# Proforma for compiling the characteristics of a potential MPA

## A General information

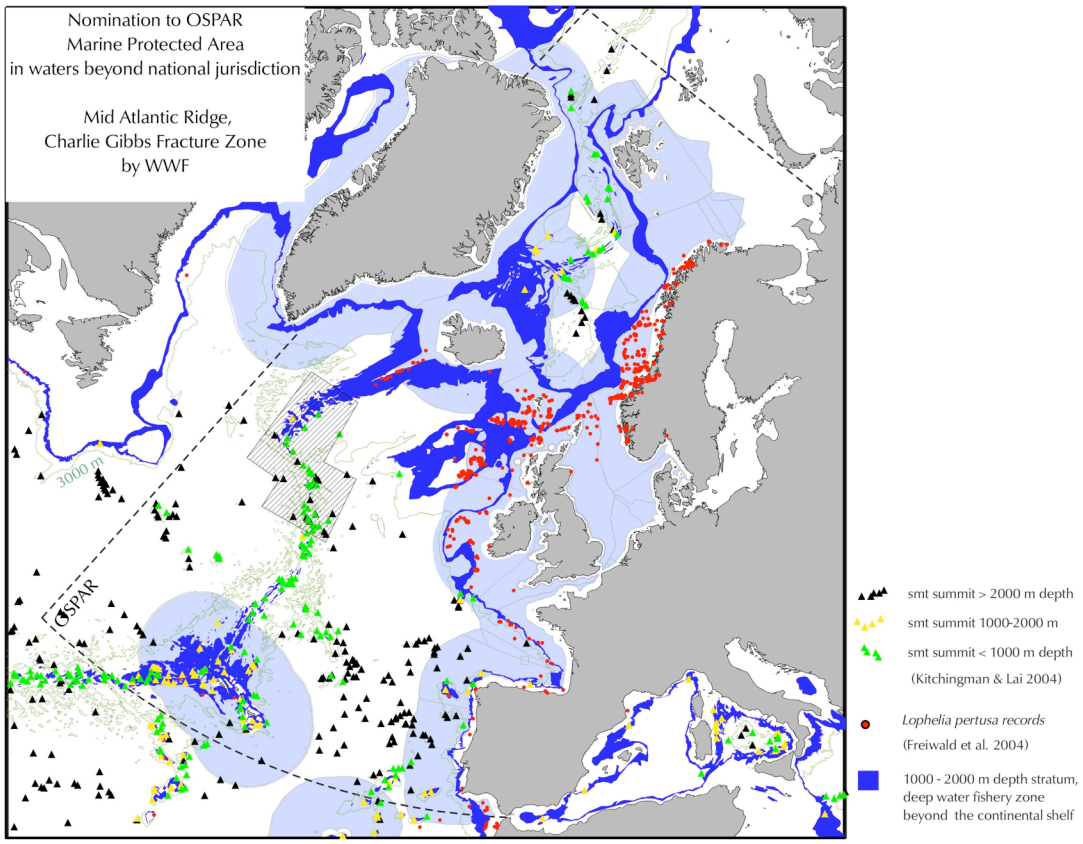


Fig. 1: Location in the OSPAR Maritime Area of the proposed MPA on the Mid-Atlantic Ridge

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### 1. Proposed name of MPA

# Mid Atlantic Ridge/Charlie Gibbs Fracture Zone

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### 2. Aim of MPA

- Protect and conserve areas that best represent the range of species, habitats and ecological processes in the OSPAR area.
- Protect, conserve and restore (those) species, habitats and ecological processes which are adversely affected as result of human activities;*
- Prevent degradation of and damage to species, habitats and ecological processes following the precautionary principle.

* The scale of impacts on species, habitats and ecological processes causing adverse effects is currently unknown. However, Russian researchers have repetitively called for regulation of the fisheries on the deep water fish stocks of the MAR (Shibanov *et al*. 2002, Vinnichenko 2002).

## 3. Status of the location

The Mid Atlantic Ridge is located beyond the limits of national jurisdiction of the coastal States in the OSPAR Maritime Area and Canada. The site proposed is also outside the potential Outer Continental Shelf of Iceland and Greenland (acc. Part IV, Art. 76 UNCLOS).

