OSPAR COMMISSION

# Background Document on Charlie-Gibbs North High Seas MPA

Biodiversity Series

2012

**OSPAR Convention**

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998.

It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Union and Spain.

**Convention OSPAR**

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998.

La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l’Irlande, l’Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d’Irlande du Nord, la Suède et la Suisse et approuvée par l’Union européenne et l’Espagne.

## Acknowledgement

The report was developed by the OSPAR Intersessional Correspondence Group on Marine Protected Areas led by Dr Henning von Nordheim (German Federal Agency for Nature Conservation/BfN) on the basis of the Background Document on the Charlie-Gibbs Fracture Zone (OSPAR Publication 2010/523) and a summary of the scientific considerations relevant to a potential Charlie-Gibbs North High Seas MPA, adopted by the OSPAR Biodiversity Committee in 2012. The contributions of the following are acknowledged: Odd-Aksel Bergstad, Rachel Brown, Tim Packeiser, and David Johnson.

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# Contents

# Executive Summary

The area of the Charlie-Gibbs North High Seas Marine Protected Area covers the northern part of the Mid-Atlantic Ridge (MAR), comprising the waters superjacent to part of the Charlie-Gibbs Fracture Zone. The area also encompasses the water column above a section of the Reykjanes Ridge, to the north of that fracture zone, where bottom trawling and fishing with static gear, including bottom set gillnets and longlines, has been prohibited since 2004. It is an area that covers 177 700 $km^2$.

The water column of this area above the Mid-Atlantic Ridge is located beyond the limits of national jurisdiction of the coastal states in the OSPAR maritime area and Canada. According to UNCLOS these waters are considered as High Seas, which are open to all States. The MPA overlays a subarea of the extended continental shelf submission of Iceland.

The most important physical feature of this area is the meandering sub-polar front which represents a distributional boundary for many pelagic taxa, a meeting of southern and northern species, resulting in elevated natural biological diversity. Of the species that occur there, a number are of particular concern to the work of the OSPAR Commission due to their status as threatened and/or declining. These include deep water sharks, such as the gulper shark, as well as blue whales, leather back turtles, Portuguese dogfish and the orange roughy.

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

This background document makes available the information which has been compiled and evaluated by OSPAR on the biodiversity and ecosystems of the high seas of the northern part of the Charlie-Gibbs Fracture Zone and the adjacent sections of the Mid-Atlantic Ridge. The document has been developed on the basis of a proposal for an MPA in ABNJ covering the whole Charlie-Gibbs Fracture Zone which was proposed to OSPAR in 2008. At the 2010 Ministerial Meeting, the OSPAR Commission adopted OSPAR Decision 2010/2 on the establishment of the Charlie-Gibbs South MPA. This document responds to the Ministerial Commitment to work within the framework of OSPAR to resolve outstanding issues with regard to the high seas of the northern part of the Charlie-Gibbs Fracture Zone area by 2012.

# A General information

## 1. Name of MPA

Charlie-Gibbs North High Seas MPA

## 2. Aims of MPA

- protect, conserve and restore species, pelagic habitat and ecological processes which are adversely affected as result of human activities;
- prevent degradation of and damage to species, pelagic habitat and ecological processes following the precautionary principle;
- protect and conserve a special and representative section of the water column above the Mid-Atlantic Ridge which in itself is a major portion of the bathyal habitat of OSPAR Region V.

## 3. Status of the location

The water column of this area above the Mid-Atlantic Ridge is located beyond the limits of national jurisdiction of the coastal states in the OSPAR maritime area and Canada.

According to UNCLOS these waters are considered as High Seas, which are open to all States, including the freedom of scientific research.

The MPA overlays a subarea of the extended continental shelf submission of Iceland.

## 4. Marine region

Wider Atlantic (OSPAR Region V)

## 5. Biogeographic region

Atlantic sub-region; Cool-temperate waters

## 6. Location

The area covers the northern part of the Mid-Atlantic Ridge (MAR), including waters superjacent to part of the Charlie-Gibbs Fracture Zone. The area also comprises a section of the Reykjanes Ridge (20 644 km2), to the north of that fracture zone, where bottom trawling and fishing with static gear, including bottom set gillnets and longlines, has been prohibited since 2004 until presently 31$^{st}$ December 2015 (NEAFC Recommendation on the protection of vulnerable marine ecosystems from significant adverse impacts in the NEAFC Regulatory area, 2009)[1].The area extends from the central crest of the ridge along the slopes and rifts on either side of the ridge axis into waters with depths of 3500 m or more.

