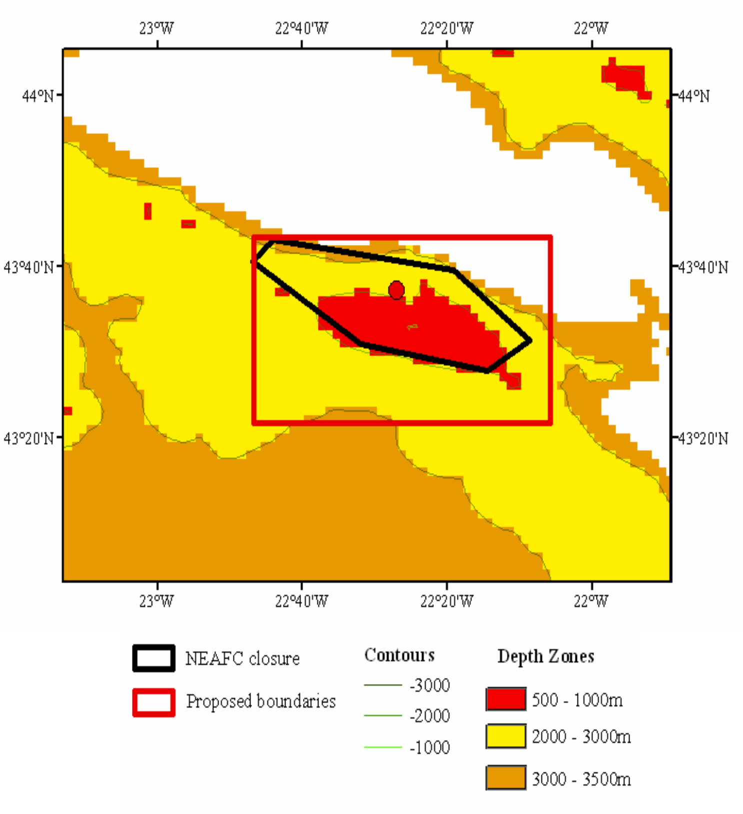

Figure 2. *Proposed MPA boundaries shown with current NEAFC fishery closure and the depth zones around Antialtair seamount.*

Antialtair seamount has been protected by a NEAFC fishery closure since 2005, and this will be in effect until the 31st December 2008 (ICES, 2007). The proposed marine protected area incorporates and extends the NEAFC closure (see Figure 2). This was done for two main reasons, firstly it makes the boundaries easier to manage and comply with. Secondly it incorporates a greater proportion of the fishable area around Antialtair seamount. As there is very little information about the biology of this seamount it seems prudent to apply the Precautionary Principle and have a larger rather than smaller marine protected area.

B Selection criteria

a. Ecological criteria/considerations

1. Threatened and/or declining species and habitats

The proposed area includes seamount habitat, which is listed as priority threatened or declining habitat by OSPAR (OSPAR Commission, 2003). It includes seamount and potentially cold-water coral and sponge reef 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 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).

In addition to the above mentioned habitats, *Hoplostethus atlanticus* (Orange roughy), which has been listed as a threatened and/or declining species by OSPAR (OSPAR Commission, 2003) has been caught on this seamount (Durán Muñoz *et al* 2000). Although the total amount of this species caught is lower than other locations surveyed, the yield is the second highest (474kg/hour) only beaten by the nearby Olympus-Antialtair seamount (Durán Muñoz *et al* 2000).

2. Important species and habitats

In view of the limited scientific information about Antialtair seamount a precautionary approach to protection is recommended. The area has already been afforded temporary protection through NEAFC fishery closures, which will be in place till the 31st December 2008. Antialtair seamount is classified as seamount habitat, which is recognised as threatened or declining habitat by OSPAR (OSPAR Commission, 2003; see Threatened and/or declining species and habitats criterion above).

3. Ecological significance

The nearest topographic feature to the Antialtair seamount is the section of the Mid-Atlantic Ridge between the Azores and Charlie-Gibbs Fracture Zone. This part of the Mid-Atlantic Ridge has the highest concentration of seamounts found in the north Atlantic (Epp & Smoot, 1989). The Mid-Atlantic Ridge is an active seafloor-spreading centre, separating the Eurasian and American plates (Epp & Smoot, 1989; Dinter, 2001). The Antialtair seamount is therefore older than the seamounts of the Mid-Atlantic Ridge and as such may potentially support a greater number of endemic species, although this remains to be proven through surveys. In addition to this seamount communities in general have been identified as ecological significant marine areas according to criteria developed by the CBD for identifying candidate sites for protection on the high seas (UNEP, 2007).

4. High natural biological diversity

There is very little site-specific information available about the biological diversity of Antialtair seamount. Logan (1998) found that the Brachipod fauna of the seamount did not differ significantly from six other seamounts or the nearby continental margin. Seamounts in general are known to support a large and diverse fish fauna, with as many as 798 species found 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, 2003; Clarke et al, 2006).

5. Representativity

There is no site-specific information available about the biology and ecology of Antialtair seamount. It is thought that this seamount is a representative example of seamounts of the OSPAR high seas area not found to the east of the Mid-Atlantic Ridge.

6. Sensitivity

Seamounts have been identified as both threatened or declining habitat by OSPAR and Vulnerable Marine Ecosystems in relation to high seas fisheries by the FAO (OSPAR Commission, 2003; FAO, 2007). In addition the sensitivity of Altair seamount has been recognised by NEAFC with the current temporary fishing closure. In view of the recognition of the vulnerability of seamounts by the UN, CBD, NEAFC and OSPAR it is recommended that the protection afforded Antialtair seamount is extended to marine protected area status.

7. Naturalness

In 2004 VMS data showed that fishing vessels moving at bottom trawling speed were present over Antialtair seamount (ICES, 2007). Following the establishment of the NEAFC fishing closures in 2005 bottom fishing effort increased over Antialtair seamount, showing a clear targeting of this area by fishing vessels (ICES, 2007). This indicates that the area may have already been impacted by fishing activity and that the NEAFC closures are not entirely effective. However, despite this recorded effort it is likely that this seamount may still have a high degree of naturalness as compared to other more heavily fished areas (ICES pers. comm..). Durán Muñoz *et al* (2000) found that only a few areas within the proposed boundaries were suitable for bottom trawl fishing.

b. Practical criteria/considerations

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 proposed area or their present condition. Given the evidence of increasing fishing activity in recent years (see Naturalness criterion), it is likely that any species affected will take time to recover from past impacts. However, it is impossible to evaluate this criterion without more information about the site.

2. Degree of acceptance

As noted earlier, the proposed area includes seamount habitat, which is listed as priority threatened or declining habitat by OSPAR (OSPAR Commission 2003). Seamount habitat qualifies as a Vulnerable Marine Ecosystems in relation to high seas fisheries according to criteria developed by FAO (FAO 2007, Rogers et al, 2008). Seamount habitat is also 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). Therefore there are strong scientific grounds warranting protection of the area.

The proposed area incorporates an existing NEAFC fishery closure, which has been in effect since 2005 (ICES, 2007). However, there is evidence that the year following this closure fishing activity increased (ICES, 2007). Therefore it is likely to be accepted by NEAFC and the fishing community but monitoring of the area and enforcement of regulations will be required to prevent non-compliance.

3. Potential for success of management measures

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. The NEAFC fishery closure that exists in the area did not prevent bottom fishing activity within the closure in the year following its implementation (ICES, 2007). 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). The challenge will be to bring illegal and unregulated fishing under control although some progress is being made on this within the NEAFC region. Because the area incorporates the current NEAFC closures the management or at least enforcement of measures may be easier. If OSPAR protection is implemented that incorporates these closures, management measures may succeed better than if the areas were in addition to the NEAFC closures.

4. Potential damage to the area by human activities

For seamount habitats, the most damaging industry operating in 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). This is clearly shown by the fact that there is no available information about the biology of Antialtair seamount. 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 (Roberts, 2002; Clark et al, 2007). Antialtair has already been targeted by fishers in the area and therefore fishing is a significant threat despite the presence of the NEAFC closure (ICES, 2007).

Bioprospecting on seamounts for possible sources of biotechnology (for example bacteria on hydrothermal vents) may occur in the future (Gubbay, 2003). However, no information is known about bioprospecting within the proposed area and it seems more likely that this will occur around hydrothermal vents in the near future (Synnes, 2007).

There is no information about mining within or near the proposed 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).

5. Scientific value

As has already been mentioned scientific research on seamounts often lags far behind their exploitation (Brewin et al, 2007). Scientific knowledge of seamounts in general is poorer than for many other marine habitats (Gubbay, 2003). At present there is no information about the biological community within the proposed marine protected area. As a seamount, which may potentially support more endemics than the younger seamounts of the Mid-Atlantic Ridge, this area has high scientific value. The severe lack of knowledge about the proposed area means that it 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.