According to Article 134 (2) UNCLOS, activities in the Area (sea-bed, ocean floor and subsoil thereof) shall be governed by the provisions of Part XI. According to Article 137 (2) UNCLOS "All rights in the resources of the Area are vested in mankind as a whole, on whose behalf the Authority shall act. These resources are not subject to alienation. The Minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority."

According to Article 86 *et seq*. UNCLOS the superjacent waters are considered as High Seas, which are open to all States, including the freedom of scientific research.

According to Article 238 UNCLOS all States have the right to conduct marine scientific research.

## 4. Marine region

OSPAR Region V, Mid Atlantic Ridge

## 5. Biogeographic region

Atlantic Realm; Atlantic Subregion, North Atlantic Province; South Iceland-Faroe Shelf, Cool-temperate Waters

## 6. Location

The area proposed covers a part of the northern Mid Atlantic Ridge, south of Iceland, including the Charlie Gibbs, Faraday and Maxwell Fracture zones. The proposed area comprises the seamounts Faraday and Hekate, and in the north the section of the Reykjanes Ridge where bottom trawling and fishing with static gear, including bottom set gillnets and longlines has been prohibited since 2004 until presently 31 December 2009 (NEAFC Recommendation VII: 2008).

## 7. Boundaries of the proposed MPA:

| Latitude N | Longitude W |
|---|---|
| 58 | -30 |
| 58 | -37 |
| 51 | -37 |
| 51 | -33 |
| 49 | -33 |
| 49 | -26 |
| 53.5 | -26 |
| 53.5 | -30 |
| 58 | -30 |

## 8. Size

The marine protected area proposed has an extent of approx. 620000 sqkm.