[1]Consolidated text of all NEAFC recommendations on regulating bottom Fishing http://neafc.org/system/files/consolidated_bottomfishing_regulations.pdf

The coordinates for the boundaries of the MPA are:

| "Latitude" N | "Longitude" W |
|---|---|
| 51,400000 | -37,000000 |
| 51,400000 | -35,340000 |
| 51,500000 | -30,700000 |
| 51,640000 | -30,440000 |
| 51,910000 | -30,020000 |
| 52,200000 | -29,770000 |
| 53,500000 | -27,000000 |
| 53,500000 | -32,000000 |
| 55,000000 | -32,000000 |
| 55,000000 | -37,000000 |

The original proposed boundaries for a marine protected area covering the whole of the Charlie-Gibbs Fracture Zone reflected a scientific agreement reached at OSPAR ICG MPA in April 2008 and described in the Background Document (OSPAR, 2010) that the enclosed area should fully incorporate representative sections of the MAR north and south of the Charlie-Gibbs Fracture Zone, and the meandering Sub-Polar Front that separates cool northern waters from warmer southern waters and sustains a relatively high abundance and biomass across the food web. The Charlie-Gibbs Fracture Zone and the Sub-Polar Frontal Zone are both special features of the mid-ocean North Atlantic. The Sub-Polar Front, usually lies just south of the Charlie-Gibbs Fracture Zone, but varies in position. Following the OSPAR meeting in Bergen in 2010, OSPAR Decision 2010/02 saw the establishment of the Charlie-Gibbs South MPA (see Figure 1). It was proposed that a high seas MPA be created in the northern area of Charlie-Gibbs Fracture Zone matching the original boundaries but for the water column only of the northern area and not affecting the sovereign rights of any State with jurisdiction over the seabed.