Much of the current focus of seamount research in the OSPAR region is on the Mid-Atlantic Ridge in the form of the MAR-ECO project (see Bergstad et al, 2008 for a description). Other seamount research programmes include the European Commissions fifth framework program called OASIS (Oceanic Seamounts: An Integrated Study) that sponsored a series of expeditions to North Atlantic seamounts (primarily the Sedlo and Seine seamounts) (Brewin et al, 2007). The OASIS project concluded its fieldwork phase in 2005, however a more recent program 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).

C. Proposed management and protection status

1. Proposed management

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

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2. Any existing or proposed legal status

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

- N/A High seas area

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

- NEAFC fishery closure (until 31st December 2008)

<u>Presented by</u>
Contracting Party:
Organisation:
Date:

References

Bergstad, O.A., Falkenhaugh, T., Astthorsson, O.S., Byrkjedal, I., Gebruk, A.V., Piatkowski, U., Priede, I.G., Santos, R.S., Vecchione, M., Lorance, P. & Gordon, J.D.M. (2008) Towards improved understanding of the diversity and abundance patterns of the mid ocean ridge macro- and megafauna. *Deep-Sea Research II* **55:** 1 – 5.

Brewin, P.E., Stocks, K.I. & Menezes, G. (2007) A History of Seamount Research. Chapter 3. Pp 41-61. In Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Clark, M.R., Tittensor, D., Rogers, A.D., Brewin, P., Schlacher, T., Rowden, A., Stocks, K. & Consalvey, M. (2006). Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction. UNEPWCMC, Cambridge, UK.

Davies, A.J., Roberts, J.M. & Hall-Spencer, J., (2007) Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management. *Biological Conservation* **138:** 299-312.

Deng, R., Dichmont, C., Milton, D., Haywood, M., Vance, D., Hall, N. & Die, D. (2005) Can vessel monitoring system data also be used to study trawling intensity and population depletion? The example of Australia's northern prawn fishery. *Canadian Journal of Fisheries and Aquatic Sciences* **62 (3):** 611-622.

Dinter, W.P. (2001) Biogeography of the OSPAR Maritime Area. A synopsis and synthesis of biogeographical distribution patterns described for the North-East Atlantic. – Angewandte Landschaftsökologie Vol. 43, German Federal Agency for Nature Conservation, Bonn. 166 pp.

Durán Muńoz, P., Román, E. & González, F. (2000) Results of deep-water experimental fishing in the North Atlantic: An example of co-operative research with the fishing industry. ICES CM 2000/W:04. Available at: http://filaman.ifm-geomar.de/ICES_Documents/ICES_Documents2000/W/W0400.pdf last accessed 24/03/2008

Epp, D. & Smoot, N.C. (1989) Distribution of seamounts in the North Atlantic. *Nature* **337:** 254 – 257.

FAO (2007) Draft International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. FAO TC:DSF/2008/2.

Gubbay, S. (2003) Seamounts of the North East Atlantic. OASIS, Hamburg and WWF, Germany, Frankfurt am Main, November 2003.

Hareide, N.-R. & Garnes, G. (2001) The distribution and catch rates of deep water fish along the Mid-Atlantic Ridge from 43 to 61$_o$N. *Fisheries Research* **51:** 297 – 310.

Hilborn, R., Micheli, F. & De Leo, G.A. (2006) Integrating marine protected areas with catch regulation. *Canadian Journal of Fisheries and Aquatic Sciences* **63(3):** 642 – 649.

ICES (2007) Report of the Working Group on Deep-water Ecology (WGDEC) , 26-28 February 2007, . ICES CM 2007/ACE:01 Ref. LRC. 61 pp.

Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B. & Williams, A. (2001). Seamount benthic macrofauna off southern Tasmania: community structure and impacts of trawling. *Marine Ecology Progress Series* **213:** 111-125.

Kourti, N., Shepherd, I., Schwartz, G. & Pavlakis, P. (2001) Integrating spaceborne SAR imagery into operational systems for fisheries monitoring. *Canadian Journal of Remote Sensing* **27 (4):** 291-305.

Kourti, N., Shepherd, I., Greidanus, H., Alvarez, M., Aresu, E., Bauna, T., Chesworth, J., Lemoine, G., Schwartz, G. (2005) Integrating remote sensing in fisheries control. *Fisheries Management and Ecology* **12 (5):** 295-307.

Lack, M., Short, K., & Willock, A. (2003). Managing risk and uncertainty in deep-sea fisheries: lessons from Orange Roughy. TRAFFIC Oceania and WWF Endangered

Seas Programme, 73pp.
Marr, S. & Hall-Spencer, J.M. (2002) UK coral reefs. *The Ecologist* **32 (4):** 36-37.
Murawski, S.A., Wigley, S.E., Fogarty, M.J., Rago, P.J. & Mountain, D.G. (2005) Effort distribution and catch patterns adjacent to temperate MPAs. *ICES Journal Of Marine Science* **62 (6):** 1150-1167.
OSPAR Commission (2003). Initial OSPAR List of Threatened and/or Declining Species and Habitats. OSPAR Commission ISBN 1-904426-12-3
OSPAR Commission (2007) Annual Report of the OSPAR Commission 2006/2007. OSPAR Commission ISBN 1-905859-84-9
Probert P.K. (1999) Seamounts, sanctuaries and sustainability: moving towards deep-sea conservation. *Aquatic Conservation* **9**: 601-605
Roberts, C.M. (2002) Deep impact: the rising toll of fishing in the deep sea. *Trends in Ecology and Evolution* **17(5):** 242 – 245.
Rogers, A.D., Clark, M.R., Hall-Spencer, J.M. & Gjerde, K.M. (2008) The Science behind the Guidelines: A Scientific Guide to the FAO Draft International Guidelines (December 2007) for the Management of Deep-Sea Fisheries in the High Seas and Examples of How the Guidelines may be Practically Implemented. IUCN, Switzerland 2008.
Shears, N.T., Grace, R.V., Usmar, N.R., Kerr, V. & Babcock, R.C. (2006) Long-term trends in lobster populations in a partially protected vs. no-take Marine Park. *Biological Conservation* **132:** 222 – 231.
Synnes, M. (2007) Bioprospecting of organisms from the deep-sea: scientific and environmental aspects. *Clean Technologies and Environmental Policy* **9(1):** 53 – 59.
UNEP (2007) Report of the Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection. Azores, Portugal, 2-4 October 2007. UNEP/CBD/EWS.MPA/1/2
Worm, B., Lotze, H.K. & Myers, R.A. (2003). Predator diversity hotspots in the blue ocean. *Proceedings of the National Academy of Sciences, USA* **100:** 9884-9888.

Annex 1

Species and habitats of special interest for the Antialtair 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[10]

- Orange roughy (*Hoplostethus atlanticus*)

Other Species of special concern

- Cetaceans
- Deep water sharks
- Oceanic seabirds like Cory's Shearwater

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

[10] Based on their known geographic distributions and habitat associations, the presence of threatened species, including Leatherback turtle (*Dermochelys coriacea*), Loggerhead turtle (*Caretta caretta*), Portuguese dogfish (*Centroscymnus coelolepis*), Gulper shark (*Centrophorus granulosus*), and Leafscale gulper shark (*Centrophorus squamosus*), is strongly suspected, but remains to be proven by direct observation.

Addendum 6

Proposed OSPAR Marine Protected Area

Josephine Seamount

A. General information

1. Proposed name of MPA

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.

(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.

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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.

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.

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.

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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).

3. Status of the location

The proposed area has been designed to be located beyond the limits of national jurisdiction of the coastal states in the OSPAR Maritime Area.

However, on 11 May 2009 the Portuguese Republic has 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. These claims submitted by Portugal – if approved by the UN CLCS - would encompass the seabed in the area of the proposed Josephine Seamount MPA.

The international legal regime that is applicable to the site 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.