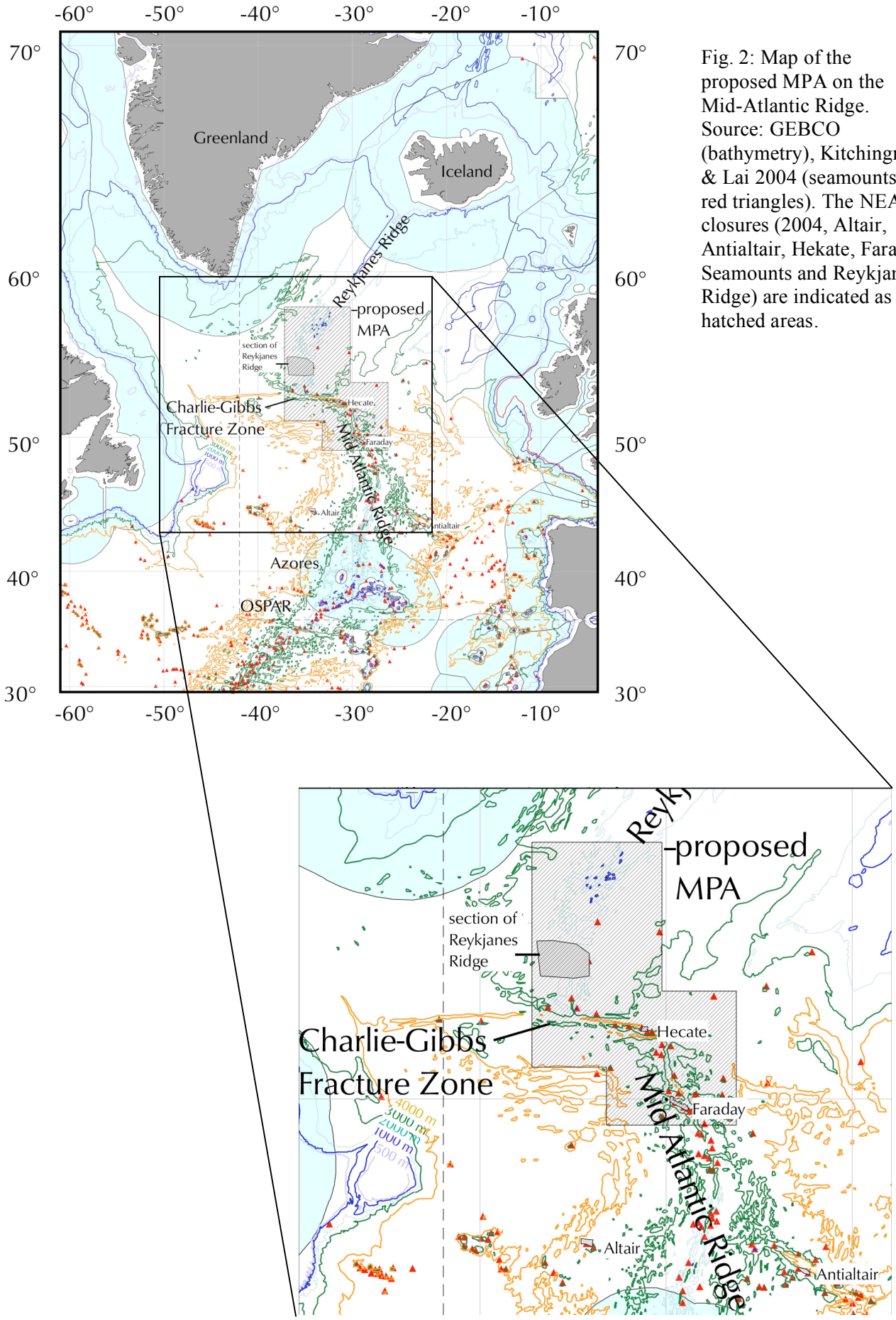


Fig. 2: Map of the proposed MPA on the Mid-Atlantic Ridge. Source: GEBCO (bathymetry), Kitchingman & Lai 2004 (seamounts, red triangles). The NEAFC closures (2004, Altair, Antialtair, Hekate, Faraday Seamounts and Reykjanes Ridge) are indicated as hatched areas.

## 9. Characteristics of the area

In the OSPAR Maritime Area, the mid-Atlantic Ridge (MAR) extends from the Lomonossov Ridge in the Arctic Ocean to its southern border. Its shallower part extends from Iceland south to the Azores, both islands on top of ridge-associated seamountsThe MAR represents 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. The topography is spectacular with depths ranging from 4500 m in the deepest channel to only 700-800m on top of adjacent seamounts.

Relief of the axial part of the MAR is presented by systems of separated volcanic rocky mountains. More than 170 seamounts with depths less than 1500 meters were found in the northern part of MAR between 43° and 60°N during Russian explorations in 1972-1984. The majority of seamounts is 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 and shelly and benthos detritus (Shibanov *et al*. 2002 and literature therein). With its deep, sometimes abyssal valleys and intermittend 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 the isolated seamounts surrounded by deep ocean and from continental slopes where effects of coastal processes are pronounced. They affect not only the availablity 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*. Opdahl *et al*. 2008). 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 midocean 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 & Khlimoy 2004) .

Along the ridge, the Charlie Gibbs Fracture Zone (CGFZ) is a major transversal feature at about 52°N, next to two others at 50° (Faraday Fracture Zone) and 48° N (Maxwell Fracture Zone), respectively . At the CGFZ the axis of the southern part of ridge shifts about 5° east from that of the northern part and forms the deepest connection between the northeast and northwest Atlantic. The topographic features have a major impact on the hydrography, and the flow of deep-water between the western and eastern deep-sea basins of the North Atlantic which occur through these deep channels and affects to whole circulation (Rossby 1999, Bower *et al*. 2002, Søiland *et al*. 2008).

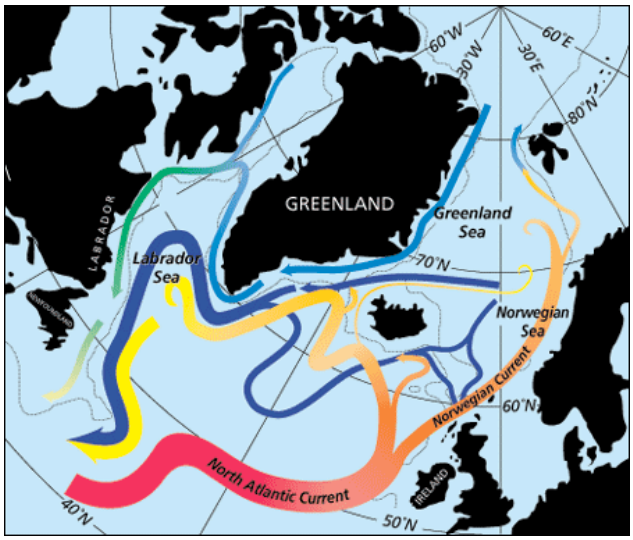


Fig 3: Pathways associated with the transformation of warm subtropical waters into colder subpolar and polar waters in the northern North Atlantic. Along the subpolar gyre pathway the red to yellow transition indicates the cooling to Labrador Sea Water, which flows back to the subtropical gyre in the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

