Protecting ecologically and biologically significant areas (EBSAs):

Lessons learned from the implementation of UN resolutions to protect deep-sea biodiversity

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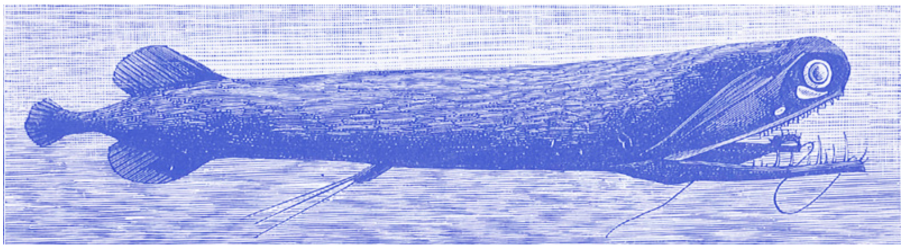

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Cover: Pelican eel *Eurypharynx pelecanoides* found on 2300 m depth (De Natuur, 1884)

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Contents

Summary

This report describes and evaluates the protection of biodiversity of the high seas (areas beyond nations EEZ) through the implementation of UN resolutions and comes forward with recommendations that can be used for the protection of biodiversity through a parallel process: the selection of EBSAs by the CBD (Part 1). We furthermore provide background information on deep-sea habitats (Part 2) and human pressures (Part 3) and we created a database of vulnerable marine ecosystems (VMEs) closed to bottom fisheries (www.highseasmpas.org).

Part 1. Protection of deep-sea biodiversity

The biodiversity of the open ocean and deep-sea is under increasing pressure. To protect deep-sea biodiversity in the high seas (areas beyond EEZs), the United Nations General Assembly (UNGA) has called for urgent action. A series of resolutions (59/25, 61/105 and 64/72) have been adopted by the UN General Assembly over the past several years (2004, 2006 and 2009). These commit high seas fishing nations both individually and through relevant Regional Fishery Management Organizations (RFMOs) to manage (bottom) fisheries in areas beyond national jurisdiction to prevent significant adverse impacts on vulnerable marine ecosystems or else prohibit such fishing from occurring.

The key measures called for by the UN GA resolutions concern:

- Impact assessments prior to fishing
- Identification of vulnerable marine ecosystems (VMEs) (such as cold water corals and sponges)
- Closure of areas where VMEs occur (see map on www.highseasmpas.org)
- Application of the “Move-on” rule (when VMEs are encountered, the ship should move on)
- Long-term sustainability of deep-sea fish stocks
- Gear restrictions
- Transparency/accountability

These key measures have only partially been implemented at best:

- Most states have not conducted impact assessments consistent with FAO guidelines
- Substantial high seas areas have been closed to bottom fishing but most of the area closures are temporary and limited to areas of little interest to the fishing industry.
- Most high seas bottom fisheries target (and take as bycatch) long lived, slow growing, low fecundity species which are highly vulnerable to overexploitation and depletion.
- The absence of sufficient information on the biological characteristics and status of most target and bycatch species impacted by high seas bottom fisheries renders it impossible to establish conservation and management measures to ensure long-term sustainability.

In a parallel process, the Conference of the Parties of the Convention on Biological Diversity (CBD) adopted a set of internationally agreed scientific criteria for identifying ecologically or biologically significant marine areas (EBSAs) in 2008, in response to the call of the World Summit on Sustainable Development (Johannesburg, 2002) for the development of representative networks of Marine Protected Areas, including in areas beyond national jurisdiction, by 2012. EBSAs should be used to form the basis for selecting areas in need of protection to establish a representative network of marine protected areas. The Conference of the Parties of the CBD also ‘encourages’ States to make use of environmental impact assessments (EIAs) and strategic environmental assessments to avoid degradation or destruction of ecologically or biologically significant marine areas. However, a detailed plan for the management of activities with a potential for adverse impacts on EBSAs has not yet been agreed other than to establish

representative areas of marine protected areas. The process of selecting EBSAs started in 2011 with a number of regional workshops.

Based on the lessons learned from the implementation of UN resolutions to protect deep-sea biodiversity, we have defined a set of recommendations that apply to the selection and establishment of EBSAs. In short, we recommend (see Chapter 5):

1. Robust application of the criteria for the identification of EBSAs
2. Robust use of the best biogeographic information and predictive modeling to determine where EBSAs are likely to occur
3. Comprehensive and uniform application of environmental impact assessments
4. Clear application of the precautionary approach in relation to scientific uncertainty as to the potential negative impact on EBSAs
5. Preventing "significant adverse impacts" on EBSAs
6. Sensible use of the move-on rule
7. Incorporation of international agreements to protect EBSAs into national, regional and international law
8. Regular review and oversight of the actions taken by States and regional organizations
9. Institutional mechanisms for protecting EBSAs, including through establishing MPAs in areas beyond national jurisdiction
10. Enforcement: Monitoring, control and enforcement are essential to the effective management of fisheries and the same applies to other activities in areas beyond national jurisdiction

Part 2. Overview of deep-sea ecosystems

Since the 19th century, 27 new habitats and/or ecosystems have been discovered in the deep sea, the majority of which only in the past few decades. The Census of Marine Life (CoML) program, a massive 10-y research program that has ended in 2010 has provided many new insights in global marine biodiversity. We have summarized information on these habitats and we provide distribution maps were possible.

The largest part of the deep-sea seafloor (75%) consists of abyssal plains, followed by the continental margin (11%), ridges (9.2%) and seamounts (2.6%). Seamounts are volcanic mountains with peaks rising more than 1 km about the surrounding seabed. Their complex topography may contribute to a high productivity and they can be hotspots for marine life. The CoML discovered 600 new species on 5 investigated seamounts. Small seamounts are called 'knolls' and flattened seamounts are known as 'guyots'. The seamount biological communities are very vulnerable to deep-sea fishing. Cold water corals are estimated to cover at least 280,000 km^2 (7x the size of the Netherlands), which is similar to the area covered by shallow water corals (284,300 km^2). Of the approximately 5080 known coral species worldwide, >65% occur below 50 m depth (>3300 species). Whale falls are dead whales, of which there may be half a million at any given time worldwide, which serve as food rich oasis for a suite of organisms for decades and share a number of species with cold seeps and hot vents. The latter are chemosynthesis based communities, where many organisms are found that are not found anywhere else on earth.

Part 3. Overview of threats to deep-sea biodiversity

Of all anthropogenic impacts in the deep-sea in areas beyond national jurisdiction, the impact of fishing is the largest and most direct and, in the case of the North East Atlantic, probably of at least an order of magnitude greater than all other activities combined. In the future, ocean acidification, oil and gas extraction, carbon capture and storage, and seabed mining may have important consequences for deep-sea biodiversity. At this moment, high seas fishing is generally concentrated in areas with high biomass of biodiversity, while shipping or infrastructure projects are probably not related to biodiversity hotspots.

Deep-sea fishing. By far the majority of the vessels conducting deep-sea bottom fisheries on the high seas are bottom trawl vessels. Bottom trawling scrapes and ploughs the sediment and damages benthic habitat forming species such as sponges and cold water corals. In addition, deep-sea fishing targets and takes as bycatch low productivity species of fish; species which are highly susceptible to overexploitation and which cannot easily recover from over fishing. Moreover, deep-sea fishing not only causes the decline of fish populations at fishable depths, but may affect fish populations at depths well below or beyond the actual fishing grounds. An estimated 285 vessels were active in high seas bottom fisheries in 2006. This fleet catches about 0.36% of the global marine fish catch. Bottom trawling (80% of the catch) is the most widespread form of bottom fisheries, followed by bottom longline fisheries. The area impacted by bottom trawling is estimated to be two orders of magnitude higher than by bottom longline fisheries. Longlines can however be used in areas not accessible to bottom trawlers, such as rocky areas.

Another important future threat to biodiversity is ocean acidification. It is feared that organisms such as cold water corals will become hindered in growth and will become vulnerable to dissolution as a result of a decrease in the carbonate saturation state of oceanic waters. Also oil and gas extraction can result in huge environmental impacts, as was shown by the Deepwater Horizon disaster in the Gulf of Mexico. Currently, carbon capture and storage does not take place in the high seas yet, but CO_2 can potentially be put stored in geological formations under the seabed, in the water column below 2500 m or in 'carbon lakes' at depths exceeding 3000 m. Deep-sea mining is still in an experimental stage, but this activity will become a commercial activity and will have a large-scale impact on the seabed. Other impacts include submarine cables and pipelines, exploratory research, bioprospecting and dumping of waste.

Finally, in the annexes of this report we have included the texts of the relevant agreements, a list of VME areas closed to bottom fisheries, maps, and a number of links to useful databases and websites.

1. Introduction

Scope and purpose

To protect deep-sea biodiversity, the United Nations have adopted a number of resolutions that should protect vulnerable marine ecosystems through the regulation of deep-sea fisheries on the high seas (waters beyond a nation's EEZ). In a parallel process, the Convention on Biological Diversity calls upon states to identify and establish marine protected areas, based on a set of criteria. In part 1 of this report we analyze the progress made in deep-sea protection and we formulate a set of recommendations. In part 2, we provide a short overview of the main deep-sea ecosystems and of the currently existing marine protected areas in the high seas. In part 3 we provide an overview of threats to deep-sea biodiversity.