Proposed Boundary Co-ordinates

Latitude	*Longitude*
37.46°N	*14.65°W*
37.63°N	*13.75°W*
36.86°N	*13.42°W*
36.18°N	*14.45°W*
36.76°N	*15.72°W*
36.45°N	*15.39°W*

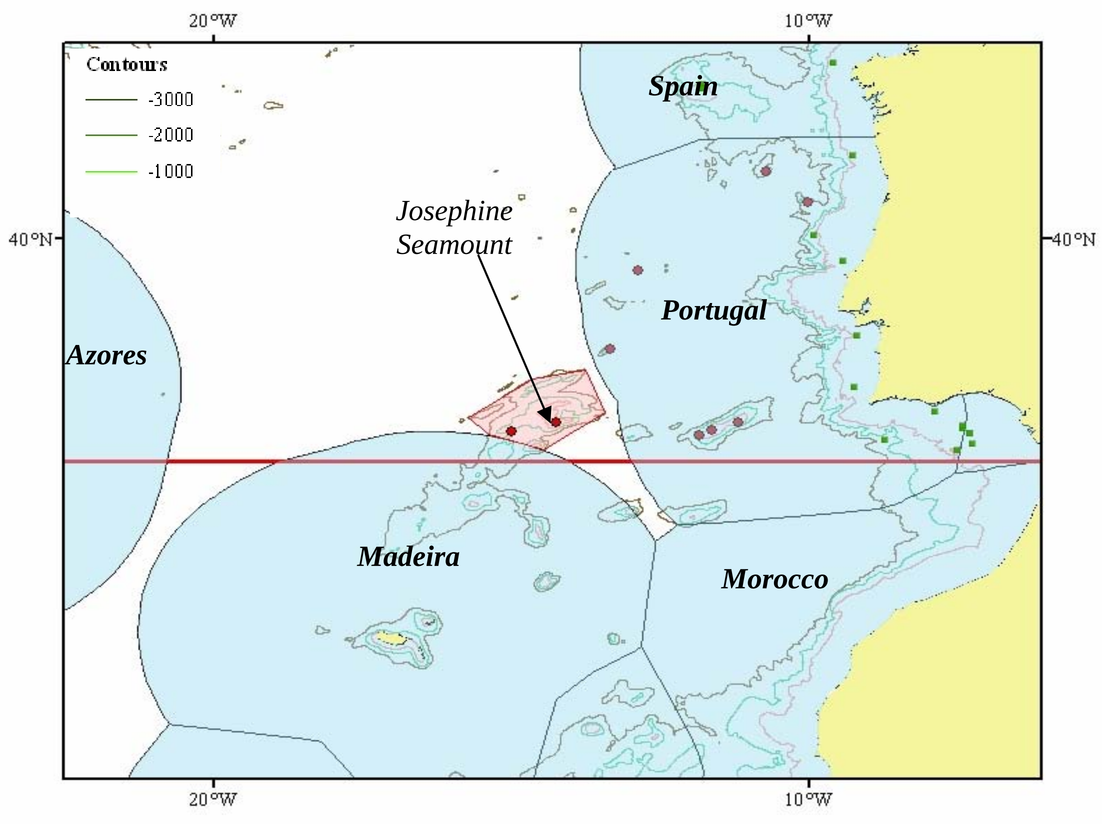

Figure 1. *The proposed marine protected area boundaries are shown in shaded red and the relevant Exclusive Economic Zones are shown in shaded blue. The thick red line running east to west is the boundary of the OSPAR maritime area. Red dots are known seamount locations and green squares are Lophelia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

7. Size

19,370 km^2

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 proposed 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.

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

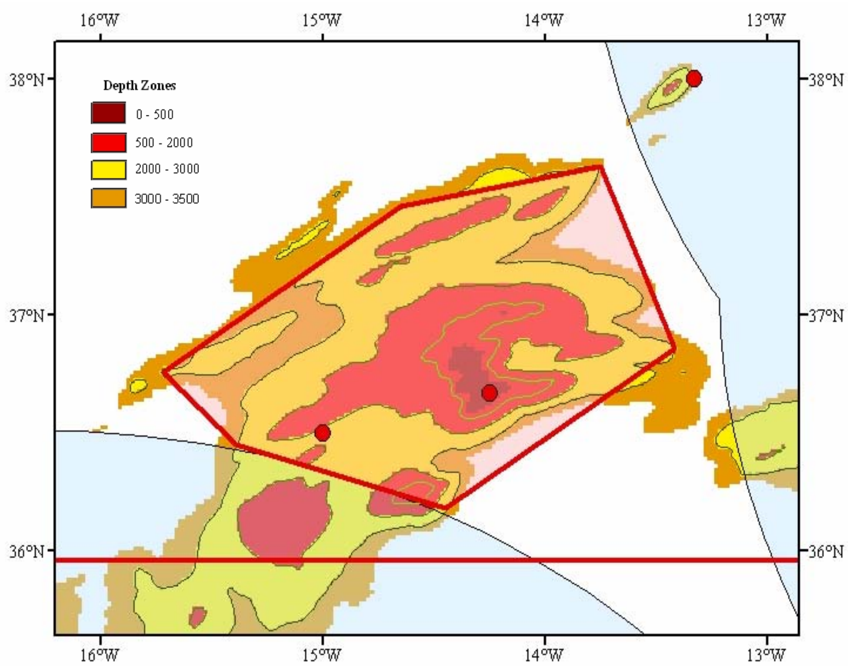

Figure 2. *The fishable zones within and around the proposed marine protected area boundaries, white areas are deeper than 3500 metres. Boundaries have been designed to incorporate as much of the area down to a depth of 3000 metres, whilst maintaining them as straight and easy to*

used is pelagic trawl, but bottom trawl and purse seine are also used. The proposed 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 proposed 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 proposed area there are a few small areas which are deeper than 3000m, see Figure 2.

B Selection criteria

a. Ecological criteria/considerations

1. Threatened and/or declining species and habitats

The proposed 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 proposed 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 World Conservation Union (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 proposed 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 the proposed 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 proposed 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.

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 is volcanic in origin and harbors 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).

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 proposed 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 proposed 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).

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 proposed area and of seamounts of the North East Atlantic in general (Gubbay, 2003) this may not be accurate.

5. Representativity

The Josephine and Horseshoe Seamounts are proposed 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 Josephine Seamount it is likely that it 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).

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 proposed 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 proposed 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 2000t 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 2000t 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 World Conservation Union (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 Subareas, including IX, which is where the proposed 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 identifies 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 proposed marine protected area) and IXb (the Subarea that the proposed 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

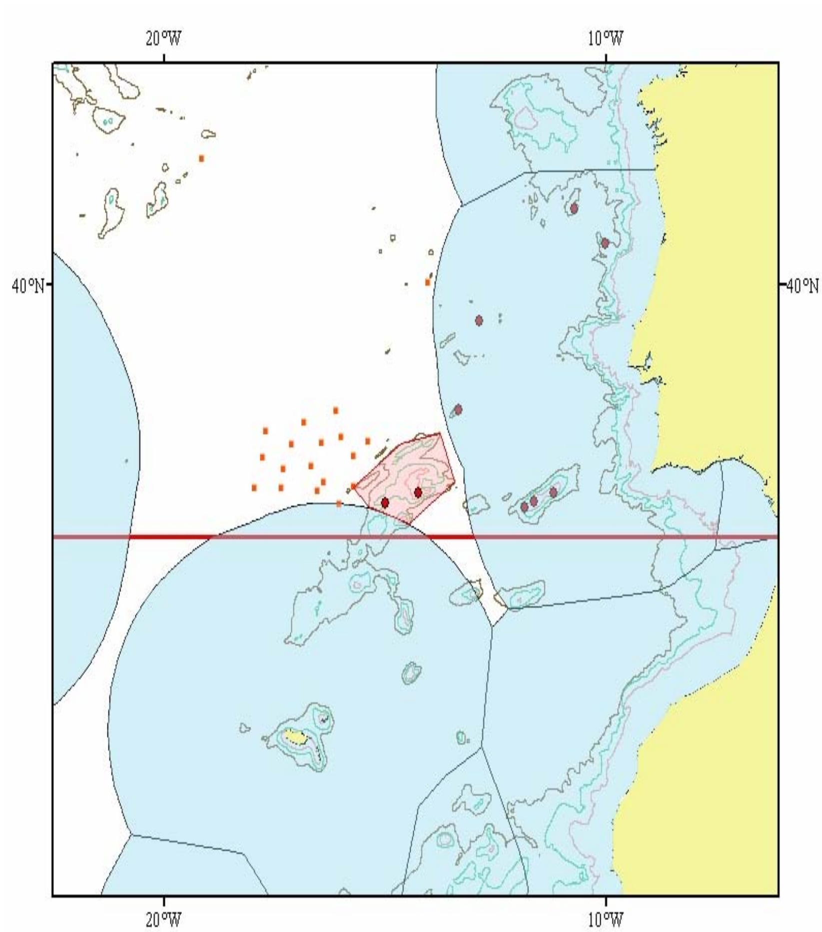

Figure 5. Historical Sperm whale catch data (orange squares), shows that the region to the northeast of the proposed area has a cluster of recorded catches. Red circles are known seamount locations, blue shaded areas are Exclusive Economic Zones, the red shaded area is the proposed marine protected area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

Azores, 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 the proposed area. The World Conservation Union'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 proposed 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).

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).

b. Practical criteria/considerations

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 proposed area or their present condition. Given the ongoing 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. Degree of acceptance

As noted earlier, the proposed 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 warranting protection of the area.