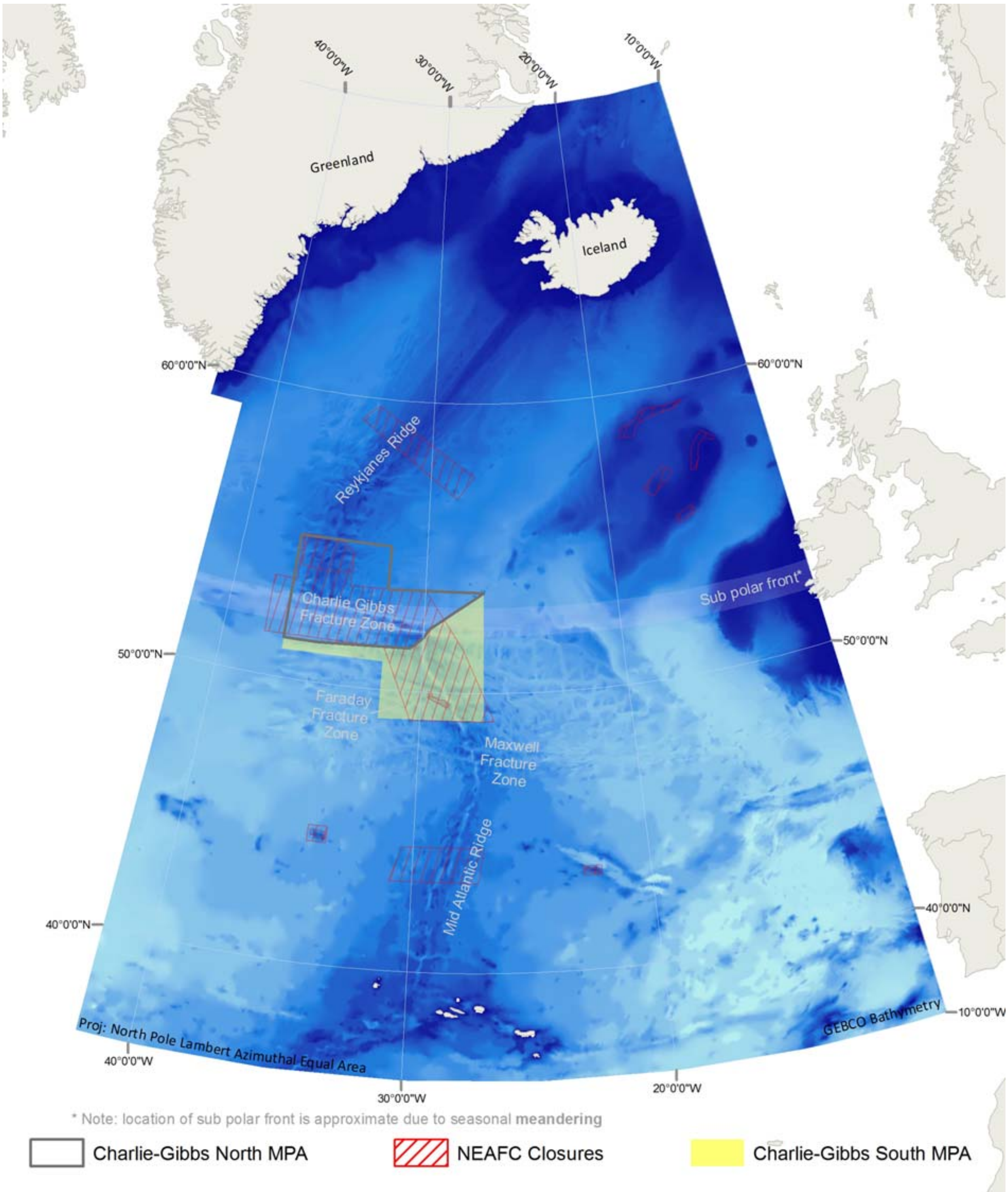


**Figure 1.** Location of the Charlie-Gibbs North MPA

## 7. Size

178 651 km²

## 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 (*e.g*. Sclater and Tapscott, 1979; Garrisson 1993). 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. 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 MAR dominates the seafloor topography in the High Seas of the OSPAR maritime area. The topography is highly differentiated with depths ranging from 4500 m in the deepest channel to only 700 – 800 m on top of adjacent seamounts (Sclater and Tapscott, 1979). The MAR constitutes a major proportion (perhaps half) of the total bathyal habitat of the North Atlantic Ocean as a whole, and thus a major living space for the associated deepwater communities.

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 also strongly shapes the habitat characteristics in the water column through modification of currents and production patterns (see *e.g.* Opdal *et al.,* 2008). The MAR has a profound role in the circulation of the water masses in the North Atlantic (Rossby, 1999; Bower *et al.*, 2002; Read et al. 2010; Søiland *et al.*, 2008). The complex hydrographic setting around the MAR in general and the presence of the ridge itself leads to enhanced vertical mixing and turbulence that may result 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 MAR (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 high seas MPA incorporates waters superjacent to part of a topographically and hydrographically especially complex section of the MAR (*e.g*. Søiland *et al.,* 2008) and as such is expected to be home to diverse and interesting deep-sea fauna . From the north, the Reykjanes Ridge stretches south-westwards from Iceland to approximately 52°N, where a major fracture zone known as the Charlie-Gibbs Fracture Zone offsets the ridge by 5° to the east and opens the deepest (maximum depth 4500m) connection between the northwest and northeast Atlantic (

(Rossby, 1999; Bower *et al.*, 2002; Read *et al*. 2010; Søiland *et al.,* 2008).

The general circulation in the epipelagic zone (0-200m) is well understood as the warm North Atlantic current flowing northeastwards from the subtropical gyre in the Southwest Atlantic towards the European shelf with two to four branches crossing the MAR. Where the warm, saline North Atlantic water meets the cold, less saline water of the subpolar gyre from the Labrador and Irminger Seas, the Sub-Polar Front is created, which is a permanent feature. The meandering of the Sub-Polar Front coincides with temporal variation in the character and spatial distribution of the water masses and frontal features (Søiland *et al.* 2008). This front is one of the major oceanic features in the OSPAR maritime area, 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) and biological production and biomass in the pelagial (see *e.g*.

Gislasson *et al.,* 2008, Opdal *et al,.* 2008, Pierrot-Bults 2008, Youngbluth *et al.* 2008). Due to the influence of the Sub-Polar 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.

A cooperative, multinational, large scale investigation programme focussing on 'Patterns and Processes of the Ecosystem of the Northern mid-Atlantic'(MAR-ECO) as part of the global Census of Marine Life Initiative has been conducted in this area over the last few years duration until end 2010 (Bergstad *et al.,* 2008a) and with an extended UK project ECOMAR until 2012. Many scientific papers have been published in the years since the project's inception that span ecological zones and taxonomic ranges in particular in three focal areas, one of these being the Charlie-Gibbs Fracture Zone area (see 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 MAR. Much of the information used in this proposal is from recently published papers by scientists involved in the MAR-ECO project.

### Pelagic system

The pelagic productivity of the northern part of the MAR (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; Sigurdsson *et al.*, 2002; Anderson *et al.*, 2005; Gislasson *et al.*, 2008). 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, Stemmann *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 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 MAR were the egg production rates higher than in the Charlie-Gibbs Fracture Zone and Sub-Polar Front (Gislason *et al.,* 2008). The Sub-Polar 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 MAR proper and lowest in the adjacent Irminger Sea. Contrary to the adjacent basins, the distribution of fish larvae was shallower over the MAR, 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. 2). 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, Vecchione et al., 2010).