The aim of this report is to contribute to the protection of deep-sea biodiversity by providing recommendations and relevant information on several aspects of deep-sea biodiversity to policy makers, managers and scientists. IMARES and Matthew Gianni have compiled this report for the Dutch Ministry of Economic Affairs, Agriculture and Innovation (Ministry of EL&I).

Protection of deep-sea biodiversity

The biodiversity of the open ocean and deep sea is under increasing pressure; in the case of the latter, deep-sea fishing constitutes the most immediate direct threat (e.g., Robberts 2002, Freiwald et al. 2004, Benn et al. 2010). The United Nations General Assembly (UNGA) has called upon high seas fishing nations and regional fishery management organizations/arrangements (RFMO/As) to identify areas where vulnerable marine ecosystems (VMEs) such as cold-water corals and deep-sea sponge beds are known or likely to occur, and close such areas to bottom fishing unless the fisheries can be managed such that damage to these ecosystems is prevented.

In a parallel process, the Conference of Parties (COP) to the Convention on Biological Diversity (CBD) has adopted a set of criteria for identifying ecologically and biologically significant areas (or EBSAs) in need of protection in areas beyond national jurisdiction (CBD 2008). These criteria are designed to assist States in the designation of representative networks of marine protected areas, including in areas beyond national jurisdiction, as called for in the Johannesburg Plan of Implementation of the World Summit on Sustainable Development in 2002 (UN 2002).

This report reviews the implementation of the UN General Assembly resolutions for the protection of deep-sea biodiversity in areas beyond national jurisdiction (ABNJ) from the harmful impacts of fisheries. It also considers the extent to which the General Assembly's approach to the management of deep-sea fisheries could serve as a precedent or blueprint for international action for the protection of ecologically and biologically significant areas (EBSAs) in both deep sea and open ocean ecosystems from other activities with the potential to adversely impact biodiversity.

This report also provides a short overview of different deep-sea ecosystems and of the threats to these ecosystems. In addition to this report, we have developed a Google Earth presentation on high seas areas closed to bottom fisheries by States and RFMO/As at present (2010), including the coordinates of the closures, the size (km^2) and year of establishment, and the dates at which the closures are currently set to expire. Both the report and the map of closed areas can be obtained from: http://www.highseasmpas.org.

Structure of the report

This report consists of three parts. In part 1, we provide an analysis and lessons learned from the protection of deep-sea biodiversity so far. We start with an overview of the resolutions that were adopted by the United Nations General Assembly (UNGA) to protect deep-sea biodiversity (Chapter 2). This overview is followed by a review of the implementation on these resolutions (Chapter 3). In Chapter 4, we compare the UNGA resolutions with another mechanism to protect deep-sea biodiversity, the establishment of EBSAs (Ecologically and Biologically Significant Areas). In Chapter 5, we provide recommendations, based on the previous chapters. In part 2, starting with Chapter 6, we give an short description of different deep-sea ecosystems. In part 3, we provide information on the threats to deep-sea biodiversity, the most important of which is deep-sea fisheries (Chapter 7). Finally, in the Annexes we list the relevant texts of the UNGA resolutions, the FAO guidelines to select vulnerable ecosystems (VMEs) and the CBD guidelines to select EBSAs. We also provide a list of protected areas in the high seas that can also be viewed in a Google Earth presentation (www.highseasmpas.org), and we provide a list of research programs and databases on deep-sea biodiversity.

This report is mainly based on literature research and to some extent on correspondence and discussions with scientists, policy makers, NGOs, students and other people. The first author, Matthew Gianni, is a high seas fisheries advisor, and was hired by IMARES to analyse the implementation of the UN resolutions (Part 1 of this report) as well as to provide information on deep sea fisheries (Part 3). The second author wrote the section on habitats, on human impacts other than fisheries and compiled the maps.

Assignment

The Dutch Ministry of Economic Affairs, Agriculture and Innovation has requested IMARES to provide a review of UNGA resolutions on high seas fishery measures, to provide maps of biodiversity and of areas closed to bottom fisheries, and to provide a set of recommendations. This report and the additional Google Earth presentation (available from www.highseasmpas.org) are the results.

List of acronyms and abbreviations

ABNJ	Areas Beyond National Jurisdiction	
CBD	Convention on Biological Diversity	(www.cbd.int)
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources	(www.ccamlr.org)
CoML	Census of Marine Life	(www.coml.org)
COP	Conference of the Parties	(www.cbd.int/cop/)
DFS	Demersal Fish Stocks	
EBSA	Ecologically and Biologically Significant Area	
EEZ	Exclusive Economic Zone	
EU	European Union	
FAO	United Nations Food and Agriculture Organization	(www.fao.org)
FSA	United Nations Fish Stock Agreement	
GFCM	General Fisheries Commission for the Mediterranean	(www.gfcm.org)
high seas	All parts of the sea that are not included in the exclusive economic zone (EEZ), in the territorial sea or in the internal waters of a State	
ICES	International Council for Exploration of the Sea	(www.ices.dk)
IUCN	International Union for Conservation of Nature	(www.iucn.org)
MPA	Marine Protected Area	
NAFO	Northwest Atlantic Fisheries Organization	(www.nafo.int)
NEAFC	North East Atlantic Fisheries Commission	(www.neafc.org)
RFMA	Regional Fishery Management Association	
NPFC	North Pacific Fisheries Commission	(http://nwpbfo.nomaki.jp/)
RFMO	Regional Fishery Management Organization	
SEAFO	South East Atlantic Fisheries Organization	(www.seafo.org)
SIOFA	Southern Indian Ocean Fisheries Arrangement	
SPRFMO	South Pacific Regional Fisheries Management Organization	(www.southpacificrfmo.org)
UNCLOS	United Nations Convention on the Law of the Sea	
UNFSA	United Nations Fish Stock Agreement	
UNGA	United Nations General Assembly	
VME	Vulnerable Marine Ecosystem	

Part 1. Protection of deep-sea biodiversity

Lophelia reef showing pink and white Lophelia *with associated fauna, Norwegian shelf, 250 m depth (MAREANO-Institute of Marine Research, Norway)*

2. Overview of UN GA resolutions to protect deep-sea biodiversity

Recognizing the vulnerability of deep-sea ecosystems to harmful impacts from deep-sea fisheries, and the importance of protecting the global oceans commons, the UN General Assembly conducted an extensive debate over the course of the past 10 years concerning the need for international action to address this problem (UNICP 2009). As a result, the General Assembly adopted a series of resolutions to protect Deep Sea biodiversity from the harmful impacts of Fisheries in areas Beyond National Jurisdiction, beginning with resolution 59/25 in 2004 (UNGA 2005).

UNGA Resolution 59/25 (2004)

UNGA Resolution 59/25 called on high seas fishing nations and regional fisheries management organizations (RFMOs) to take urgent action to protect vulnerable marine ecosystems from destructive fishing practices, including bottom trawl fishing. The resolution further called on flag States and other interested nations to establish regional fisheries management organizations to regulate bottom fishing in areas of the high seas areas where bottom fishing occurred but where such organizations did not exist (see Annex A).

UNGA Resolution 61/105 (2006)

By 2006, negotiations had begun to establish RFMOs in the Northwest Pacific and the South Pacific, and an agreement was finalized and adopted (but had not yet entered into force) to establish an RFMO in the South Indian Ocean. However, very few areas of the high seas had actually been protected from the harmful impacts of bottom fishing (UN SG 2006). The UNGA reviewed the implementation of the provisions of 59/25 in 2006 and agreed to a more detailed set of measures required of flag States and RFMOs. These were set out in paragraphs 83-87 of resolution 61/105 adopted in December 2006 (UNGA 2006) (See Annex A).

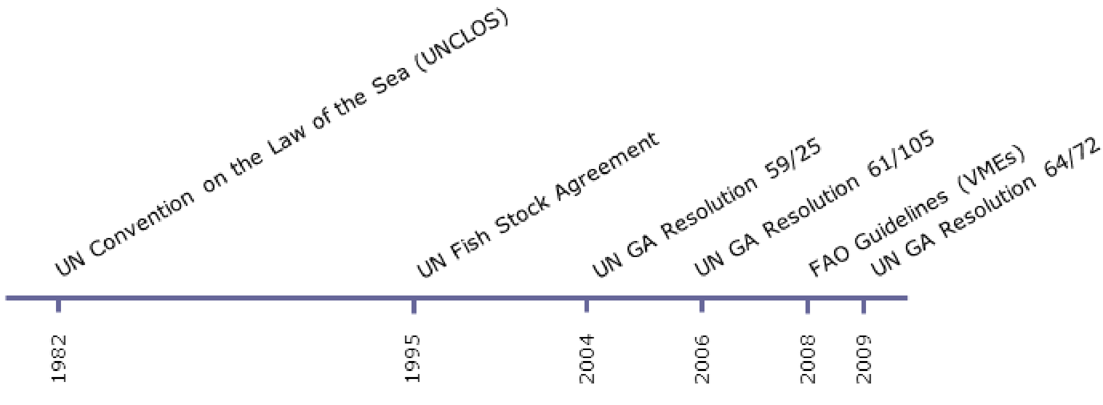


Figure 1. Time line: Development of the UN GA resolutions.