The proposed 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 proposed marine protected area, which may cause some resistance to implementation. Given that several nations are known to fish within the proposed 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 proposed 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 proposed 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 proposed 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.

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).

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 proposed 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).

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 proposed 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:

Organisation:

Date:

References

Barceloss, L., Meol, O., Porteiro, F. & Menezes, G.(2002) Feeding ecology of orange roughy in theAzores archipelago. Abstracts from Theme Session on Oceanography and Ecology of Seamounts – Indications of Unique Ecosystems (M). ICES CM:2002/M:42 (Poster).

Bartsch I., (1973a) Halacaridae (Acari) von der Josephinebank and der Groβen Meteorbank aus dem ostlichen Nordatlantic. I. Die Halacaridae aus den Schleppnetzproben. *«Meteor» Forschungergebnisse, Reiche D* **13:** 37–46.

Bartsch I., (1973b) Halacaridae (Acari) von der Josephinebank and der Groβen Meteorbank aus dem ostlichen Nordatlantic. II. Die Halacaridae aus den Bodengreiferproben. *«Meteor» Forsch.-Ergebnisse, Reiche D* **15:** 51–78.

Beck T, Metzger T, Freiwald A. (2006) Biodiversity inventorial atlas of macrobenthic seamount animals. Deliverable 25 of the EU-ESF project OASIS (Oceanic seamounts: an integrated study; EVK2-CT-2002-00073) [online]. 126 p. http://www1.uni-hamburg.de/OASIS/Pages/publications/BIAS.pdf.

Bentivegna, F., Ciampa, M., Mazza, G., Paglialonga, A. & Travaglini, A., 2003. Loggerhead turtle (*Caretta caretta*) in Tyrrhenian sea: trophic role of the Gulf of Naples. In *Proceedings of the First Mediterranean Conference on Marine Turtles, Rome, 24-28 October 2001*(ed. D. Margaritoulis and A. Demetropolous), pp. 71.75. Nicosia: Barcelona Convention - Bern Convention - Bonn Convention (CMS).

Bolten, A.B., Bjorndal, K.A., Martins, H.R., Dellinger, T., Biscoito, M.J., Encalada, S.E. & Bowen, B.W. (1998)Transatlantic developmental migrations of loggerhead sea turtles demonstrated by mtDNA sequence analysis. *Ecological Applications* **8:** 1 – 7.

Bouchet P. & Metivier B. (1988) Campagne Océanographique «SEAMOUNT 1». Compte-rendu et list des stations. Rapport non publié. 29 pp.

Brewin, P.E., Stocks, K.I. & Menezes, G. (2007) A History of Seamount Research. Chapter 3. Pp 41-61. In Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Carr, A.F. (1986) Rips, fads and loggerheads. *Bioscience* **36:** 92 – 100.

Clark MR, Tittensor D, Rogers AD, Brewin P, Schlacher T, Rowden A, Stocks K. & Consalvey M (2006). Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction. UNEPWCMC, Cambridge, UK.

Clark, M.R., Vinnichenko, V.I., Gordon, J.D.M., Beck-Bulat, G.Z., Kukharev, N.N. & Kakora, A.F. (2007) Large-scale Distant-water Trawl Fisheries on Seamounts. Chapter 17. Pp 361-399 in Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Etnoyer, P. & J. Warrenchuk. (2007) A catshark nursery in a deep gorgonian field in the Mississippi Canyon, Gulf of Mexico. Bulletin of Marine Science. **81(3)**: 553-559.

Davies, A.J., Roberts, J.M. & Hall-Spencer, J., (2007) Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management. *Biological Conservation* 138: 299-312.

Delaugerre, M. & Cesarini, C., 2004. Confirmed nesting of the loggerhead turtle in Corsica. *Marine Turtle Newsletter*, **104**, 12.

Deng, R., Dichmont, C., Milton, D., Haywood, M., Vance, D., Hall, N. & Die, D. (2005) Can vessel monitoring system data also be used to study trawling intensity and population depletion? The example of Australia's northern prawn fishery. *Canadian Journal of Fisheries and Aquatic Sciences* 62 (3): 611-622.

Diehl M. (1970) Die neue ökologisch extreme-sand Ascidie von Josephine-Bank *Seriocarpa rhizoides* Diehl, 1969 (Ascidiacea Styelidae) *«Meteor» Forschungergebnisse*, **D7**: 43-58.

Dijkstra H.H. & S. Gofas. (2004) Pectinoidea (Bivalvia: Propeamussiidae and Pectinidae) from some northeastern Atlantic seamounts. *Sarsia* **89**: 33-78.

Dinter, W.P. (2001.): Biogeography of the OSPAR Maritime Area. A synopsis and synthesis of biogeographical distribution patterns described for the North-East Atlantic.–Angewandte Landschaftsökologie Vol. 43, German Federal Agency for Nature Conservation, Bonn. 166 pp.

Encalada, S.E., Bjorndal, K.A., Bolten, A.B., Zurita, J.C., Schroeder, B., Possardt, E., Sears, C.J. & Bowen, B.W. (1998) Population structure of loggerhead turtle (*Caretta caretta*) nesting colonies in the Atlantic and Mediterranean as inferred from mitochondrial DNA control region sequences. *Marine Biology* **130:** 567 – 575.

FAO (2007) Draft International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. FAO TC:DSF/2008/2.
Figuiredo, M.J., Figuiredo, I. & Machado, P.B. (2001) Deep-water penaeid shrimps (Crustacea: Decapoda) from off the Portuguese continental slope: an alternative future resource? *Fisheries Research* **51:** 321 – 326.
Fomin, G.V., Sunadakov, A.Z., Akhramovich, A.P., Galimullin, M.G., Vasiljev, G.P., Zalessinsky, L.A. et al (1980) Manual on Fisheries on Seamounts of the Open Part of the Atlantic Ocean, 186pp. Zaprybpromrazvedka, Kaliningrad (In Russian).
Freese, J.L., Auster, P.J., Heifetz, J. & Wing, B.L. (1999) Effects of trawling on seafloor habitat and associated invertebrate taxa in the Gulf of Alaska. *Marine Ecology Progress Series* **182:** 119 – 126.
Freese, J.L. (2001) Trawl-induced damage to sponges observed from a research submersible. *Marine Fisheries Review* **63:** 7 – 13.
Froese, R. & Pauly, D. (eds) (2007) FishBase. World Wide Web Electronic Publications www.fishbase.org . Last accessed 22/02/08
Gaspard D., (2003) Recent brachiopods collected during the "SEAMOUNT 1" CRUISE off Portugal and the Ibero-Moroccan Gulf (Northeastern Atlantic) in 1987. Geobios. 36: 285-304.
Genin, A. and Dower, J.F (2007) Seamount Plankton Dynamics. Chapter 5. Pp 85-100 in Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.
Gibson, C., Valenti, S.V., Fordham, S.V. & Fowler, S.L. (2008) The Conservation of Northeast Atlantic Chondrichthyans: Report of the IUCN Shark Specialist Group Northeast Atlantic Red List Workshop. viii + 76pp
Gillet P. & Dauvin J.-C., (2000) Polychaetes from the Atlantic seamounts of the southern Azores: biogeographical distribution and reproductive patterns. *Journal of the Marine Biological Association of the United Kingdom*, **80(6)**: 1019–1029.
Gofas S. (2005) Geographical differentiation in Clelandella (Gastropoda: Trochidae) in the northeastern Atlantic. *Journal of Molluscan Studies* **71**:133–144.
Gofas S., (2007) Rissoidae (Mollusca: Gastropoda) from northeast Atlantic Seamounts. *Journal of Natural History*, **41(13–16)**: 779–885
Gofas, S. & Beu, A. (2002) Tonnoidean gastropods of the North Atlantic Seamounts and the Azores. *American Malacological Bulletin* **17(1-2):** 91 – 108.
Gonçlaves, J.M.S., Bispo, J. & Silva, J.A. (2004) Underwater survey of ichthyofauna of eastern Atlantic seamounts: Gettysburg and Ormond (Gorringe Bank). *Archive of Fishery and Marine Research* **51(1-3):** 233 – 240.
Grasshoff M., (1972) Die Gorgonaria des ostlischen Nordatlantic und des Mittelmeeres. I. Die Familie Ellisellidae (Cnidaria: Anthozoa:). Auswerlung der «Atlantischen Kuppenfahrten 1967» von F. S. «Meteor». *«Meteor» Forschungergebnisse*, **D10**: 73–87
Grasshoff M., (1985) Die Gorgonaria und Anthipatharia der Grossen Meteor-Bank und der Josephine-Bank (Cnidaria: Anthozoa). *Senckenbergiana maritima*, **17**: 65–87.
Green, N.; Bjerkeng, B.; Hylland, K.; Ruus, A. & Rygg, B. (2003). Hazardous substances in the European marine environment: trends in metals and persistent organic pollutants. *EEA Topic Report*, 2/2003. European Environment Agency: Copenhagen, Denmark. ISBN 92-9167-628-4. 83 pp.
Gubbay, S. (2003) Seamounts of the North East Atlantic. OASIS, Hamburg and WWF, Germany, Frankfurt am Main, November 2003.
Hartmann-Schroder G., (1979) Die Polychaeten der «Atlantischen Kuppenfahrt» von F. S. «Meteor». *«Meteor» Forschungergebnisse*, **D31**: 63–90.
Hesthagen I.H. (1970) On the near-bottom plankton and benthic fauna of the Josephine Seamount and the Great Meteor Seamount. *«Meteor» Forschungergebnisse*, D 8: 61-70.
Holland, K.N. and Grubbs, R.D. (2007) Fish Visitors to Seamounts: Tunas and Billfish at Seamounts. Chapter 10 Section A. Pp 189-201 in Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.
ICES (2002) Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources. Horta, The Azores, Portugal. 4 – 10 April, 2002. ICES CM 2002/ACFM:16 Ref. G.
ICES (2007) Report of the Working Group Elasmobranch Fishes (WGEF), 22–28 June 2007, Galway, Ireland. ICES CM 2007/ACFM:27. 318 pp.