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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 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 ist a permanent feature (Figure 3). The subpolar front meandering at 61-62°N and 30-31°W is an area of high biological production and biomass in the pelagial and benthal (see MarEco results 2008) and and can be considered a third oceanographic zone, distinct from the areas north and south of the frontal zone on the ridge (i.e. Heger *et al*. 2008).

**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 and Kawaguchi, 1980; Magnusson, 1996). 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 and Gordon, 1983; Roe and Badcock, 1984; Sameoto, 1988). The redfish 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 and Magnusson, 1995)" (from 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, 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, 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 MAR were the egg production rates higher than in the CGFZ and subpolar front (Gislason *et al*. 2008). The subpolar front is acting as a boundary for several species, reflecting vertically and horizontally the different water masses and therefore also clearly reflected in the zooplankton community structure north and south of CGFZ (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 (from Mar-Eco cruise report Leg 2), indicating that the MAR does excert 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*occured north/within and south of the frontal zone, respectively. The highest number of species was collected in the southern box. 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).

Sigurðsson *et al*. (2002) identified a total of 99 species of **pelagic fish** from 43 families which group into 5 main assemblages from the trawl-acoustic redfish surveys south of Iceland. From the acoustic surveys it is evident that the deep scattering layer formed by a.o. deep pelagic fishes is most dense over the northern mid Atlantic ridge (Fig. 4). Both, the latitudinal and the cross-ridge patterns were confirmed by Opdahl *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.

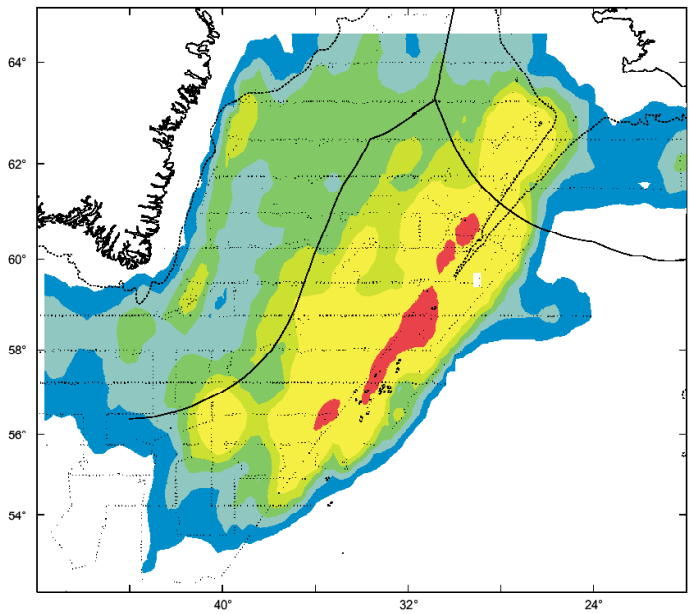


Fig. 4: Deep scattering layer of pelagic fish except redfish (red shows highest concentration) over the northern Mid Atlantic Ridge, north of 56° N (June-July 2001). Source: Sigurðsson *et al.* (2002, his Fig. 3).

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 7 species of dolphins (Doksaeter *et al*. 2008): Two of the four most frequently observed species occurred only north of the CGFZ (Pilot whale, white-sided dolphin), the other two species (common dophin, striped dolphins) were found in the warmer, more saline water south of the CGFZ. Dolphins tended to aggregate over the slope of the ridge, independant of water depth, following the distribution of their most important prey, various species of mesopelagic fishes and squid.