Resolution 61/105 committed high seas fishing nations both individually and through relevant RFMOs to manage bottom fisheries in areas beyond national jurisdiction to *"prevent"* significant adverse impacts on vulnerable marine ecosystems or else prohibit such fishing from occurring. The resolution, in paragraph 83 (see text in Annex A), called on States and RFMOs to do so through:

- conducting impact assessments of deep-sea fisheries on the high seas to determine whether significant adverse impacts would occur;
- to map and close areas on a precautionary basis where vulnerable marine ecosystems (VMEs) such as cold-water coral reefs are known or likely to occur unless bottom fishing in these areas can be managed to prevent significant adverse impacts;
- to ensure that deep-sea fisheries on the high seas are managed to ensure the long term sustainability of deep-sea fish stocks;
- and to require vessels to cease fishing in areas where VMEs are encountered during fishing operations.

The resolution further called on States and RFMOs to implement these measures by no later than December 2008 (with a deadline of December 2007 in the case of interim measures) and to publicize lists of vessels authorized to engage in bottom fishing in areas beyond national jurisdiction and the measures they have taken to implement the resolution.

The resolution recognizes three types of areas on the high seas in relation to jurisdiction over the management of deep-sea fisheries:

(1) areas where RFMOs with the legal competence to manage bottom fisheries have been established (i.e. the northern North Atlantic, Southeast Atlantic, Southern Ocean and the Mediterranean Sea);
(2) areas where negotiations were underway to establish such organizations (i.e. the Northwest Pacific and South Pacific Oceans) as a result of UNGA resolution 59/25; and
(3) areas where no RFMO exists nor is under negotiation (i.e. Southwest Atlantic).

In the first instance, the resolution calls on States through RFMOs to adopt and implement the measures in paragraph 83 of the resolution; where RFMOs don't exist but are under negotiation, the resolution calls on States involved in the negotiations to adopt multilaterally agreed *"interim measures"* consistent with paragraph 83; and finally in areas where no RFMO exists nor negotiations are underway to establish an RFMO, the resolution calls on flag States to individually adopt measures consistent with paragraph 83 of the resolution and make them, together with lists of vessels the flag States have authorized to engage in high seas bottom fisheries, publically available through the UN FAO.

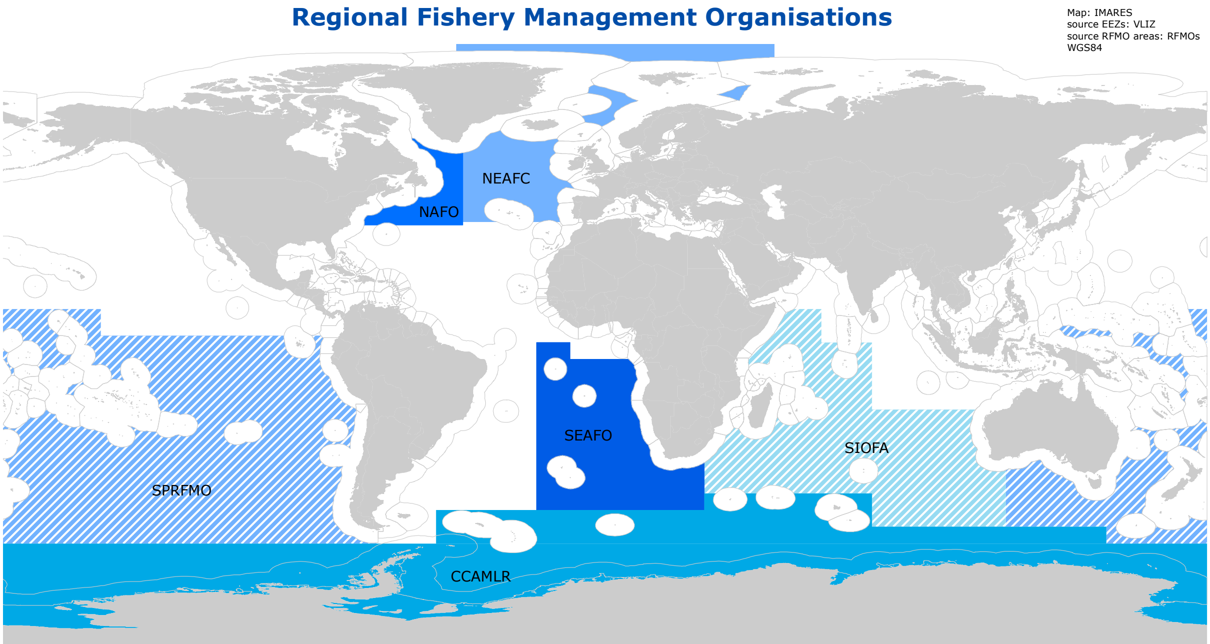


Figure 2. RFMOs with the legal competence to manage bottom fisheries (filled) and RFMOs agreed but not yet in force and/or under negotiation (dashed). For the North Pacific Fisheries Organisation no boundaries have been defined yet. The Mediterranean and Black Sea are managed by the GFCM (not shown). Maps are indicative only.

FAO Guidelines (including criteria for identifying VMEs)

In response to the adoption of resolution 61/105 in 2006, a set of International Guidelines for the Management of Deep sea Fisheries in the High Seas (hereinafter referred to as the FAO Guidelines) were negotiated under the auspices of the United Nations Food and Agriculture Organization (FAO 2008). The guidelines are listed in Annex B. The FAO Guidelines were designed to assist States and RFMOs in the implementation of the UNGA resolutions, through, inter alia, establishing internationally agreed scientific and technical criteria for identifying vulnerable marine ecosystems (VMEs), conducting impact assessments, and determining whether impacts on these ecosystems from bottom fisheries would qualify as *"significant adverse impacts"*. The FAO Guidelines were adopted in 2008 and incorporated into a new resolution adopted by the UN General Assembly the following year (UNGA 2009).

UNGA Resolution 64/72 (2009)

The UN General Assembly in 2009 conducted a review of the actions taken by States and RFMOs to implement the 2006 resolution with respect to the management of bottom fisheries in areas beyond jurisdiction (UNGA 2009). The General Assembly expressed concern that *"despite the progress made, the urgent actions called for in paragraphs 80 and 83 to 87 of its resolution 61/105 have not been sufficiently implemented in all cases"* and called for further actions by States and RFMOs. Resolution 64/72, adopted in December 2009, both reinforced resolution 61/105 and called for further measures to be adopted and implemented through calling on States and RFMOs to not authorize deep-sea fisheries in areas beyond national jurisdiction unless or until the measures in both resolutions 61/105 and 64/74 are implemented. Resolution 64/72 placed particular emphasis on conducting prior impact assessments consistent with the standards set in the FAO Guidelines through calling on States and RFMOs *"to ensure that vessels do not engage in bottom fishing until such assessments have been carried out"* (see texts in 8).

UN Fish Stock Agreement (1995) and UN Convention on the Law of the Sea (UNCLOS) (1982)

The evolution of the debate on this issue at the UN General Assembly, including through the annual meetings of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea (http://www.un.org/Depts/los/consultative_process/consultative_process.htm), and the measures progressively agreed by the UN General Assembly resolutions, essentially follow from, and give effect to, the general provisions for fisheries conservation and the protection of marine biodiversity contained in a number of instruments, in particular the 1995 UN Fish Stocks Agreement (UNFSA) (UNGA 1995) and the United Nations Convention on the Law of the Sea (UNCLOS) (UN 1982). Articles 5 and 6 of the UNFSA oblige States, inter alia, to:

- *"assess the impacts of fishing…on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks" (Article 5(d));*
- *"minimize…impacts on associated or dependent species, in particular endangered species" (Article 5(f));*
- *"protect biodiversity in the marine environment" (Article 5(g));*
- *"take measures to prevent or eliminate overfishing and excess fishing capacity and to ensure that levels of fishing effort do not exceed those commensurate with the sustainable use of fishery resources" (Article 5(h));*
- *"apply the precautionary approach widely…in order to protect the living marine resources and preserve the marine environment" and "be more cautious when information is uncertain, unreliable or inadequate. The absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures" (Articles 6.1 & 6.2);*
- *"develop data collection and research programmes to assess the impact of fishing on non-target and associated or dependent species and their environment, and adopt plans which are necessary to ensure the conservation of such species and to protect habitats of special concern" (Article 6.3(d)).*

As with the UNGA resolutions, the primary implementing mechanism for the obligations in the UNFSA are flag States and RFMOs. The UNFSA in turn was negotiated as an implementing agreement of the Law of the Sea Convention (LOSC) and expands on a number of the general obligations related to fisheries conservation and the protection of the marine environment in the LOSC. Amongst these are Articles 116-119 which oblige States to cooperate in the conservation and management of fisheries on the high seas and taking into account any generally recommended international minimum standards for the conservation of the living resources of the high seas; Article 192 establishing the general obligation *"to protect and preserve the marine environment"*; Article 194.5 requiring States to take measures *"necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life";* and Article 206 which obliges States to assess the potential effects of activities on the marine environment *"when States have reasonable grounds for believing that such planned activities under their jurisdiction or control may cause significant and harmful changes to the marine environment."*