ICES (2007b) Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP), 8 - 15 May 2007, ICES Headquarters. ICES CM 2007/ACFM:20.478 pp.

Kaschner, K. (2007) Air-breathing visitors to seamounts: Marine Mammals. Chapter 12 Section A. Pp 230-238 in Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Koslow J.A. (2001) Fish Stock and benthos of seamounts. In: Thiel H., Koslow A. (Eds) Managing Risks to Biodiversity and the Environment on the High Sea, Including Tools such as Marine Protected Areas – Scientific requirements and Legal Aspects. Proceeding of the Expert Workshop held at the International Academy for Nature conservation Isle of Vilm, Germany, 27 February – 4 March 2001. BfN – Skripten 43. pp. 43-54

Kourti, N., Shepherd, I., Schwartz, G. & Pavlakis, P. (2001) Integrating spaceborne SAR imagery into operational systems for fisheries monitoring. *Canadian Journal of Remote Sensing* **27 (4):** 291-305.

Kourti, N., Shepherd, I., Greidanus, H., Alvarez, M., Aresu, E., Bauna, T., Chesworth, J., Lemoine, G., Schwartz, G. (2005) Integrating remote sensing in fisheries control. Fisheries Management and Ecology 12 (5), 295-307.

Krylova E.M., (2006) Bivalves from the seamounts of the north-eastern Atlantic. In: A.N. Mironov, A.V. Gebruk, A.J. Southward (eds), Biogeography of the North Atlantic seamounts, pp. 76-95. Moscow, KMK Press.

Kunze, E. & Llewellyn-Smith, S.G. (2004) The role of small scale topography in turbulent mixing of the global ocean. *Oceanography* **17(1):** 55 – 64.

Kyne, P.M. & Simpfendorfer, C.A. (2007) A collation and summarization of available data on deepwater chondrichthyans: biodiversity, life history and fisheries. A report prepared by the IUCN SSC Shark Specialist Group for the Marine Conservation Biology Institute. February 2007. pp 137.

Levin, L.A. & A. Gooday. (2003) The Deep Atlantic Ocean. Ch. 5 in Ecosystems of the World: The Deep Sea. Elsiever, Amsterdam. Pp. 111-178.

Litvinov, F.F. (1989) Structure of epipelagic elasmobranch communities in the Atlantic and Pacific oceans and their change in recent geological time. *Journal of Ichthyology* **46(8):** 613 – 624.

Litvinov, F.F. (2007) Fish visitors to seamounts: Aggregations of large pelagic sharks above seamounts. Chapter 10B, pp 202 – 206. In: Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Lopez-Gonzales P.J. & Briand P. (2004) A new scleraxonian genus from Josephine Bank, north-eastern Atlantic (Cnidaria, Octocorallia). *Hydrobiologia* **482**: 97–105.

Marr, S. & Hall-Spencer, J.M. (2002) UK coral reefs. The Ecologist 32 (4): 36-37.

Melo, O. & Menezes, G.M.M. (2002) Exploratory fishing of the orange roughy (*Hoplostethus atlanticus*) in some seamounts of the Azores Archipelago. Abstracts from Theme Session on Oceanography and Biology of Seamounts – Indications of Unique Ecosystems. ICES CM:2002/M:26.

Mironov A.N. (2006). Echinoids from seamounts of the north-eastern Atlantic, onshore-offshore gradients in species distribution. In: A.N. Mironov, A.V. Gebruk, A.J. Southward (eds), *Biogeography of the North Atlantic seamounts*, pp. 96-133. Moscow, KMK Press.

Monniot C. & Monniot F. (1992) Ascidies des seamounts lusitaniens (campagne Seamount I). *Bull. Mus. Natl. Hist. Nat., Paris.* **4A(3-4)**: 591-603.

Morato, T. & Clark, M.R. (2007) Seamount fishes: ecology and life histories. Chapter 9 pp 170 -188 In:Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. & Santos, R.S. (eds) Seamounts: ecology, fisheries & conservation. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Morato, T., Cheung, W.W.L. & Pitcher, T.J. (2006) Vulnerability of seamount fish to fishing: fuzzy analysis of life history attributes. *Journal of Fish Biology* **68:** 209 – 221.

Moura, T.,Figueiredo, I., Neves, A., Farias, I., Pereira, B. S. and Reproductive data on Portuguese dogfish *Centroscymnus coelolepis*, shark *Centrophorus squamosus* and gulper shark *Centrophorus granulosus* exploited in the Portuguese continental slope. Working Document.

Murawski, S.A., Wigley, S.E., Fogarty, M.J., Rago, P.J. & Mountain, D.G. (2005) Effort distribution and catch patterns adjacent to temperate MPAs. *ICES Journal Of Marine Science* **62 (6):** 1150-1167.

OSPAR Commission (2003). Initial OSPAR List of Threatened and/or Declining Species and Habitats. OSPAR Commission ISBN 1-904426-12-3

OSPAR Commission (2007) Annual Report of the OSPAR Commission 2006/2007. OSPAR Commission ISBN 1-905859-84-9

Pakhorukov, N.P. (2008) Visual observations of fish from seamounts of the southern Azores region (the Atlantic Ocean). *Journal of Ichthyology* **48:** 114 - 123

Pasternak F.A. (1985) Specific composition and the ways of forming of the bottom fauna isolated underwater rises. Gorgonarians and antipatharians of the seamounts Rockeway, Atlantis, Plato, Great-Meteor and Josephin (Atlantis ocean). *Transactions of the P.P. Shirshov Institute of oceanology [Trudy Instituta Okeanologii]*, **120**: 21–38. (In Russian, English summary).

Poltarukha O.P. & Zevina G.B. (2006) Barnacles (Cirripedia, Thoracica) of the north-eastern Atlantic. In: A.N. Mironov, A.V. Gebruk, A.J. Southward (eds), *Biogeography of the North Atlantic seamounts*, pp. 162-176. Moscow, KMK Press.

Probert P.K. (1999) Seamounts, sanctuaries and sustainability: moving towards deep-sea conservation. *Aquatic Conservation* **9**: 601-605

Queiroz, N., Lima, F.P., Maia, A., Ribeiro, P.A., Correia, J.P. & Santos, A.A. (2005) Movement of blue shark, *Prionace glauca,* in the north-east Atlantic based on mark-recapture data. *Journal of the Marine Biological Association of the UK* **85(5):** 1107 – 1112.

Rad, U. von (1974) Great Meteor and Josephine Seamounts (eastern North Atlantic): Composition and origin of bioclastic sands, carbonate and pyroclastic rocks. *"Meteor" Forschungsergebnisse*. **C19**: 1-61.

Ramil F., Vervoort W. & Ansin J.A. (1998) Report on the Haleciidae and Plularioidea (Cnidaria, Hydrozoa) collected by the French SEAMOUNT 1 Expedition. *Zologuche Verhandelingen*. **322**: 1-42.

Richardson, P.L., Bower, A.S. & Zenk, W. (2000) A census of Meddies tracked by floats. *Progress in Oceanograpgy* **45:** 209 - 250

Rogers A.D. (1994) The biology of seamounts. *Advances in Marine Biology* **30**: 305–349.

Rogers, A.D., Clark, M.R., Hall-Spencer, J.M. and Gjerde, K.M. (2008) The Science behind the Guidelines: A Scientific Guide to the FAO Draft International Guidelines (December 2007) for the Management of Deep-Sea Fisheries in the High Seas and Examples of How the Guidelines may be Practically Implemented. IUCN, Switzerland 2008.