The ecosystem associated to the Mid Atlantic Ridge seems to be of particular importance to sei and sperm whales. The highest aggregations of baleen whales and especially sei whales (*Balaenoptera 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). Sei whales in particular were most abundant over the slopes of steep seamounts and rises in water depths between 1500 and 3000 m, whereas sperm whales 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) :

Northern fulmars 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 km2, and no large-scale concentrations were noted. However, discrete elevations in densities were recorded both in the Reykjanes and the CGFZ regions. The Greater Shearwater (*Puffinus*

*gravis*) was observed only in the frontal area just north of the CGFZ. Most of the birds were recorded in the frontal area of the fracture zone, 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 CGFZ frontal area great shearwaters were mainly seen in singles. Corys Shearwater (*Calonectric diomedea*), on the other hand is found only south of the Greater Shearwater distribution area – usually not in flocks except forr an area where warm Gulf Stream water surfaced. Cory´s shearwater was 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 CGFZ and subpolar frontal region. The turtles presumably use the overall current direction for transport to their north American rookeries and benefit of the elevated plankton biomass near the subpolar front.

**Benthic system**

Ridges like the Mid Atlantic ridge provide a large variety of benthic habitats. The hard bottoms 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 MAR 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*. review of 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 occured 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 CGFZ 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 ostur and 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 (Feller *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. Molodsova *et al*. (in prep) 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. At several very large areas the remains of former coral reefs were found. However, no conclusive answer is possible on the likely cause of destruction. Also, the video inspections revealed lost fishing gear in several places (Fig. 6, Mortensen *et al*. 2008) which, given the very few stations sampled, may point to a very high number of lost gear.

*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 was most common on the video in the north and central sites, but rare on video in the south. 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. (ICES WG DEC report 2006). 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).

**Demersal Fish fauna**

The biogeography of the seamount related fish fauna of the North Atlantic, caught mainly as bycatch in pelagic 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), including 44 species of deepwater sharks such as Chlamydoselachidae, Pseudotriakidae, Scyliorinidae and Squalidae, including leafscale gulper shark (*Centrophorus squamosus*), Gulper shark (*C. granulosus*), Portuguese dogfish (*Centroscymnus coelepis*) [1]. Shibanov *et al*. (2002), in a brief summary of hundreds of Russian scientific papers, account for more than 200 benthic and pelagic fish species in the region and consider roundnose grenadier, redfish, alfonsino and orange roughy at the most important for commercial exploitation.

The biogeographic boundary of the CGFZ is also evident in the distribution of commercially relevant deep water fish (Hareide & Garnes 2001): 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 by trawling at appr. 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,* see Fig. 4) and south of 46 °N by goldeneye perch (*Beryx splendens*). The authors report about the quick[3] exaustion of these seamount aggregations 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 biogegraphic zones, however emphasize the importance of the CGFZ and the subpolar front for the location of the split between northern and transitional communities.

Vinnichenko (2002) quotes a number of studies (Samokhvalov *et al.,* 1981; Borets, Kulikov, 1986; Melnikov *et al.,* 1993; Zaferman, Shestopal, 1996; Vinnichenko, 1998; Shibanov, 1998; Vinnichenko, 2002) to support

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[1] These three species of deep water sharks were accepted for nomination to OSPAR for inclusion on the OSPAR List by BDC/MASH 2007.

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

[3] 1 year of longlining on *Sebastes marinus*, 2 years of *Beryx splendens* fishery

that the abundance of fish stocks on the seamounts is rather low. Therefore, the stock abundance and catch depend on the production of fish on the seamounts. 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) concludes that "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".