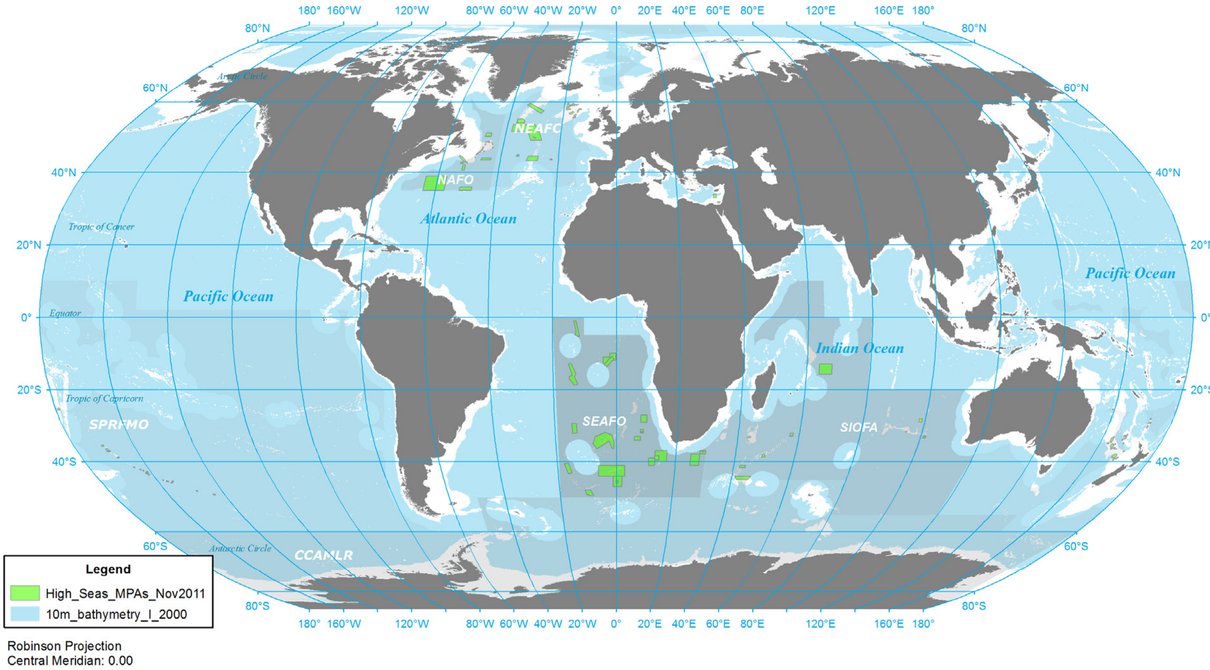


Figure 3. Vulnerable Marine Ecosystems (VMEs) closed to bottom trawling (green areas) and RMFO regulatory areas (blue areas). An animated map can be found at www.highseasmpas.org.

Convention on Biological Diversity

Finally, it is worth noting that the issue of deep-sea fishing has been debated at meetings of the Conferences of Parties to the Convention on Biological Diversity (CBD COPs) since 2004. Most recently, in October 2010, CBD COP-10 Decision X/29 called on States *"to fully and effectively implement paragraphs 113 through 130 of the United Nations General Assembly resolution 64/72 on responsible fisheries in the marine ecosystem, addressing the impacts of bottom fishing on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks, in areas beyond national jurisdiction, in particular paragraphs 119 and 120 of the resolution, calling on States and/or regional fisheries management organizations (RFMOs), consistent with the Food and Agriculture Organization of the United Nations International Guidelines for the Management of Deep-Sea Fisheries in the High Seas and consistent with the precautionary approach, to conduct impact assessments, conduct further marine scientific research and use the best scientific and technical information available to identify areas where vulnerable marine ecosystems are known or likely to occur, either adopt conservation and management measures to prevent significant adverse impacts on such ecosystems or close such areas to fishing, and adopt measures to ensure the long-term sustainability of deep-sea fish stocks (both target- and non-target stocks), and not to authorize bottom-fishing activities until such measures have been adopted and implemented"* (CBD 2010).

3. Review of the implementation of the UNGA resolutions related to deep-sea fisheries in areas beyond national jurisdiction

Since 2006, framework regulations to implement paragraph 83 of resolution 61/105 (see Annex A) have been adopted by five of the six RFMOs which have legal competence to manage deep-sea fisheries - the North-East Atlantic Fisheries Commission (NEAFC), the Northwest Atlantic Fisheries Organization (NAFO), the South East Atlantic Fisheries Organisation (SEAFO), General Fisheries Commission for the Mediterranean (GCFM) and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) (Figure 2).

In the South Pacific and the Northwest Pacific, the countries participating in the negotiations to establish RFMOs in these regions, in 2007, multilaterally agreed *"interim measures"* consistent with paragraph 83 of 61/105 as called for in paragraph 85 of resolution 61/105. The negotiations to establish an RFMO in the Northwest Pacific were subsequently expanded to include the Northeast Pacific and in March 2011 interim measures were adopted for high seas bottom fishing in the Northeast Pacific. An agreement to establish an RFMO for the high seas deep-water and bottom fisheries in the Southern Indian Ocean, the Southern Indian Ocean Fisheries Agreement (SIOFA)- was opened for signature and ratification in 2006 but an RFMO has not yet been established (FAO 2006). The flag States concerned (Australia, Mauritius and the Cook Islands) have not adopted multilaterally agreed interim measures as has been done in the South Pacific and Northwest Pacific (http://www.un.org/depts/los/reference_files/Draft_SG_Fisheries_Report.pdf).

High seas areas where no RFMO with the legal competence to regulate deep-sea fisheries exists or is under negotiation include the Central and Southwest Atlantic and a portion of the Northern Indian Ocean and Central Pacific Ocean (Figure 2). Paragraph 86 of resolution 61/105 calls on flag States individually to implement the management measures outlined in paragraph 83 of the resolution (see texts in Annex A). The European Union has adopted a regulation to implement UNGA 61/105 applicable to all EU Member flag States engaged in bottom fishing in such areas (EC 2008). South Korea has also adopted a regulation applicable to the high seas bottom fisheries in the Southwest Atlantic (Ministry for Food, Agriculture, Forestry and Fisheries, Republic of Korea, pers. comm.). It is not clear whether any other flag States whose vessels engage in high seas bottom fishing activities in such regions have done so.

While framework agreements have been adopted in many regions, the implementation of regulations to manage bottom fisheries in the high seas has been less vigorous. As indicated previously, the UN General Assembly in 2009 reviewed the implementation of resolution 61/105 and adopted resolution 64/72 which both reinforced and strengthened the call for action in the 2006 resolution. Following are reviews of the implementation of the four key provisions of paragraphs 83 of resolution 61/105 and 119-120 of resolution 64/72.

Impact Assessments

Resolution 61/105, in paragraph 83(a), calls on States *"To assess, on the basis of the best available scientific information, whether individual bottom fishing activities would have significant adverse impacts on vulnerable marine ecosystems, and to ensure that if it is assessed that these activities would have significant adverse impacts, they are managed to prevent such impacts, or not authorized to proceed"*. This was further reinforced in resolution 64/72 in paragraph 119(a) which calls on States to *"Conduct the assessments called for in paragraph 83 (a) of its resolution 61/105, consistent with the Guidelines, and to ensure that vessels do not engage in bottom fishing until such assessments have been carried out"*.

Although the regulations adopted by NEAFC, NAFO and SEAFO were designed to implement resolution 61/105, the regulations only require Contracting Parties to submit impact assessments for high seas bottom fisheries *"where possible"*. As a result of this caveat, as of December 2010 no member country of any of these RFMOs has yet conducted an impact assessment of the bottom fisheries by their flagged vessels operating in these RFMO areas. In 2010 NAFO amended its regulation by requiring impact assessments where fishing takes place outside of historically fished areas – the fisheries *"footprint"* – or *"if there are significant changes to the conduct or technology of existing bottom fisheries, or new scientific information indicating a VME in a given area"*. Otherwise, existing fisheries are effectively exempt from a requirement to conduct impact assessments (NAFO 2011).

By contrast, the same caveat *"where possible"* was also initially included in the text of the measure adopted by CCAMLR in 2007 to implement UNGA resolution 61/105 (CCAMLR 2007). The following year only five Contracting Parties with vessels engaged in bottom fishing in the area submitted impact assessments to the CCAMLR Commission. CCAMLR measure 22-6 was subsequently amended in 2008 and 2009 to require Contracting Parties to submit impact assessments to the CCAMLR Commission as a precondition for authorizing bottom fishing in the area. As a result, all Contracting Parties whose vessels engage in bottom fishing in the CCAMLR area had submitted impact assessments by 2009.