Roberts, C.M. (2002) Deep impact: the rising toll of fishing in the deep sea. *Trends in Ecology and Evolution* **17(5):** 242 – 245.

Roberts, C.M. (2007) The Unnatural History of the Sea. Island Press, Washington, DC.

Samadi, S., Schlacher, T. & de Forges, B.R. (2007) Seamount benthos. Chapter 7, pp119 – 140. In: Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. & Santos, R.S. (eds) Seamounts: ecology, fisheries & conservation. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Santos, M.A., Bolten, A.B., Martins, H.R., Riewald, B. & Bjorndal, K.A. (2007) Air-breathing Visitors to Seamounts: Sea Turtles. Chapter 12 Section B. Pp 239-244 in Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Shcherbachev Yu, N., E.I. Kukuev & V.I. Shlibanov, (1985) Composition of the benthic and demersal ichthyocenoses of the submarine mountains in the southern part of the North Atlantic Range. *Journal of Ichthyology* **25**:110-125.

Shestopal I.P., O.V. Smirnov & A.A. Grekov (2002) Bottom Long-Line Fishing for Deepwater Sharks on Sea-Mounts in the International Waters of the North Atlantic (Elasmobranch Fisheries) NAFO SCR Doc. 02/100 Serial No. N4721

Stock, J.H. (1970) The pycnogonida collected off northwestern Africa during the cruise of Meteor. *Meteor Fors.-Ergeb* **D5** :6-10

Stock, J.H. (1991) Pycnogonides de la campagne Seamount 1 au large de la peninsula iberique et dans le golfe ibero-morocain. *Bulletin du Museum National d'Histoire Naturelle Section A Zoologie* **13:**135 - 42

Stocks, K.I. & Hart, P.J.B. (2007) Biogeography and biodiversity of seamounts. Chapter 13, pp 255 – 281 In: Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. & Santos, R.S. (eds) Seamounts: ecology, fisheries & conservation. Fish and Aquatic Resources Series, Blackwell, Oxford, UK.

Synnes, M. (2007) Bioprospecting of organisms from the deep-sea: scientific and environmental aspects. *Clean Technologies and Environmental Policy* **9(1):** 53 – 59.

Tabachnick K. & L. Menchenina, (2007) Revision of the genus *Asconema* (Porifera: Hexactinellida: Rossellidae). *Journal of the Marine Biological Association of the UK* **87**: 1403–1429

Thiel H. (2001) Unique Science and Reference Areas on the High Sea In: Thiel H., Koslow A. (Eds) Managing Risks to Biodiversity and the Environment on the High Sea, Including Tools such as Marine Protected Areas – Scientific requirements and Legal Aspects. Proceeding of the Expert Workshop held at the International Academy for Nature conservation Isle of Vilm, Germany, 27 February – 4 March 2001. BfN – Skripten 43. pp. 43-54.

Thiel H. (2003) Anthropogenic impacts on the Deep Sea. Ch. 13 in Ecosystems of the World: The Deep Sea. Elsiever, Amsterdam. Pp. 427-470

Tomás, J., Mons, J.L., Martín, J.J., Bellido, J.J. & Castillo, J.J., 2002. Study of the first reported nest of loggerhead sea turtle, *Caretta caretta*, in the Spanish Mediterranean coast. *Journal of the Marine Biological Association of the United Kingdom*, **82**, 1005.1007.

Tracey, D., Neil, H., Gordon, D. & O'Shea, S. (2003) Chronicles of the deep: ageing deep-sea corals in New Zealand waters. *Marine Biodiversity. Water and Atmosphere* **11(2):** 22 – 24.

UNEP (2007) Report of the Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection. Azores, Portugal, 2-4 October 2007. UNEP/CBD/EWS.MPA/1/2

Vinnichenko, V.I. (2002) Russian investigations and fishery on seamounts of the Azores area. In: *Relatório das XVIII e XIX Semana das Pescas dos Açores* (ed. Anonymous), pp. 115 – 129. Secretaria Regional da Agricultura e Pescas, Horta.

Vinnichenko, V.I. & Khlopenyuk, V.F. (1983) Manual on the Fishery for Mackerel and Hourse Mackerel on the Josephine and Ampere Seamounts, 28pp. Sevrybpromrazvedka (Northern Fish Scouting Organization), Murmansk (in Russian).

Walker, P., Cavanagh, R.D., Ducrocq, M., & Fowler, S.L. (2005) Northeast Atlantic including Mediterranean and Black Sea. Pp: 71–86. In: Fowler, S.L., Cavanagh, R.D.,Camhi, M., Burgess, G.H., Cailliet, G.M., Fordham, S.V.,Simpfendorfer, C.A. and Musick, J.A. (comp. and ed.).2005. Sharks, Rays and Chimaeras: The Status of the Chondrichthyan Fishes. IUCN SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Zezina O.N. (2006) Deep-sea brachiopods in Russian collections from the Atlantic Ocean. In: A.N. Mironov, A.V. Gebruk, A.J. Southward (eds), *Biogeography of the North Atlantic seamounts*, pp. 67-75. Moscow, KMK Press.

Zibrowius H., (1980) Les Scleractiniares de la Mediterranee et de l' Atlantique nord-oriental. *Memoires de l'Institut Oceanographique*, **11**: 1–283.

Zibrowius H, & Cairns S.D. (1992) Revision of the northeast Atlantic and Mediterranean Stylasteridae (Cnidaria: Hydrozoa). *Mémoires du MuseumNational d'histoire Naturelle. Zool*. **153**: 1-136.

Xavier J., van Soest R. Demosponge fauna of Ortmonde and Gettysburg Seamounts (Gorringe Bank, north-east Atlantic) : diversity and zoogeographic affinities. JMBA. 87: 1643-1653.

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

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

Addendum 7

Proposed OSPAR Marine Protected Area

Milne Seamount

A. General information

1. Proposed name of MPA

Milne 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 Milne 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 Milne 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.
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.

[1] The conservation vision describes a desired long-term conservation condition and function for the ecosystems in the entire Milne 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 Milne 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.

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.

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.

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

c. The **habitats associated with seamounts.**

2.3.4. **Habitats and species of specific concern**

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

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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).

3. Status of the location

The proposed area 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 the site 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 of the Wider Atlantic

5. Biogeographic region

Atlantic Realm; Atlantic Subregion; Cool-temperate waters

6. Location

The features to be incorporated within the Milne Seamount Protected Area also include the surrounding cluster of un-named seamounts.
Boundary co-ordinates

Latitude	Longitude
45.30°N	41.22°W
45.30°N	39.10°W
44.18°N	39.10°W
44.18°N	41.22°W

7. Size

20,913 km^2

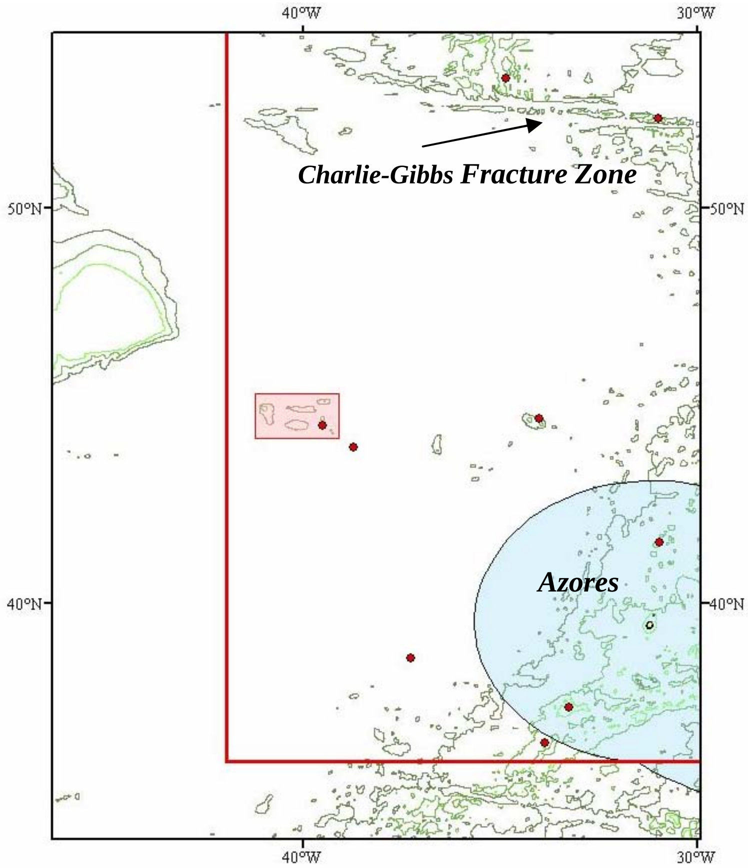

Figure 1 *Proposed marine protected area boundaries and location. Red circles represent known major seamount locations, blue shaded areas represent Exclusive Economic Zones and the red shaded area is the proposed Milne seamount protected area. The bold red line shows the southern and western OSPAR maritime boundary.*

8. Characteristics of the area

The Milne seamount (44º 30'N 39º 30'W) is located to the west of the Mid-Atlantic Ridge. It rises to within 1000m of the surface and is associated with several other seamounts, including the nearby Williams peak (43º 95'N 38º 72'W) which rises to within 2000m of the surface. An ICES (2005) report shows a cluster of unnamed seamounts around the Milne and Williams seamounts. Few scientific studies mention Milne seamount by name (Louden *et al*, 2004) and little biological information is available.