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 a wider area this relatively high pelagic fish diversity was confirmed by Sutton et al. (2008). 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 MAR). 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 Charlie-Gibbs Fracture Zone (CGFZ) related to meso- and bathypelagic fish biomass, and likely related to elevated primary productivity in the frontal zone.

The entire oceanic North Atlantic, including the MPA, is inhabited by highly migratory fish species such as tunas, billfishes and epipelagic sharks. The significance of the proposed area for these fishes is not known. Altogether 13 species of **cetaceans**, with 1,433 individuals were observed along the entire section of the MAR studied during the Mar-Eco cruise (Skov *et al.,* 2008). About half of the individuals (727) belonged to seven species of dolphins (Doksaeter *et al.,* 2008): Two of the four most frequently observed dolphin species (pilot whale *Globicephala melas*, white-sided dolphin *Lagenorhynchus acutus*), occurred only north of the Charlie-Gibbs Fracture Zone, the other two species (common dolphin *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 MAR seems to be of particular importance to sei (*Balaenoptera borealis*) and sperm whales (*Physeter macrocephalus*). The highest aggregations of baleen whales and especially sei whales 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. borealis* 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 MAR-ECO cruise in the summer of 2004 provided a snapshot of **seabird** distribution along the MAR: 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 three 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 MAR. 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 Sub-Polar Front just north of the Charlie-Gibbs Fracture Zone. Most of the birds recorded were found in the area of the Sub-Polar 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 three and ten 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 MAR, in particular enhanced abundances over the Charlie-Gibbs Fracture Zone and Sub-Polar Front regions (See Threatened/Declining Species and Habitats criterion B.a.1. below for more information).

### Demersal (benthopelagic) fish fauna

The actual number of demersal fish species depends on the fishing gear used during research 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 rupestris*) 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 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 coelolepis*).

The biogeographic boundary of the Charlie-Gibbs Fracture Zone is also evident in the distribution of commercially relevant deep water fish (Hareide & Garnes, 2001; Shibanov *et al.,* 2002): North of 52 °N[2], 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 at approximately 1600 m depth on and in the vicinity of coral reefs, 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. It was 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[3] of redfish and alfonsino when commercially fished in the early 1990s and speculate about a changing balance

[2] Including the area on the Reykjanes Ridge and Hecate Seamount closed by NEAFC since 2004.

[3] One year of longlining on *Sebaste marinus*, Two years of *Beryx splendens* fishery.

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 2 composed by Shibanov *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.

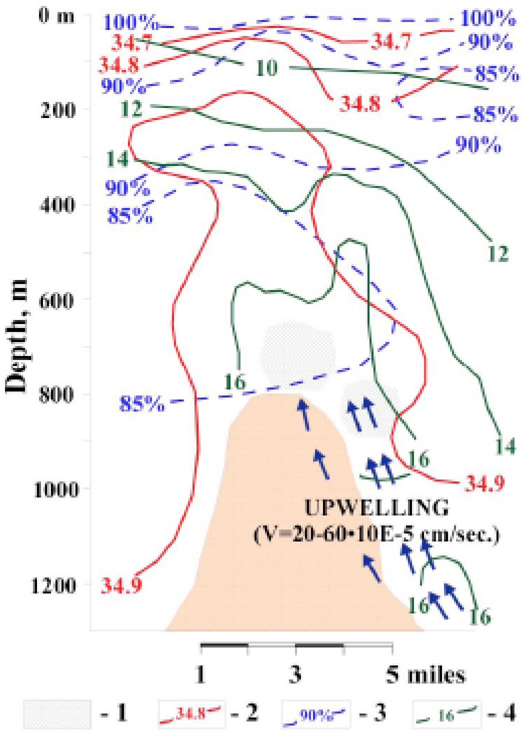


**Figure 2.** The distribution of roundnose grenadier (1-hatched) in relation to environmental parameters (2-salinity, 3-dissolved oxygen, 4-biogenes in meg at/l) and the seamount peak and slope in the area of the CGFZ at 53° N (Shibanov *et al.,* 2002)

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, Sutton *et al.,* 2008) demonstrate that the overall abundance of potentially commercially relevant fish stocks on the seamounts of the MAR is rather low. Therefore, the stock size and catch depend on the production of fish on the seamounts.