In the Northwest Pacific, the main fishing nations whose vessels engage in high seas bottom fisheries - Japan, Republic of Korea and the Russian Federation - have submitted impact assessments for their fisheries to the North Pacific RFMO negotiating process (see http://nwpbfo.nomaki.jp). In the South Pacific, New Zealand has provided a comprehensive review of its high seas bottom trawl fishery but not an impact assessment per se (New Zealand Ministry of Fisheries 2009). Spain submitted an impact assessment of its proposed bottom gillnet fisheries in the South Pacific; however no other country fishing in the region has yet done so. Impact assessments have been not been conducted for the high seas bottom fisheries by any of the nations bottom fishing on the high seas in the Indian Ocean (e.g. Australia, Cook Islands, Mauritius) or the Northeast Pacific (Russian Federation). For the high seas fisheries in the Southwest Atlantic Ocean, though required by EU regulation, the EU Member States fishing in the region (e.g. Spain) has not conducted impact assessments for its bottom fisheries as of November 2010.

Where impact assessments have been done to date by flag States and RFMOs, they have varied considerably in quality and detail and have been either preliminary or partial at best, in light of the criteria elaborated in the UN FAO Guidelines for the Management of Deep-Sea Fisheries in the High Seas. Thus far, the most comprehensive and detailed information has been produced by New Zealand with respect to bottom fisheries in the South Pacific and the Southern Ocean (New Zealand Ministry of Fisheries 2009) and Japan (Fisheries Agency of Japan 2008) with respect to bottom fisheries in the Northwest Pacific. However, even these assessments, as well as those produced by other States, have not been able to clearly determine whether individual bottom fishing activities would or would not have significant adverse impacts on vulnerable marine ecosystems. In most cases this is due to a combination of factors, including insufficient baseline information on the presence, likely occurrence and ecology of VMEs in the areas to be fished; insufficient information on the precise areas in which bottom fishing will or is likely to take place; insufficient information on the interaction of the bottom fishing gear with VME related species; and insufficient information on the extent, severity, duration, and likely scale of the impact of bottom fishing on VMEs known or likely to occur in areas subject to bottom fishing. In spite of this, in virtually all cases the flag States and RFMOs concerned have asserted that no significant adverse impacts were likely to occur to vulnerable marine ecosystems and have continued to authorize high seas bottom fishing.

Identify vulnerable marine ecosystems (VMEs) and close areas where VMEs are known or likely to occur unless significant adverse impacts (SAIs) can be prevented

Paragraph 83(c) of UNGA 61/105 calls for the following measures: *"In respect of areas where vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals, are known to occur or are likely to occur based on the best available scientific information, to close such areas to bottom fishing and ensure that such activities do not proceed unless conservation and management measures have been established to prevent significant adverse impacts on vulnerable marine ecosystems"*. This was further reinforced by resolution 64/72 paragraph 119(b) which called on States and RFMOs *to "Conduct further marine scientific research and use the best scientific and technical information available to identify where vulnerable marine ecosystems are known to occur or are likely to occur and adopt conservation and management measures to prevent significant adverse impacts on such ecosystems consistent with the Guidelines, or close such areas to bottom fishing until conservation and management measures have been established, as called for in paragraph 83 (c) of its resolution 61/105"*.

A number of States including Norway, Spain, the UK, Canada, Japan and the Russian Federation, have conducted independent benthic surveys of areas of the high seas, including those of interest to bottom fishing fleets, to map VMEs. As a result, a number of VME areas, primarily areas of concentrations of cold-water corals in the Atlantic, have been identified and closed to bottom fishing. These include the adoption of area closures by NEAFC covering large portions of the Mid Atlantic Ridge and the Hatton and Rockall Banks in the Northeast Atlantic. Altogether, NEAFC estimates that approximately 54% of the high seas areas south of Iceland at fishable depths are now closed to bottom fishing (www.fao.org/fishery/topic/16204/en and www.neafc.org). In the Northwest Atlantic, NAFO has agreed to close six seamount areas with a provision that 20% of each area may remain open to exploratory fishing, and to close 12 additional areas along the slope of the Grand Banks and Flemish Cap in the Northwest Atlantic to protect *"significant"* concentrations of sponges and several species of corals. In the Southeast Atlantic, SEAFO initially adopted closures of ten major seamount groups; the closures were revised in 2010 based on more detailed geomorphological and biogeographic information and information from research cruises. In the Southwest Pacific, New Zealand closed approximately 40% of the bottom fisheries *"footprint"* as defined by the South Pacific RFMO negotiating process. In the Northwest Pacific, the States concerned have proposed closing a small portion of one of the seamounts on the Emperor Seamount chain. Elsewhere, the Oceanographic Institute of Spain (OIE) has identified 8-9 VME areas on the high seas in the Southwest Atlantic and proposed that they be closed to bottom fishing; it remains to be seen whether Spain, the flag State concerned, will adopt measures sufficient to protect these VMEs. (www.thefishsite.com/fishnews/14557/spain-commits-to-protecting-marine-biodiversity) (Durán Muñoz et al. 2012). In the Indian Ocean, a group of fishing companies whose vessels engage in deep-sea bottom fishing on the high seas has voluntarily agreed to close 13 areas to bottom fishing (Shotton 2006). These closures cover approximately 6% of the seamounts at fishable depths in the region. The closures can be visualized on www.highseasmpas.org.

While substantial areas of the high seas have been closed to bottom fishing, nonetheless, it is clear that implementation of this provision of the UNGA resolution has been rather limited compared to the overall area of the high seas at fishable depths where VMEs are likely to occur. It is worth noting that the proposal put forward by Norway to close areas of the Mid Atlantic Ridge to bottom fishing (subsequently adopted by NEAFC in 2009) indicated that VMEs were likely to occur on most seamount peaks along the mid-Atlantic ridge. New Zealand, in its decision to close approximately 40% of its fisheries *"footprint"* in the high seas of the South Pacific, acknowledges that VMEs are likely to occur on the ridge peaks and seamounts through the areas covered by its footprint. Both Norway and New Zealand nonetheless assert that by closing *"representative areas"* of VMEs along the Mid Atlantic Ridge and within the South Pacific

fisheries footprint respectively, the measures called for in the UNGA resolutions to prevent significant adverse impacts have been effectively implemented (New Zealand Ministry of Fisheries 2009).
This, however, is not entirely the case. While these area closures, equivalent to deep-sea marine protected areas or marine reserves, at least insofar as bottom fisheries are concerned, protect a significant portion of the VMEs in each region, they do not provide the full protection called for in the UNGA resolutions. The resolutions call for effective measures to be put into place to prevent significant adverse impacts to VMEs wherever they are known or likely to occur. In the case of New Zealand's approach to managing bottom fisheries on the high seas of the South Pacific, bottom fishing in the 60% of the footprint that remains open is only subject to a *"move-on"* rule in approximately half of this area and no restrictions on fishing are in place in the remaining area. New Zealand reports that much of the bottom fishing (predominantly bottom trawl fishing) in the open areas since 2007 has targeted previously undiscovered or unfished seamount areas within the footprint, with potential adverse impacts on VMEs (New Zealand Ministry of Fisheries 2009). In a similar vein, the scientific advice provided to SEAFO in 2010 indicated that most seamounts at depths lesser than 1000 meters could contain VMEs based on the biogeographic characteristics of the region (SEAFO 2010b). Some have been closed, but many remain open to bottom fishing (although the relatively strict quotas currently in place, if adhered to, would minimize damage to VMEs).

Most of the area closures adopted by RFMOs to date are only temporary and several of the closed areas (e.g. the seamount closures adopted by NAFO) allow for 'exploratory' or 'research' bottom fishing in some portion of the area. Most areas where significant bottom fishing activity has occurred on the high seas over the past 5-10 years remain open to continued bottom fishing, primarily bottom trawling (except in the CCAMLR area), with limited restrictions (e.g. a 'move-on rule') or no restrictions in place to protect VMEs. Area closures have generally been confined to areas which either have not been previously fished or where limited fishing has occurred in the recent past (e.g. over the past 5-20 years), and/or areas of limited current interest to the fishing industry. The areas closed to date represent a only a portion of the areas of the high seas where VMEs are likely to occur (Weaver et al. 2011).

Long-term sustainability of deep-sea fish stocks

Paragraphs 80 and 83(b) of UNGA 61/105 call on States and RFMOs to sustainably manage fish stocks and assess the impact of bottom fishing on the long-term sustainability of deep-sea fish stocks. This issue was the subject of further negotiation in 2009 resulting in paragraph 119(d) of UNGA resolution 64/72 calling on States and RFMOs to *"Adopt conservation and management measures, including monitoring, control and surveillance measures, on the basis of stock assessments and the best available scientific information, to ensure the long-term sustainability of deep-sea fish stocks and non-target species, and the rebuilding of depleted stocks, consistent with the Guidelines; and, where scientific information is uncertain, unreliable, or inadequate, ensure that conservation and management measures be established consistent with the precautionary approach, including measures to ensure that fishing effort, fishing capacity and catch limits, as appropriate, are at levels commensurate with the long-term sustainability of such stocks"*.