Between 75 and 40 million years ago, the Milne area was a hotspot of excess volcanism, which has since declined. This has produced the cluster of neighbouring seamounts that exhibit an average isostatic crustal thickness of around 23 km (Louden *et al*, 2004). It is therefore likely that the Milne seamount is made from the characteristic volcanic substrata with a complex structure, offering a variety of ecological niches (Epp & Smoot, 1989; Kitchingman & Lai, 2004). In addition, the neighbouring seamounts are of varying heights and depths (>2000m from the surface), which will likely affect the species assemblages around them (ICES, 2005).

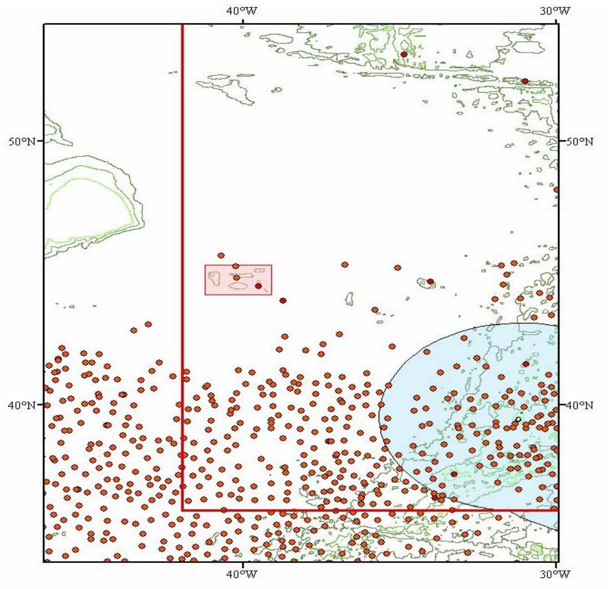

Figure 2. *Historical Sperm whale (Physeter macrocephalus) catch data (orange dots). The thick red line represents the western and southern OSPAR maritime boundary, blue shaded areas are Exclusive Economic Zones and the red shaded area is the proposed marine protected area. Data from Townsend 1935.*

Figure 2 shows historical Sperm whale (*Physeter macrocephalus*) catch data (19th and early 20th centuries) for the region around the proposed marine protected area. A few individuals of this cetacean species were once caught around the Milne seamount, although the map suggests the area was not especially important for them. However, individual Sperm whales may still frequent the area. Significant aggregations of Sperm whales were recorded feeding around the Charlie-Gibbs Fracture Zone of the Mid-Atlantic Ridge to the northeast (Skov et al, 2008). Other cetacean species are also likely to frequent the proposed area as well as other top-predators.

A recent, long-term study of breeding Cory's shearwaters (*Calonectris diomedea*) in the Azores found that they used a dual-foraging strategy (Magalhães *et al* 2008). The Azores breeding population comprises between 50,000 and 90,000 breeding pairs, which constitutes more than 70% of the breeding numbers of the Atlantic subspecies *C. diomedea borealis* (Monteiro et al, 1996; Magalhães *et al* 2008). The birds undertake on average three short (1-4 day) trips followed by a long trip of up to 20 days (Magalhães *et al* 2008). *C. diomedea* on long trips headed north of the Azores to core areas of enhanced productivity resulting from cold water upwellings (Magalhães *et al* 2008). One foraging area was the Milne seamount cluster (see Figure 3), with birds from western, central and eastern regions of the Azores foraging there (Magalhães *et al* 2008). As an oceanic seamount cluster may be an important foraging area outside the Mid-Atlantic Ridge.

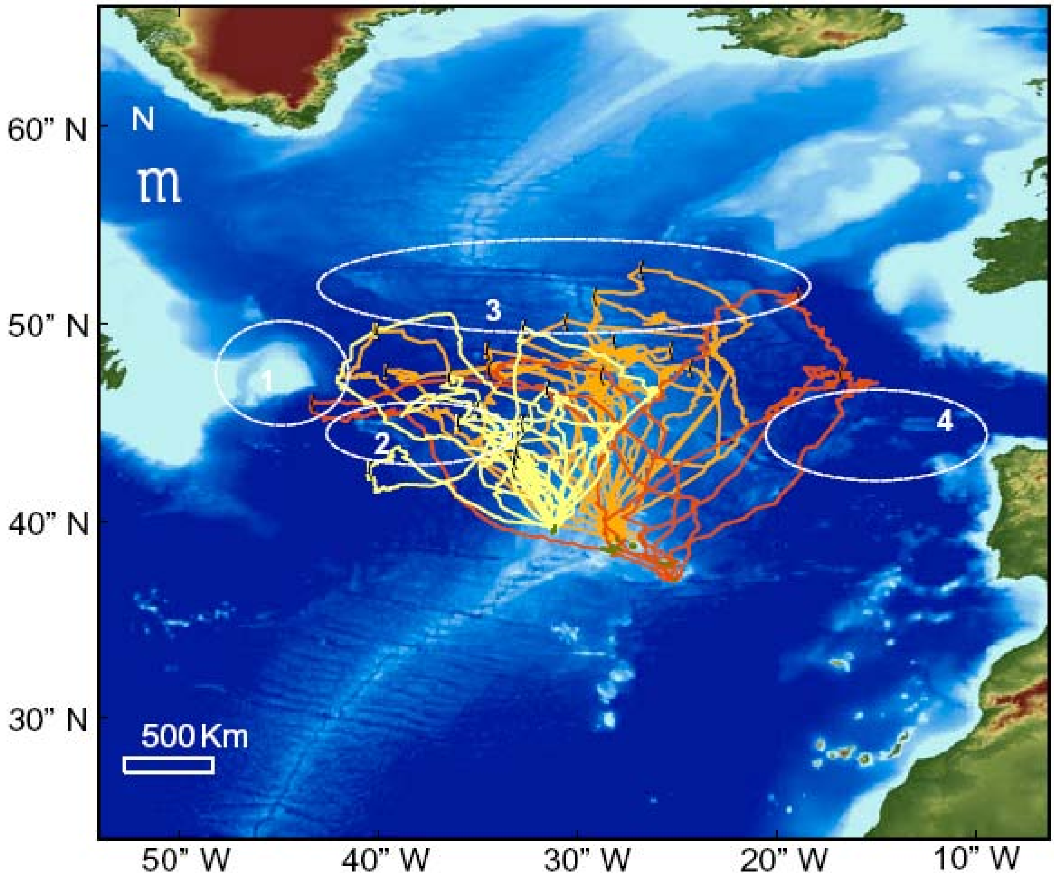

Figure 3. *Calonectris diomedea*. Foraging ranges and destinations of long trips (5-18 days) from three islands in western (yellow), central (orange) and eastern (red) Azores. Circles mark maximum ranges for individual foraging trips. Oceanographic features: 1, Flemish Cap; 2, Milne Seamounts; 3, Charlie Gibbs Fracture Zone; 4, Charcot seamounts. Sea depths: pale, < 1000m; medium, 1000-2000m; dark blue, > 3000m. Reproduced from Magalhães et al, (2008).