Since 1998, the Advisory Committee on Fishery Management of the International Council for the Exploration of the Sea (ICES ACFM) has continuously advised the North East Atlantic Fisheries Commission (NEAFC) and the European Commission (EC) on a strict regulation (in 2000 even on the temporary cessation) of deep water fisheries. In 2001, ICES ranked deep water 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 deep water squalid 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).

ICES has not issued specific advice for the area, nor for the MAR. (Bergstad *et al.,* 2012) analysed species composition data from the entire North Atlantic deepwater area and found the MAR fauna to be rather rich and most similar to the fauna along the slope of western Europe. Comparisons of recent biomass levels suggested that levels on the MAR were similar to those observed along European slopes, but higher than on Northwest Atlantic slopes.

# B Selection criteria

## a. Ecological criteria/considerations

## 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 OSPAR (Texel-Faial) selection process.)*

The following species on the OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR Agreement: 2008-06) occur within the boundaries of 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** |

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

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

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

ICES (2002) consider Orange roughy to be one of the most sensitive deep water 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). A ridge like the MAR which extends across the whole Atlantic Ocean with numerous seamount-like peaks suitable for orange roughy aggregations, **may** therefore have a special importance for maintaining the global population of Orange roughy.

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

### *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 Sub-Polar 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 Sub-Polar 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 area to feed (see also Sensitivity criterion), but the balance of evidence suggests this is mainly within the southern part of the MPA.

### *Blue Whale (Balaenoptera musculus)*

Blue whales roam between all of the oceans. As plankton feeders, they particularly depend on zones of rich plankton production during their migrations. Blue whales were sighted on rare occasions in the vicinity of the MAR and the Charlie-Gibbs Fracture Zone during the MAR-ECO cruises (Doksæter *et al.,* 2008). It is possible that blue whales spend some time in the Sub-Polar frontal area with its increased pelagic biomass, such as for example sei and sperm whales do (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). (See also Ecological Significance criterion; Skov *et al.,* 2008). However, on balance there is very little evidence that the area is specifically important for cetaceans.

### *Deep-water sharks (Portuguese dogfish (Centroscymnus coelolepis), Gulper shark (Centrophorus granulosus), Leafscale gulpershark (Centrophorus squamosus))*

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). Illegal, unreported and unregulated fishing is also known to take place for deep-water sharks especially in international waters (ICES, 2007b). Given the bycatch problem and the vulnerability of deep-water sharks (see below B.2.) there is therefore an urgent need to establish deep-water refuges from fishing.

Notwithstanding the evidence above it is concluded that all these species have very wide ranges: there is no information to indicate that the area has particular importance for any of the listed species and therefore the significance of the area for the above mentioned species remains uncertain. Their presence, however, contributes to the ecological significance and high natural biological diversity criteria (see 3 and 4 below).

## 2. Important species and habitats

(The area is important for species, habitats/biotopes and ecological processes as identified by the OSPAR (Texel-Faial) selection process but not listed by OSPAR as threatened and/or declining)

The Mid-Atlantic Ridge comprises about half the North Atlantic bathyal habitat (depth range 800-3500m), hence it is a major feature of OSPAR Region V. There is evidence of a rich macrofauna associated with the ridge habitats, perhaps as rich in terms of biomass and abundance as that observed along the continental shelves. This is at least the case for demersal and meso-and bathypelagic organisms. A notable difference between the mid-ocean ridge and continental slopes is the apparent lack of major abundant epipelagic planktivorous fish such as herring, mackerel and blue whiting.

The northern MAR has been considered by some researchers 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 MAR was higher than the numbers recorded for the Corner Rise Mounts (34° to 35°N, 48° to 52°W) and the same as on the seamounts near Rockall (56° to 59°N, 13° to 18°W).

***Elasmobranchs***

Several species occur in the MPA and elasmobranchs are acknowledged (as a group) to be sensitive to over-exploitation, but there is no information to indicate that populations in this area have been depleted.

In conclusion, while the mid-ocean ridge is very significant in terms of species richness and abundance, it is not known whether the area is of special significance compared with other subareas of the ridge. This area together with the existing Charlie-Gibbs South MPA spans a hydrographical frontal zone and the observed elevated abundance of many species in the frontal zone suggests that these two areas together may be relatively important. The MPA has a fauna similar to that found along the entire Rekjanes Ridge northwards to Iceland.

## 3. Ecological significance

The area comprises the northern section of the hydrographical feature known as the Sub-polar Frontal Zone. The area comprises the water column above the geomorphological features such as seamounts, cliffs, plains and slopes that are shallow compared with the adjacent abyssal waters. As in most frontal zones, there is evidence of elevated abundance of many faunal components ranging from zooplankton to fish and mammals. The complicated topography and frontal zone features appear to enhance productivity and primary and perhaps secondary production in the water column. Together with the Charlie-Gibbs South MPA the area would span the frontal zone and thus incorporates an area of the MAR with particular ecological features and significance.