Most high seas bottom fisheries target low productivity species (e.g. orange roughy *Hoplostethus atlanticus*, grenadiers, deep-sea sharks) that are highly vulnerable to overexploitation and depletion. There are exceptions, such as the bottom fisheries for Argentine hake and squid in the Southwest Atlantic along the Patagonian shelf and northern prawns in the Northwest Atlantic, though in the case of the latter, the depths at which this fishery occurs (i.e. > 1000m) means it is likely to impact low productivity fish species in addition to cold-water corals, sponges and other vulnerable benthic species. In addition, a large number of species have been recorded as bycatch in many high seas bottom fisheries, in particular bottom trawl fisheries, the majority of which are likely to be low productivity species. For example, New Zealand reports that some 22 species of fish are variously targeted in the New Zealand high seas bottom fisheries in the South Pacific with another 115 species reported as bycatch (New Zealand Ministry of Fisheries 2009). Nonetheless, insufficient information is available to determine even the status of stocks of the main target species – orange roughy – in the region, much less the status of the other 136 species impacted by the fishery (New Zealand Ministry of Fisheries 2010).

Elsewhere, some 70 species have been reported in the mixed species deep-water trawl fisheries in the Northeast Atlantic (Bensch et al. 2008); information from the former USSR and Ukrainian deep-sea trawl fisheries for alfonsino *Beryx* spp. and orange roughy *Hoplostethus atlanticus* on seamounts in the Indian Ocean region between 1972 and 2000 indicated that well over 100 species or species groups were recorded taken as bycatch in these fisheries (although some of the species recorded as bycatch were pelagic species); Japan reports in its impact assessment that some 40-50 species or species groups were recorded by a research trawl expedition in 1993 in 5 seamount areas in the North Pacific where bottom fishing currently takes place.

The status of target species or bycatch species in deep-sea fisheries on the high seas is known in only relatively few cases. In such cases, the stocks are for the most part considered overexploited or depleted. Regulations are in place in some areas (CCAMLR, NAFO, NEAFC, SEAFO) to manage the catch of a number, but not all, target species, and at least some species of commercial value taken as bycatch in high seas bottom fisheries. However, few, if any of the fisheries impacting deep-sea stocks or species on the high seas can currently be considered sustainable. Deep-sea fisheries are often referred to as 'serial (or sequential) depletion' fisheries (Gianni 2004, STECF 2010) and a number of studies or reports since 2006 continue to confirm the problematic nature of fisheries for deep-sea species. The IUCN Shark Specialist Group classifies the two main species of deep-sea sharks of commercial value (Leafscale gulper shark *Centrophorus squamosus*, Portuguese dogfish *Centroscymnus coelolepis*) taken as target or bycatch in high seas bottom fisheries in the Northeast Atlantic as endangered and a third species (gulper sharks) as critically endangered (Kyne & Simpfendorfer 2007). A review of deep-sea fisheries in the Northeast Atlantic by the European Commission in 2007 concluded that many deep-sea fish stocks have such low productivity that "sustainable levels of exploitation are probably too low to support an economically viable fishery." (EC 2007). Nonetheless, the European Union continues to authorize deep-sea fishing on the high seas of the Northeast Atlantic through a biennial exercise in setting TACs and quotas, most recently in November 2010, in spite of the fact that ICES and the European Commission recognize that there is insufficient scientific knowledge and information on the status of deep-sea species to determine what, if any, level of exploitation these species could sustain (EU 2010, PEW 2010).

In the Southeast Atlantic, stocks of several target species (e.g. orange roughy) are consider depleted though SEAFO has established strict quotas for most target species fished in the region (SEAFO 2010a). The status of bycatch species is unknown. In the Northwest Pacific, the two main target species, alfonsino *Berix* spp. and pelagic armourhead *Pseudopentaceros wheeleri*, are considered overexploited or depleted (ftp://ftp.fao.org/docrep/fao/012/i1116e/i1116e02f.pdf)(Yanagimoto 2007a, b). A cap on fishing effort has been established by the States concerned; however the efficacy of this measure has been debated. The catch and status of non-target species is largely unknown. In the South Indian Ocean, there are no restrictions on the catch in the deep-water high seas fisheries in the region although industry sources claim that bycatch is low. There are no catch restrictions in place in the Southwest Pacific nor in the Southwest Atlantic as far as the authors are aware.

"Move-on" rule

Finally, paragraph 83(d) of UNGA 61/105 calls on States *"To require members of the regional fisheries management organizations or arrangements to require vessels flying their flag to cease bottom fishing activities in areas where, in the course of fishing operations, vulnerable marine ecosystems are encountered, and to report the encounter so that appropriate measures can be adopted in respect of the relevant site".* This issue was also subject to further elaboration in paragraph 119 (c) of resolution 64/72 as follows: *"Establish and implement appropriate protocols for the implementation of paragraph 83 (d) of its resolution 61/105, including definitions of what constitutes evidence of an encounter with a vulnerable marine ecosystem, in particular threshold levels and indicator species, based on the best available scientific information and consistent with the Guidelines, and taking into account any other conservation and management measures to prevent significant adverse impacts on vulnerable marine ecosystems, including those based on the results of assessments carried out pursuant to paragraph 83 (a) of its resolution 61/105 and paragraph 119 (a) of the present resolution"*.

While the intent of this prevision of the resolution may have been constructive, a number of reviews of the implementation by States and RFMOs of this provision – through the adoption of the so-called "move-on" rule - have concluded that it is of limited conservation value, if any, and does not represent a precautionary, or risk averse method of preventing significant adverse impacts on VMEs (DSCC 2009, ICES 2010, Rice 2010, Rogers & Gianni 2010, Auster et al. 2011). These reviews highlight a number of problems with the move-on rule, including the poor retention of VME indicator species in fishing gear, the inability to quantify or assess the extent of the impact on VMEs on the seabed based on the quantities of VME related species brought to the surface in the fishing gear, the fact that no single weight of *"corals"* or *"sponges"* can serve as a threshold level for all species of these organisms nor for other classes of organisms given the differing morphological characteristics of species within broad taxonomic groups. Moreover, in most cases move-on rules only apply to encounters with corals and sponges but not to other VME related species and it is often impossible to tell where the encounter with the VME occurred during the course of fishing operations, especially in the case of bottom trawl fisheries along continental slope areas (i.e. such as occurs in the NAFO area) or across large geological features which may involve towing a net for 20-40 kilometers along the seabed per set of the gear. These and other reasons led the ICES Working Group on Deep-sea Ecology to conclude that *"the current encounter and move on rules would still permit pervasive and cumulative destruction of VMEs in the NAFO and NEAFC management areas"* (ICES 2010).

It is important to emphasize that the move-on rule should be considered as a measure of last resort to protect VMEs, as a complement to, not a substitute for, impact assessments, identifying and closing areas where VMEs are known or likely to occur, and establishing regulations to prevent significant adverse impacts to VMEs in areas where high seas bottom fishing is permitted to take place, as reflected in the language of paragraph 119(c) of resolution 64/72. Even where stringently applied, the move-on rule alone is not likely to be effective in preventing significant adverse impacts to VMEs. The Bottom Fishery Impact Assessment submitted by New Zealand in December 2008 to the Science Working Group of the South Pacific RFMO negotiations notes that commercial bottom trawl fishing gear is often not likely to retain much, if any, coral and/or other vulnerable bottom species impacted by bottom trawl gear and thus likely to be of limited value in assessing whether significant adverse impacts have occurred to VMEs (New Zealand Ministry of Fisheries 2009). The move-on rule adopted by CCAMLR in respect of bottom longline fisheries has led to some area closures thus far. However, in the case of NAFO, NEAFC, SEAFO, the North Pacific and in the South Pacific where the move-on rule is the only regulation in place designed to protect VMEs in areas where bottom fishing is permitted to take place, the degree of protection afforded by the rule is likely to be minimal, if at all.

Gear restrictions

At least four RFMOs have adopted some gear restrictions. CCAMLR has established a prohibition on high seas bottom trawling and bottom gillnet fishing in the Southern Ocean. NEAFC has established a ban on bottom gillnet fishing below 200 meters on the high seas of the Northeast Atlantic. The General Fisheries Commission of the Mediterranean (GFCM) has established a prohibition on bottom trawl fishing below 1000 meters. SEAFO has adopted a prohibition on bottom gillnet fishing (the SEAFO Scientific Committee in 2007 recommended a temporary prohibition of bottom trawl fishing as well but this recommendation has not yet been adopted by SEAFO). However, bottom fishing, including bottom trawling, continues to be permitted across wide areas of the high seas. The best scientific information available has consistently highlighted that bottom trawl fishing has the most immediate and destructive impact on vulnerable benthic marine ecosystems as discussed in Chapter 7.

Transparency/accountability

Transparency of information is critical to the implementation of the UNGA resolutions. The high seas are a global commons and any nation whose flagged vessels engage in deep-sea fishing on the high seas has a responsibility to the international community, under international law, to demonstrate that it is able to manage the activities of the vessels to ensure the conservation and protection of biodiversity and the sustainable exploitation of fish stocks. UNGA resolutions 61/105 and 64/72 stress the importance of transparency through calling on States and RFMOs to make publically available the measures they have adopted to implement the resolution.