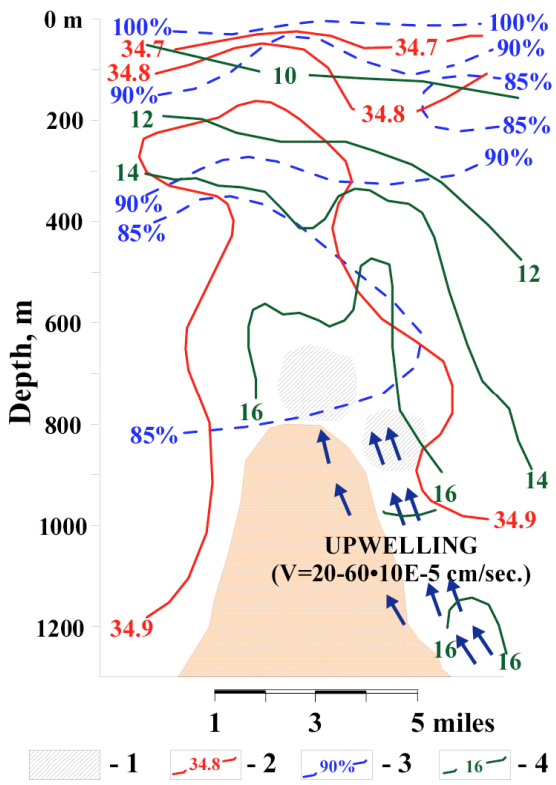


Fig. 4: The distribution of roundnose grenadier (1-hatched) in relation to environmental parameters (2-salinity, 3-dissolved oxygen, 4-biogenes in meg at/l) and the seamount peak and slope in the area of the CGFZ at 53° N (Shibanov et al. 2002)

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## B Selection criteria

### *a. Ecological criteria/considerations*

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#### 1. Threatened and declining species and habitats

Species:

| | | | | |
|---|---|---|---|---|
| **Hoplostethus atlanticus* (Collett, 1889) | Orange roughy | *hoplostète orange* | **I, V** | **All where it occurs** |
| *Caretta caretta* (Linnæus, 1758) | Loggerhead turtle | *caouanne* | **IV, V** | **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:

| | | |
|---|---|---|
| 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**[4] |

All of the above mentionned species and habitats occur in the proposed area, however, there is insufficient knowledge to proove the special importance of the MAR section proposed to the life and success of populations and communities other than the indications given in Part A.

What can generally be said is that due to its high productivity at the subpolar front, the area is of particular importance as a feeding area for marine mammals, in particular also baleen whales. The ridge structure is important for deep water sharks, its topographically induced hydrographic conditions enhance deepwater teleost fish aggregations, including of orange roughy, 40 taxa of cold water corals, including *Lophelia pertusa* and *Solenosmilia variabilis* as main structure builders, and 27 octocoral taxa most commonly occur between 800 and 1400 m.

#### 2. Important species and habitats

The northern MAR is considered to be the main reproduction area of *i.e.* roundnose grenadier, and may be crucial for the reproduction of bathypelagic fish. It provides the only extensive hard substrate available for propagation of benthic suspension feeders off the continental shelves and isolated seamounts.

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#### 3. Ecological significance

1. High proportion of habitat in the OSPAR area

The northern part of the MAR lies entirely in the OSPAR area. The area proposed comprises but a section of the MAR including the Charlie Gibbs Fracture Zone and adjacent areas. Along the MAR, species communities change gradually from north to south however the CGFZ and coinciding the subpolar front represent an important barrier to this along ridge dispersal.

2. A high biological productivity system is represented.

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[4] A search for further evidence will be made.

The subpolar front at about 52° N is a typical high production convergence zone of subpolar and Atlantic water. The high plankton production attracts a large number and variety of secondary consumers and top predators. Large aggregations of feeding whales were observed to exploit high concentrations *Calanus finmarchicus* just north of CGFZ .

## 4. High natural biological diversity

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 the 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

## 5. Representativity

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 MAR provides the only hard substrate and relatively shallow depths in the otherwise sedimentary abyssal plains of the North Atlantic.

## 6. Sensitivity

The proposed section of the MAR through it associated 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 deep water species such as orange roughy, 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.

## 7. Naturalness

Despite the remoteness of the Mid Atlantic Ridge, the area is not pristine anymore. Primarily, Soviet/Russian trawlers have intensively exploited the roundnose grenadier, orange roughy and alfonsino stocks of the MAR since the early 1970s (Shibanov *et al*. 2002). 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 roundnose grenadiers. After the quick depletion of the local seamount stocks on the northern MAR (see Fig. 5) the fishery was conducted only periodically. The fishery on roundnose grenadier takes deepwater redfish, orange roughy, blackscabbard fish and deepwater sharks as a bycatch (Shibonov *et al*. 2002, Clark *et al*. 2007[5]). In the 1980s, a significant longline fishery for tusk developed on the seamounts between 51 and 57 ° N. 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, an Clark *et al*. 2007 and literature therein).