More specifically the area has:

*a) High proportion of frontal zone habitat in the OSPAR area*

The meandering Sub-Polar Front is currently partially protected with the Charlie-Gibbs South MPA; however this front (and the CGFZ itself) represents an important barrier to along ridge dispersal of biological communities. Along the MAR species communities change gradually from north to south and this area aims to incorporate diversity from the northern pelagic communities not included in the Charlie Gibbs South MPA.

*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 Sub-Polar 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

Sub-Polar Front is not a static feature and moves latitudinally on a time scale of days, but is normally found just south of the Charlie-Gibbs Fracture Zone (Bergstad *et al.,* 2008).

As a surrogate for phytoplankton biomass, surface Chlorophyll *a* concentrations measured around the Sub-Polar 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 productivitiy 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 MAR 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 MAR 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 Sub-Polar Front area; Heger *et al.* (2008) recorded increased deep-sea pelagic bioluminescent activity in the water column over both the Faraday Seamounts and the sub-polar frontal 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).

*c) Important Feeding Aggregations*

The elevated plankton production at the Sub-Polar 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 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 MAR, 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).

Increased diversity, as compared to non-ridge areas, was seen in the **gelatinous zooplankton** of the MAR. Visual observations of what appeared to be undescribed species were made in submersible dives along the entire length of the MAR (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 MAR is taxonomically diverse, with 205 species from 52 families. Between 70 and 80 deep-water **benthopelagic fish** species were caught by Bergstad *et al.* (2008) during experimental trawls over the MAR. 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 MAR that they sampled due to a lack of replication.

The Charlie-Gibbs Fracture Zone marks a biogeographic distributional 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 of the Charlie-Gibbs Fracture Zone to allow the diversity of the species assemblages present here 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 MPA, but a full account is not yet available. Whether the area has particularly high diversity is unclear, the diversity of the MAR in general has been understudied in terms of the pelagic ecosystem (Youngbluth *et al.,* 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).

A common feature is that the Sub-Polar Frontal zone is the northern boundary of southern species whereas northern species extend beyond the Sub-Polar Front but show deeper and deeper distribution with decreasing latitude. The result is elevated natural biological diversity. Other features adding to the high diversity may be the extensive habitat diversity resulting from depth range and complex topography, and the complicated hydrography and circulatory features in the frontal zone. Ocean currents at all depths are modulated be *e.g*. tidal effects and topography resulting in meanders, eddies, and local upwelling creating a range of pelagic habitats.

Together with the Charlie-Gibbs South MPA the area would span the frontal zone and thus incorporates an area of the MAR with particular ecological features and significance.

## 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 area and is representative of this type of geological feature (Dinter, 2001). However, this high seas MPA was nominated as a representative subarea of the MAR and for the northern pelagic communities found within its boundaries. It also represents a portion of a mid-ocean frontal zone (especially if considered together with the Charlie-Gibbs South MPA). The most recently accepted biogeographical classification of the OSPAR maritime area shows that this MPA north of the Charlie-Gibbs Fracture Zone will include cool-temperate pelagic waters (Dinter, 2001). In terms of the deep-sea region the whole of the MAR is within what is described by Dinter (2001) as the Atlantic subregion.

Fock *et al.* (2004) found that the fish assemblages along the MAR 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).

# 6. Sensitivity

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

The MPA on the Mid-Atlantic Ridge through its associated current and feeding conditions, provides a habitat to a number of particularly sensitive/vulnerable species and communities in the water column. In particular deep water species such as Orange roughy (*H. atlanticus*) are considered vulnerable, as they are often slow (if at all) to recover from impacts 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 other fishes.

## Fish Species

***Site Specific Information***

The northern MAR is considered to contain more than forty seamounts of commercial importance, in terms of fisheries (ICES, 2007c). The deep-water fishery along the MAR 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).

***General Evidence of Vulnerability/Sensitivity***

Many deep-sea fish species and communities are particularly susceptible to overexploitation due to their 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 MAR 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.

## Sharks

***Site Specific Information***

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

***General Evidence of Vulnerability/Sensitivity***

The IUCN Shark Specialist Group has recently assessed the threatened status of deep-water sharks globally (Kyne & Simpendorfer, 2007). It was concluded within this report that all deep-water 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 deep-water shark fishing (Kyne, & Simpendorfer, 2007). *C. squamosus* and *C. coelolepis* stocks on the northern MAR are also considered to be depleted (ICES, 2007b). As the quotas for these two species of deep-water 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 deep-water 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

***Site Specific Information***

In total 14 species of cetaceans were observed during the MAR-ECO 2004 expedition along the MAR, 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 MAR 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 MAR 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 Sub-Polar 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 protected area incorporates habitat areas used by the dolphin species found to the north of Charlie-Gibbs Fracture Zone.