The resolutions further call on States whose vessels fish on the high seas in areas where no RFMO exists nor is under negotiation to publicize lists of the vessels they have authorized to fish in such areas. As of September 2010 only the Cook Islands, Estonia, France, Japan and Spain have submitted such information to the UN FAO, with only France, Estonia and Spain indicating which areas of the high seas bottom fishing vessels have been authorized to operate (Gianni et al. 2011).

In general the information published by RFMOs as well as the States participating in the South and North Pacific RFMO negotiating processes is quite comprehensive, including the reports of the work of the science working groups, measures adopted to manage the fisheries in response to the UNGA resolutions and the impact assessments and other information on the bottom fisheries in the regions submitted by States participating in the negotiations. There are important exceptions, however, in the information available, particularly in relation to RFMO decision-making. For example, a proposal to require impact assessments for existing fisheries was submitted to the NAFO Fisheries Commission in 2010 by the ad hoc Working Group of Fishery Managers and Scientists (WGFMS) to the Fisheries Commission: *"If proposed bottom fishing has not been covered by a previous assessment, or if there are significant changes to the fishery, or in light of new scientific information, the Contracting Party proposing to participate in bottom fishing shall submit to the Executive Secretary information and a preliminary assessment of the known and anticipated impacts of its bottom fishing activities on vulnerable marine ecosystems no less than two weeks in advance of the opening of the annual meeting in June of the Scientific Council"* (NAFO 2010).

This proposal was designed to bring NAFO regulations into line with the UNGA resolutions. However, NAFO only adopted a requirement that impact assessments be mandatory for existing high seas bottom fisheries when *"there are significant changes to the conduct or technology of existing bottom fisheries, or new scientific information indicating a VME in a given area"*. It is not clear from the record of the Annual Meeting of the Fisheries Commission in 2010 as to why the original recommendation – which would have required States to submit impact assessments of existing bottom fisheries if they hadn't already done so

- was rejected; specifically which Contracting Parties opposed the implementation of the UNGA resolutions with respect to impact assessments of existing fisheries (NAFO 2010).

Arguably one of the most effective means the UNGA has established to promote the implementation of the resolutions has been the periodic reviews of the actions taken by States and RFMOs to manage fisheries to protect deep-sea ecosystems. As indicated previously, the UNGA reviews in 2006 and 2009 concluded that not enough had been done by States to implement the previous resolutions. The UNGA reviews in both cases resulted in new and strengthened agreements for the management of deep-sea fisheries in the high seas which in turn led to further actions by States and RFMOs in the subsequent years.

In addition to the reviews scheduled by the General Assembly as part of the annual negotiations of the Sustainable Fisheries resolutions, the annual meetings of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea has contributed significantly to the ongoing monitoring and debate over the implementation of the resolutions. In these meetings, which occur on an annual basis, the open nature of the meetings has allowed for the participation of civil society which in turn has provided the UNGA an ongoing evaluation of the extent to which the UN resolutions and the actions taken by States and RFMOs have been effective in protecting deep-sea ecosystems and ensuring the long-term sustainability of deep-sea fish stocks and species (DSCC 2009, Rogers & Gianni 2010).

Conclusion

In summary, the key measures called for in resolutions 61/105 and 64/72 have only been partially implemented at best.

Impact assessments. Most States whose vessels engage in bottom fisheries on the high seas have not conducted impact assessments consistent with the internationally agreed standards established in the FAO Guidelines (see Annex A of this report) in all relevant high seas areas. The exceptions are the high seas bottom fisheries in the CCAMLR area and in the Northwest Pacific, but even these impact assessments to date are either partial or inconclusive as to whether significant adverse impacts would occur. In the case of CCAMLR, the assumption is that because bottom trawling has been banned and given the relatively small spatial extent of bottom longline fishing, the impact of bottom fishing is likely to be limited. As of 2010, impact assessments are now required by NAFO and NEAFC in new fishing areas.

Areas closed to fishing. Substantial high seas areas have been closed to bottom fishing but most of the area closures are temporary and limited to areas of little interest to the fishing industry. There has been a general reluctance on the part of many States and RFMOs to close high seas areas where bottom fishing currently takes place. Moreover, most high seas areas at fishable depths (<2000 m) where VMEs are likely to occur remain open to bottom fishing with few or no constraints.

“Move-on” rule. The move-on rule is often the only conservation regulation in place to protect VMEs in both existing and new or unfished areas; however, it is of limited value in protecting VMEs and will not, on its own, serve to prevent significant adverse impacts on VMEs in any meaningful way, particularly in regard to mobile fishing gear such as bottom trawling along continental slope areas. To the contrary, it is a reactive tool for the management of impacts on VMEs; at best it can only serve to prevent further damage after initial impacts.

overexploitation and depletion. The absence of sufficient information on the biological characteristics and status of most target and bycatch species impacted by high seas bottom fisheries renders it impossible to establish conservation and management measures to ensure long-term sustainability.

States whose vessels engage in bottom fisheries on the high seas have committed to preventing significant adverse impacts on VMES and ensuring the long-term sustainability of deep-sea fish stocks and species through implementing the measures contained in resolutions 61/105 and 64/72 and *"not to authorize bottom fishing activities until such measures have been adopted and implemented"* (UNGA resolution 64/72, paragraph 120). States have made a particular commitment in the case of impact assessments by committing to *"ensure that vessels do not engage in bottom fishing until such assessments have been carried out"* (UNGA res 64/72, paragraph 119a). However, most deep-sea fishing on the high seas continues to be authorized with limited constraints in areas fished prior to 2006.

The UN General Assembly has conducted two reviews of the actions taken by States and RFMOs to implement these provisions of the resolutions, with a third planned in 2011. The UN General Assembly reviews have been critical to the implementation of the resolutions to date. States and RFMOs have taken actions to implement the measures in the resolutions in large part because of the ongoing review by the UN General Assembly. However, to the extent that States continue to allow their vessels to engage in bottom fishing on the high seas, stricter regulation of these fisheries must be established to bring the management of the fisheries into compliance with the provisions of the UN General Assembly resolutions and international law.

4. General framework for the conservation and protection of marine biodiversity in areas beyond national jurisdiction

EBSAs

The World Summit on Sustainable Development (Johannesburg, 2002) called for the development of representative networks of Marine Protected Areas, including in areas beyond national jurisdiction, by 2012. The 9th Conference of Parties to the Convention on Biological Diversity, in Decision IX/20 adopted in May 2008 (CBD 2008), adopted an internationally agreed set of scientific criteria for identifying ecologically or biologically significant marine areas (EBSAs) in need of protection in open-ocean waters and deep-sea habitats to be used to form the basis for selecting areas to establish a representative network of marine protected areas. Decision IX/20 further established a set of scientific criteria for selecting areas to establish representative networks of marine protected areas, including in open ocean waters and deep-sea habitats (see Annex C). The 10th Conference of Parties to the CBD further advanced the issue, in Decision X/29, through requesting the CBD Secretariat to establish a *"repository for scientific and technical information and experience related to the application of the scientific criteria on the identification of EBSAs"* with a view to providing the UN General Assembly with more concrete information on EBSAs endorsed by future meetings of the CBD Conferences of Parties. A test version of the repository is available at: http://ebsa-review.cbd.int/.
Decision X/29 also 'encourages' States to make use of environmental impact assessments (EIAs) and strategic environmental assessments to avoid degradation or destruction of ecologically or biologically significant marine areas (CBD 2010).

Comparison of criteria for identifying VMEs and EBSAs

The EBSA criteria, in Annex I of Decision IX/20 of CBD COP-9, are similar to the criteria for the identification of vulnerable marine ecosystems in paragraph 42 of the UN FAO Guidelines for the Management of Deep-Sea Fisheries in the High Seas (see Annex A and Annex C of this report). While there are differences between the two sets of criteria, for all practical purposes the differences are minimal; effective application of the criteria should result in the identification of areas similar to those that would be obtained through applying the UN FAO criteria to the identification of VMEs in the deep-ocean. Indeed, this was recognized by CBD COP-10 which called on the CBD Secretariat, in collaboration with other international organizations, to establish a repository for scientific and technical information and experience related to the identification of EBSAs, as well as other relevant internationally agreed initiatives, such as FAO's work on vulnerable marine ecosystems (CBD 2010).

The major difference between approach to protecting VMEs and protecting EBSAs lies in the internationally agreed blueprint for managing activities which potentially impact such areas. The UNGA resolutions commit States to prevent significant adverse impacts to protect VMEs through taking a series of management actions – prior to environmental impact assessments, precautionary area closures and the other measures discussed in Chapters 2 and 3 of this report. With EBSAs, the CBD's Conference of Parties has provided scientific criteria for identifying EBSAs in need of protection, and scientific guidance for selecting areas to establish a representative network of marine protected areas in open ocean and deep-sea habitats (CBD COP-9, 2009). However, a detailed plan for the management of activities with a potential for adverse impacts on EBSAs has not yet been agreed other than to establish representative areas of marine protected areas.