It can be concluded that today, in particular the stocks of aggregation forming fish species such as roundnose grenadier, orange roughy, alfonsino, redfish and others are depleted in the fishery sense, or at least significantly reduced. Changes of the overall ecosystem structure can therefore be expected (ICES WG RED 2006, 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 also on the MAR, lost fishing gear was found entangled with corals on the seafloor, and large fields of Lophelia remains raise questions about the cause of

[5] Clark, M. 2007. Large-scale distant-water trawl fisheries on seamounts. Pages 361-400 In: Seamounts: Ecology, Conservation and management. Eds. Pitcher et al., pp. 1-520

destruction (Fig. 6). Waller *et al*. (2007)[6] documented extensive human–caused impacts on two of the Corner Rise seamounts, 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.

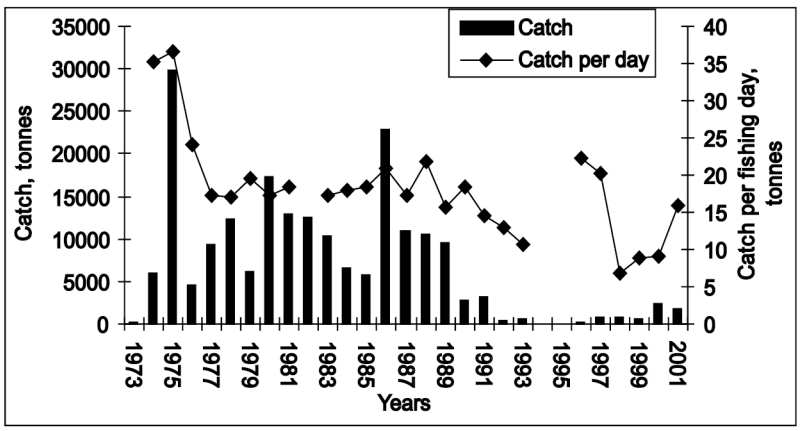


Fig. 5: Catch and Catch rate dynamic on Mid Atlantic Ridge seamounts. Soviet/Russian fisheries 1967-2001 (Vinnichenko 2002)

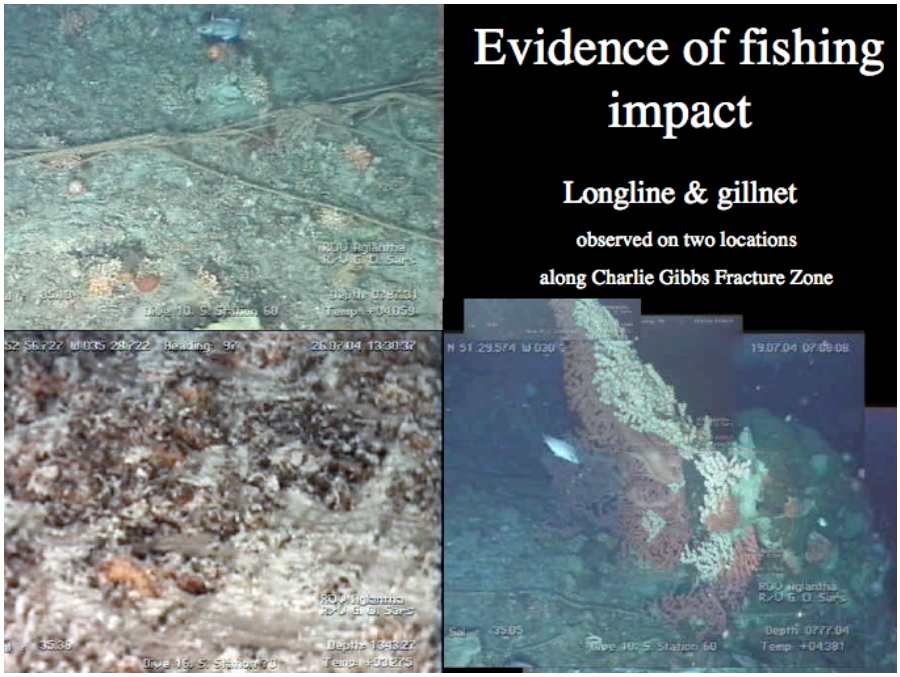


Fig. 6: Evidence of fishing impact. Ropes (A) and video mosaic of damaged Paragorgia arborea (B) from dive # 10 st. 60. (C) A net, probably from apelagic trawl lying over coral rubble (Mortensen et al. 2008)