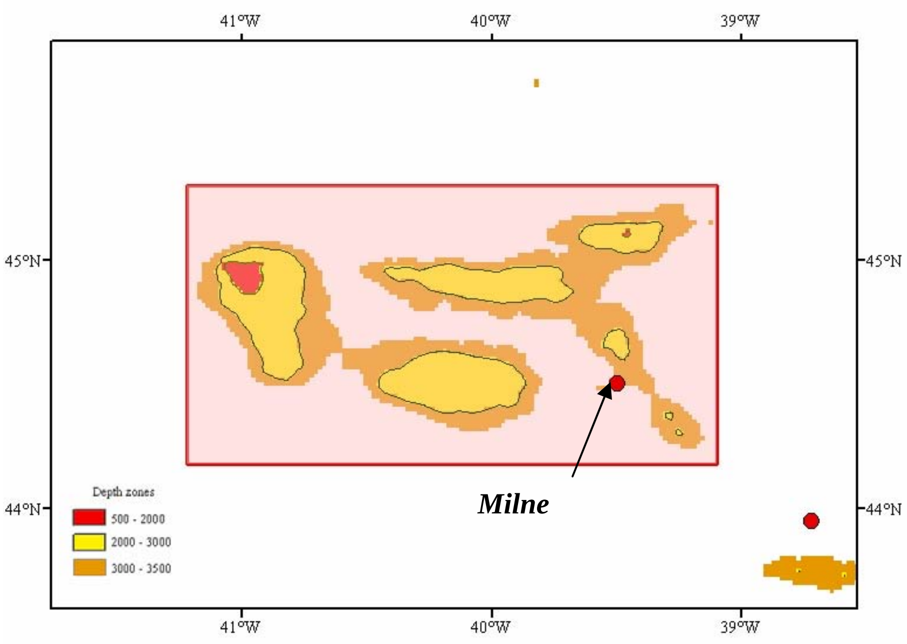

Figure 4. *The fishable zones within and around the proposed marine protected area. The white area around the proposed marine protected area represents depths greater than 3500 metres. The two red dots are known seamount locations and the red shaded area is the proposed marine protected area.*

Given the lack of direct ecological knowledge about the proposed marine protected area, boundaries proposed for the MPA were chosen based on bathymetry. Boundaries were kept straight to allow ease of management and enforcement of regulations. Figure 4 shows that the boundaries incorporate all areas with a depth less than 3500m, i.e. those areas accessible by fishing vessels. To the southeast of the proposed marine protected area, there is an unnamed seamount. This has not been included in the proposed marine protected area because the unnamed seamount is deeper than 3500m and therefore cannot be classified as vulnerable to fishing pressure at present.

B. Selection criteria

a. Ecological criteria/considerations

1. Threatened and Declining Species and Habitats

The proposed area includes seamount habitat, which is listed as a priority threatened or declining habitat by OSPAR (OSPAR Commission 2003). Seamount habitat qualifies as a Vulnerable Marine Ecosystems in relation to high seas fisheries according to criteria developed by FAO (FAO 2007, Rogers *et al* 2008). Seamount communities are also listed as habitats that are 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).

2. Important Species and Habitats

There is no available information about the benthic biological communities present at this seamount, although it can be expected that there are significant stands of coral and other bottom living organisms present based on research at the nearby Corner Rise Seamounts (Waller *et al* 2007). A recent study of breeding pairs of Cory's shearwater (*C. diomedea*) from the Azores found that both short and long foraging trips are made to the Milne seamount cluster (Magalhães *et al* 2008; see section A8 Characteristics of the Area and Figure 3 for further details).

3. Ecological Significance

There is little direct information about the ecological communities found within the proposed marine protected area.

To the east of the Milne Seamount area, the closest topographical features that have been studied are the seamounts of the northern section of the Mid-Atlantic Ridge running from the Charlie-Gibbs Fracture Zone (approximately 52 – 53^{o}N) south to the Azores and the seamounts of the Azores' continental shelf. An example of a nearby seamount is the Sedlo seamount, located in the Azores sub area of the Portuguese EEZ. Sedlo is considered to be one of the better-studied seamounts in the OSPAR area. *Hexacorrallia* and sponges have been found dominating the summit benthic epifaunal community and the seamount is an important area for several commercial fish species, visiting marine mammals, seabirds and sea turtles (Menezes *et al* 2006). The northern section of the Mid-Atlantic Ridge is currently being studied as part of the Census of Marine Life MAR-ECO project and several papers have recently been published. To the west, the nearest chain of seamounts is the Newfoundland chain, however no information is available about their biology is available. The Milne seamount area is likely to be similar to the topographical features in its surrounding area.

Seamounts are possible feeding stops along migratory routes for sea turtles. The knowledge of sea turtle associations with seamounts is primarily based on the Loggerhead turtle (*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 turtles 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). A few satellite tracking studies have been conducted within the OSPAR region and have shown that individuals can be found crossing the Atlantic in the vicinity of the proposed protected area (Hays *et al*, 2006; Doyle *et al*, 2008).

Seamounts are also known to attract large numbers of pelagic animals, such as marine mammals, tuna, billfishes and sharks (Gubbay, 2003; Morato *et al*, 2008b). As noted above, historical Sperm whale (*P. macrocephalus*) data show that this species was once caught within and around the proposed marine protected area (see Figure 2) and it is likely that individuals still frequent the area. Indeed significant Sperm whale feeding aggregations and other cetacean species, were observed on the Mid-Atlantic Ridge northeast of the proposed marine protected area (Skov *et al*, 2008).

4. High Natural Biological Diversity

As there are no published accounts of this area, it is not possible to make site-specific comments about the biological diversity.

5. Representativity

The Milne seamount is relatively isolated from nearby regions and so may show a "typical" representation of an oceanic seamount habitat. The varying heights of peaks in the cluster could also support different types of species assemblages and niches.

6. Sensitivity

In general seamounts have been identified as threatened or declining marine habitats (OSPAR Commission, 2003) and the Milne Seamount is no exception. The recent closure of several seamounts within the OSPAR area by the North East Atlantic Fisheries Commission (NEAFC) (including Hecate and Faraday seamounts on the Mid-Atlantic Ridge, Altair and Antialtair seamounts) further exemplifies recognition of their sensitivity to the effects of commercial fishing.

Given its remote location in the middle of the Atlantic, the Milne Seamount and surrounding features may have had relatively little disturbance in comparison to less remote locations, although some peaks of the similarly isolated Corner Rise Seamounts have been seriously damaged by fishing (Waller *et al*, 2007).

7. Naturalness

Due to its remote location, it is possible that the Milne seamount cluster is relatively undisturbed and may therefore represent a relatively pristine seamount example within the OSPAR area. This remains to be confirmed by direct study.

b. Practical criteria/considerations

1. Potential for restoration

Given the remote location of the Milne seamount cluster and the likely low past disturbance, protection rather than restoration is the aim of this proposal.

2. Degree of Acceptance

Seamounts have been identified as vulnerable ecosystems/habitats in many different fora and there are therefore strong scientific grounds warranting protection of this area. Fishing effort on the Milne cluster has not been quantified but, due to its remote location and relative size, it may be little fished at present. In addition recent NEAFC fishery closures have been implemented on several seamounts in the OSPAR region (ICES, 2007a). Therefore acceptance from the fishing community may be relatively high, although detailed consultation with any known stakeholders will be required..

3. Potential for Success of Management Measures

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).

4. Potential Damage to the Area by Human Activities

On the whole, the most damaging industry operating the North East Atlantic is deep-sea fishing (OSPAR, 2007). It is likely that as resources are depleted elsewhere, the exploration of seamounts in the OSPAR maritime area will continue and this could lead to the proposed area being impacted by fishing activity. As fisheries move into deeper waters the conditions are more conducive to net loss, and there is strong evidence of net dumping and significant levels of ghost fishing in the deep water north east Atlantic fishery for shark and monkfish (ICES, 2007b).

Bioprospecting on seamounts for possible sources of biotechnology (for example bacteria on hydrothermal vents) may be another future threat (Gubbay, 2003). However, no information is known about bioprospecting within the proposed area and it seems more likely that this will occur around hydrothermal vent sites in the near future (Synnes, 2007).

In the future, exploitation of seamounts by humans could expand in scope. A possible threat could be mineral exploitation through mining for their cobalt crusts (Probert, 1999). However, no information is known about the mineral composition of Milne seamount and the surrounding area.

5. Scientific value

There is little information about the Milne Seamount cluster specifically. This highlights the need for more research in this region. As noted in the introduction, scientific knowledge of seamounts in general is poorer than for many other marine habitats (Gubbay, 2003). . Therefore remote seamounts such as the proposed site have high scientific value. A research program to better understand high seas seamount habitats should accompany protection of this area.

C. Proposed management and protection status

1. Proposed management

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):

- N/A Area beyond national jurisdiction

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

- None at present

Presented by
Contracting Party:
Organisation:
Date:

Annex 1

Species and habitats of special interest for the Milne 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[10]

Other Species of special concern

- Cetaceans
- Deep water sharks
- Oceanic seabirds like Cory's Shearwater

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

[10] Based on their known geographic distributions and habitat associations, the presence of threatened species, including Orange roughy (*Hoplostethus atlanticus*), Leatherback turtle (*Dermochelys coriacea*), Loggerhead turtle (*Caretta caretta*), Portuguese dogfish (*Centroscymnus coelolepis*), Gulper shark (*Centrophorus granulosus*), and Leafscale gulper shark (*Centrophorus squamosus*), is strongly suspected, but remains to be proven by direct observation.