***General Evidence of Vulnerability/Sensitivity***

Sperm whales have a long history of over-exploitation and today's population in the North Atlantic is severely depleted from historic, pre-whaling abundances (Reeves *et al.,* 2003). Observations made by Skov *et al.* (2008) indicate that the Sub-Polar Front is a current high use habitat for this species, and abundances will have been much greater prior to the onset of commercial whaling. Today, sperm whales are known to die fairly often from entanglement in fishing gear and as a result of vessel collisions (Cetacean Specialist Group, 1996; Félix *et al.,* 1997; André *et al.,* 1994; Laist *et al.,* 2001). 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 not evaluated sperm whales recently. However, their last assessment in 1996 listed them as vulnerable on the IUCN Red List (Cetacean Specialist Group, 1996).

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). Very little recent research on sei whales has been conducted in the last quarter-century (Reeves *et al.,* 2003). They were observed feeding in the same areas near the Sub-Polar Front as sperm whales (Skov *et al.,* 2008).

However, it is not known whether this area is an important or significant habitat for these cetacean species. As explained the information gathered so far indicates that these species have been observed feeding within the area.

### Sea Turtles

#### *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 Sub-Polar 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 Sub-Polar Front) had the highest abundance of gelatinous zooplankton as compared to the rest of the MAR in 2004 (Youngbluth *et al.,* 2008). Therefore it is possible that *D. coriacea* migrating across the Atlantic visit the Sub-Polar Front area of the MAR to feed.

#### *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 programme with the albacore tuna (*Thunnus alalunga*) drift net fishery found in the Bay of Biscay region of the North-East Atlantic recorded six 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. Therefore the Sub-Polar Front area seems to provide a feeding area on route to the European continental shelf.

The area is therefore inhabited by some deepwater species, *e.g*. fish, with life history characteristics and distribution patterns that make them particularly vulnerable to overexploitation. However, there is no evidence that populations/concentrations of these species are more sensitive in this particular area than elsewhere in their wide ranges.

## 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. 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 MAR 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 mid-water 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 and the fishery was conducted only periodically (ICES, 2007). The fishery on *C. rupestris* takes deep-water redfish (*Sebastes spp*), orange roughy (*H. atlanticus*), blackscabbard fish (*A. carbo*) and deepwater sharks as bycatch (Shibanov *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 MAR. The (trawl) fishery took place on five features on the MAR, 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; 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).

It can be concluded that past fishing acitvities 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 and 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 (*C. rupestris*) 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).

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 MAR are pristine. Nevertheless, recent studies (*e.g.* MAR-ECO[4] and ECOMAR[5] projects, 2001-

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[4] http://www.mar-eco.no/about accessed 30 May 2012

present) of the MAR have revealed that the fauna was incompletely described, simply due to the fact that previous studies were few and not very comprehensive. A range of species new to science have been described and many known species had ranges extended. Species lists for most taxa were expanded significantly. In this situation it is hard to determine what should be regarded as 'natural', perhaps especially when considering the pelagic realm. The overall impression is, however, that the area can still be considered to have a rather high 'naturalness'.

## 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 MPA. 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 fishes that have been targeted by past fisheries, *e.g.* grenadier, redfish, tusk, orange roughy and others may recover substantially faster than for example coldwater corals and sponges, but some may require decades of reduced mortality and good recruitment. It is probably justified to conclude that these species that may have been reduced in abundance are already in the process of recovery.

## 2. Degree of acceptance

As noted earlier, the area includes species listed as priority concern for OSPAR (OSPAR Commission 2003). The represented 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 Convention on Biological Diversity (CBD) for identifying candidate sites for protection on the high seas (UNEP, 2007). Therefore there are strong scientific grounds warranting protection of the area.

### Fishing

North East Atlantic Fisheries Commission (NEAFC) fishery closures already exist in this region of the Mid-Atlantic Ridge incorporating the Faraday Seamount, Hecate Seamount and a section of the MAR (NEAFC, 2008). The first set of closures was instigated in 2004 and was in effect until 31st December 2008 (NEAFC, 2008). Compliance with these closures appears to have been 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 experiences increased fishing in the year following protection as compared to when it was unprotected (ICES, 2007a). No information is available for subsequent years. A much larger closure to bottom-contact gear, the middle MAR, was introduced in 2009 and will run until 31 December 2015. The northern part of this closure broadly corresponds with the boundaries of this MPA.