The ICES working group on Regional Ecosystem Description (WG RED 2006) concluded: "Over the last 15 to 20 years, the deep-water ecosystem was significantly impacted by fishing as and when fishery extended deeper partly as a result of overexploitation of shelf stocks. Deepwater stock are typically low productive and their sustainable levels of exploitation are much smaller than those of shelf stocks. Towed fishing gears have severe impacts on benthic communities; this is a major problem on structurally complex habitat including biogenic reefs. On the same kind of reefs netting is also considered undesirable as it can generate (i) habitat disturbance because of lots nets and dumping of used nets and (ii) ghost fishing. Therefore deepwater trawling should be restricted to primarily sedimentary bottoms and where possible fisheries should shift to longlining and closely managed netting (out of coral areas) as was successfully done in some southern hemisphere fisheries (fishery for Patagonian toothfish, Disostichus eleginoides, in the South Georgia and South Shetland Islands)."

[6] Waller, R., L. Watling, P. Auster, P. T. Shank 2007. Anthropogenic impacts on the Corner Rise seamounts,north-west Atlantic Ocean. J. Mar. Ass. UK 87, 1075-1076

*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. Possible shifts in species communities due to removing top predators from the ecosystem are not likely to be reversable. Judging from the slow growth rates, and given the low temperatures and food abundance, damages done to cold water coral communities and other sensitive habitats and species will take at least decades to be compensated – recovery patterns of deep water coral areas are not known yet.

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**2. Degree of acceptance**

Fishing: Presently, the fishing effort excerted 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 safegarding not only sensitive benthic habitats but also critical deep water species and stocks should be acceptable to all North Atlantic coastal states.

Science: Science will not be affected by any management regime other than being bound to a code of conduct to minimise impacts – see draft OSPAR guidelines for research (MASH06/3/4).

Tourism: no tourism

Bioprospection: unknown

Mining: subject to ISA licensing, no exploration nor exploitation plan known yet

Transport: will not be affected

Cable laying: not known, however, it seems likely that an agreement could be reached

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**3. Potential for success of management measures**

See above, if measures can be agreed and are accepted then the management objectives will be reached.

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**4. Potential damage to the area by human activities**

Fishing: Fishing is likely to have caused already a significant impact on the MAR ecosystem: Commercial deep water trawling activities by USSR/Russian vessels is ongoing since 1973, total catches amouting to 205000 t until 2001, of which 201000 t were roundnose grenadier, trawled at ca. 30 seamounts along the MAR (Shibanov *et al*. 2002). The large catches of roundnose grenadier, alfonsino and pelagic redfish of the virgin fisheries in the 70s could only be maintained for a few years due to decreasing fish densities and CPUE.

Science: Scientific sampling takes place on a very small scale compared to the overall size of the site and compared to the intensity and impact of fishing. It is unlikely that biological and also geological sampling causes any significant damage to habitats and/or species. However, science should be bound to a code of conduct to minimise impacts – see draft OSPAR guidelines for research (MASH06/3/4).

Bioprospection: see science

Mining: Would locally destroy the benthic habitat and cause toxic pollution and large scale sediment plumes in the pelagial, affecting the biota and sedimenting to the sea floor.

Transport: Risk of pollution

Military: Far-field effect of sonar, in particular LFASonar, on marine mammals

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**5. Scientific value**

The Mid Atlantic Ridge is one of the least explored places in the world. And although fishing activities have been ongoing since 3 decades, the relative human pressure on the ecosystem in general is low. This is one of the last frontiers of science.

## C. Proposed management and protection status

### 1. Proposed management

not yet defined

### 1.1. Management goals:

a. Maintain and restore the natural deepwater ecosystem of the Mid Atlantic Ridge, including its function for migratory species

b. Improve the scientific understanding

c. Improve the public understanding

### 1.2. Management objectives

d. Recovery of deepwater fish stocks and benthic ecosystem

e. Ensure longterm sustainable scientific research

f. Ensure that the increasing scientific knowledge contributes to public education.

g. Monitor the state of the ecosystem

MASH 2005 (MASH 05/8/1) agreed that the following sections are to be left empty for the time being.

### 1.3. Management measures:

### 1.4. Management enforcement and authority:

### 2. Any existing or proposed legal status

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**Presented by**

**Organisation: WWF**

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