The MAR within the 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).

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[5] http://www.oceanlab.abdn.ac.uk/ecomar/

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. It is also a consequence of the suite of other regulations introduced by NEAFC during the past decade (precautionary TACs, effort caps, vessel licencing, bottom fishing regulations outside closures, port state measures to combat IUU) and the continuous mandatory monitoring by VMS.

As a consequence, presently the fishing effort exerted on the MAR is very low (ICES, 2005). Therefore, a MPA safeguarding critical deep-water species and stocks should be acceptable to all North Atlantic coastal states. Another point is displacement of fishing effort, the MAR 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 area, combined with the fact that fishers appear to avoid some sections of the MAR completely, together leaving limited fishing to displace, it is thought that minimal displacement will occur.

The already existing closures, the currently low fishing effort in the area and an increasingly stricter management of deep-water fishery by NEAFC and the European Union (see *e.g*. NEAFC recommendations 2007, EC 2015/2006, European Parliament 2007) may indicate a 'commonality of purpose' related to the establishment of an MPA on the MAR. The measures required will have to be proportionate to the conservation objectives of the MPA and will be in the responsibility of NEAFC.

### Science

Science will not be affected by any management regime other than being bound to a code of conduct to minimize impacts – see OSPAR Code of Conduct for Responsible Marine Research in the Deep Seas and High Seas of the OSPAR Maritime Area (OSPAR Agreement 2008-01).

### Tourism

No tourism present

### Bioprospection

No information at present. However, the current debate concerning sharing of genetic resources is aiming to set out a regime whereby bioprospecting will be appropriately licensed and therefore in future this could become a significant activity with implications for the conservation objectives of the MPA.

### Mining

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

### Transport

It is unlikely that transportation will be affected.

## 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, and in the case of fisheries have been successfully 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. The challenge will be to bring illegal and unregulated fishing under control although progress is being made on this within the NEAFC region (OSPAR QSR, 2010). Because the area in question incorporates NEAFC fishery closures, the Faraday Seamount and the Hecate Seamount (NEAFC, 2008) the management or at least enforcement of measures may be easier. Further dialogue is needed with all competent authorities (*e.g*. IMO, ISA, ICCAT, IWC) and has been started in the form of developing a draft 'Collective Arrangement' between all the organisations concerned.

# 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$^{o}$ N, 35$^{o}$ 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$^{o}$ N, 30.3$^{o}$ 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 MAR by the chartered longliner *MS Loran* (Dyb & Bergstad, 2004) that was operating as part of the MAR-ECO programme 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).

As noted earlier, there has been commercial fishing activity on the MAR 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$^{o}$ and 62$^{o}$ 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$^{o}$ N (Hareide & Garnes, 2001; Gordon *et al.,* 2003).

Gordon *et al.* (2003) attributed the reduction in activity over the MAR around the beginning of the 21$^{st}$ 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 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 restrictions and closures (such as the prior mentioned NEAFC closures) have occurred to attempt to create sustainable deep-water fisheries (ICES, 2007c).

Threats from future fishing activity to this area depend on future management and economics. The current NEAFC regime provides a robust framework to limit adverse fishing impacts, bottom fishing closures are in place until 2015 and fuel prices have significantly reduced long-distance deep water fishing effort in the North-East Atlantic over the past decade.

An analysis of ship traffic (passage and density) indicates that ocean-going shipping routes cross the MPA and further work is needed to ascertain whether this may result in significant impacts (*e.g.,* ballast water organisms, underwater noise, accidental spillage of hazardous substances).

## 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 maritime area 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).

The fieldwork for the MAR-ECO project has now been completed and the results from the UK consortium's second field campaign, focusing on the Sub-Polar Front are yet to be published. This research investigated 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[6] (CoML) (Bergstad *et al.,* 2008a; Vecchione et al. 2010).

Our knowledge of mid-ocean ridges remains sparse at best. Even with the MAR-ECO project 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, 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

A management plan should be developed to reflect OSPAR Recommendation (2010/13).

## 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):

NEAFC closure to bottom fisheries.

[6] http://www.coml.org/

**Presented by**

**Contracting Party:**

**Organisation:**

**Date:**

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OSPAR COMMISSION

Victoria House
37-63 Southampton Row
London WC1B 4DA
United Kingdom

t: +44 (0)20 7430 5200
f: +44 (0)20 7242 3737
e: secretariat@ospar.org
www.ospar.org

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

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