In Decisions IX/20, X/29 and in previous decisions, the CBD COP asserts the central role of the UN General Assembly in respect of negotiating internationally agreed measures to ensure the conservation and protection of marine biodiversity in areas beyond national jurisdiction. The UN General Assembly has engaged in an extensive debate on this issue, primarily through the UN General Assembly's Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction. At the 3rd meeting of the UN General Assembly Working Group in February 2010, a number of countries, including the European Union, put forward proposals calling for a general approach to the management of any activity with a potential adverse impact on biodiversity in areas beyond national jurisdiction which draws on a number of the elements of the approach adopted in paragraph 83 and 119 of resolutions 61/105 and 64/72 respectively in regard to deep-sea fisheries. These proposals were reflected in the summary of the meeting submitted by the Co-Chairs to the President of the General Assembly. It stated that *"Several delegations proposed applying the approach, contained in resolution 61/105 on the assessment of bottom fishing activities, to all activities beyond areas of national jurisdiction that could have a significant adverse impact on vulnerable marine ecosystems"* and that the General Assembly identify overarching principles, which would define an ecosystem approach to the conservation and sustainable use of marine biodiversity beyond areas of national jurisdiction, which could include avoiding significant adverse impacts on marine ecosystems and biodiversity and the use of environmental impact assessments and area-based management tools (e.g. MPAs) (UNGA 2010).

Conclusion

The measures outlined in UN General Assembly resolutions 61/105 and 64/72 do provide a useful international framework for the management of activities beyond deep-sea fishing, with the potential to adversely impact biodiversity in areas beyond national jurisdiction, including through identifying EBSAs and establishing representative networks of MPAs. Moreover, the measures called for in both resolutions are grounded in international law, including the general provisions for the protection and preservation of the marine environment in Part XII of the Law of the Sea Convention (see page 16) that are applicable to any activity with a potential adverse impact on the marine environment. It is worth noting the recent Advisory Opinion issued by the Seabed Disputes Chamber of the International Tribunal for the Law of the Sea (ITLOS) asserted that "*It should be stressed that the obligation to conduct an environmental impact assessment is a direct obligation under the Convention and a general obligation under customary international law"* (ITLOS 2011).

If this approach embodied in resolution 61/105 and 64/72 is to be effective in the conservation and protection of biodiversity from other activities, the following recommendations should be taken into consideration, based on the review of the shortcomings in the implementation of the two resolutions to date (see Chapter 5).

5. Recommendations for selection and establishing EBSAs

Below we have defined a set of recommendations that apply to the protection of Ecologically and Biologically Significant Areas (EBSAs), based on the analyses of the effectiveness of the implementation of the UNGA resolutions (Chapters 2, 3) and a comparison with EBSAs (Chapter 4). To establish a network of MPAs based on the selection of EBSAs, we recommend:

1. **Robust application of the criteria for the identification of EBSAs:** While the definition of VMEs in the FAO Guidelines is broadly similar to the CBD criteria for EBSAs, the approach taken to date by flag States and RFMOs has largely focused only on the identification of areas of 'significant concentrations' of corals and, to a lesser extent, sponges. The application of the EBSA criteria should not be similarly limited. There is a need to identify all types of benthic species and ecosystems as well as ecological communities of deep-sea species of fish which fit the criteria for vulnerable marine ecosystems.

2. **Robust use of the best biogeographic information and predictive modeling to determine where EBSAs are likely to occur:** This is particularly important in the case of deep-sea and open ocean areas where little or no site-specific information may be available. As with the previous point, it is worth noting that substantial progress in this regard has been made by the Ocean Biogeographic Information System (OBIS) and the Global Ocean Biodiversity Initiative (GOBI) (see Annex E), amongst others, in identifying potential EBSAs. This scientific and technical work is providing direct support to the work of the CBD.

3. **Comprehensive and uniform application of environmental impact assessments (IA):** The UN General Assembly resolutions have called for all individual high seas bottom fisheries to be subject to impact assessments consistent with the internationally agreed criteria for conducting impact assessments, negotiated through the UN FAO Guidelines, to determine whether significant adverse impacts on VMEs would occur (see Chapter 2). However, the Guidelines have not been uniformly applied. In many cases, the criteria for conducting impact assessments have not been adopted by flag States and RFMOs or the States concerned have not fully implemented the criteria in the conduct of impact assessments. In other cases, 'existing' fisheries, or bottom fisheries operating in 'historically' fished areas, have been to a large extent exempted from a requirement to conduct impact assessments. Finally, even where the criteria have been fully followed, the impact assessments have not been able to make conclusive determinations as to whether significant adverse impacts would occur and whether and what type of management measures would need to be implemented to prevent significant adverse impacts of VMEs (see Chapter 3).

4. **Clear application of the precautionary approach in relation to scientific uncertainty as to the potential negative impact on EBSAs:** Even where the FAO Guidelines for the conduct of IAs have been incorporated into framework regulations at the regional level, most notably in the interim measures adopted by the States participating in the negotiation of the North Pacific RFMO and in the regulations adopted by CCAMLR, the impact assessments have not been able to make a clear determination as to whether SAIs would occur. In spite of this fact, all countries have asserted that continued bottom fishing, in some cases with some modifications to the gear (the efficacy of which cannot be determined), would not result in SAIs to VMEs. This is a shortcoming which needs to be resolved in respect of the management of deep-sea fisheries and which should be avoided in relation to impact assessments of other activities with a potential impact on EBSAs. The precautionary approach should require that where there are significant risks and scientific uncertainties, the activities concerned

should be prohibited until such uncertainties are resolved and the risks minimized with a reasonable degree of certainty.

5. Preventing "significant adverse impacts" on EBSAs: This is a crucial issue and the heart of the UN General Assembly agreement to protect VMEs from the harmful impacts of bottom fisheries. The UN Fish Stocks Agreement obligates States to *"minimize…catch of non-target species…and impacts on associated or dependent species, in particular endangered species"*. The UN GA resolution calls on States to manage high seas bottom fisheries to prevent *"significant adverse impacts"* on VMEs or else not authorize such fisheries to proceed (The only provision of the UN FSA where the term *"significant adverse impact"* is used is in relation to the impacts of *"natural phenomenon"*). There are key distinctions here which may be relevant to the approach taken to the protection of EBSAs. The UN FAO Guidelines establish a set of criteria to determine whether impacts on VMEs constitute *"significant adverse impacts"*. Unless and until the criteria for identifying VMEs and conducting impact assessments are made fully and effectively operational, it is impossible to determine whether the criteria in the FAO Guidelines for determining the 'significance' of adverse impacts is sufficiently robust. The only management measures adopted thus far that provide the certainty that significant adverse impacts on VMEs will be prevented in areas where they are known or likely to occur, are gear prohibitions and closing areas to bottom fishing. However, for areas of the high seas where States and RFMOs continue to permit bottom fishing to take place (large areas of the high seas at fishable depths) the criteria for determining whether adverse impacts constitute *"significant adverse impacts"* have not yet been operationalized in practice.

The question is whether a similar approach is sufficient to maintain the naturalness, biological diversity and productivity, functionality as habitat, and the other characteristics that define EBSAs. It remains to be seen whether the criteria contained in the FAO Guidelines will prove effective in protecting VMEs and, as such, serve as potentially useful as a model for providing a sufficient level of protection to EBSAs.

6. Sensible use of the move-on rule: While the concept behind the move-on rule has merit, the application of the move-on rule for deep-sea fisheries has been highly problematic and of limited conservation value in respect to the impact of mobile fishing gear – i.e. bottom trawling – on sessile deep-sea species (e.g. corals, sponges). It is impossible to establish a quantifiable relationship between the extent of a VME in a particular area and the extent of the impact of fishing on the VME based on the quantity of 'VME indicator species' brought up in the fishing gear. Nor is it possible to ensure that moving away from a particular area will result in preventing further adverse impacts on the VME in question or prevent impacts on other VMEs if a reasonably precise location of the encounter is not known nor the locations of other VMEs in the area are known. Moreover, the rule has often been used as a substitute for, as opposed to a complement to, comprehensive impact assessments and precautionary area closures as called for in the UNGA resolutions. While the rule does have potential value for the protection of EBSAs (particularly as it relates to the impact on mobile species in deep-sea and open ocean ecosystems) it would need to be a complement to, not a substitute for, a robust application of the criteria for the identification of EBSAs and the conduct of comprehensive impact assessments.

7. Incorporation of international agreements to protect EBSAs into national, regional and international law: The measures called for in the UNGA resolutions to protect VMEs have not been fully translated into regional regulations or national legislation and regulations by RFMOs and flag States in all areas. This has led, in part, to considerable variation in the application of the measures called for by the UNGA, including both by the same flag States operating in different ocean regions and amongst States whose vessels engage in bottom fishing for similar species within the same high seas regions. This has been a major impediment to the effective implementation of the UNGA resolutions. Effective protection of EBSAs in areas beyond national jurisdiction would require the effective translation of international agreements into legally binding regulations at the global, regional and/or national levels applicable to any activity with a potential for adverse impact on EBSAs. In addition, such regulations would need to apply to all flag States to ensure a 'level playing field' and minimize the potential for companies and vessels to flag to States with less rigorous requirements, or States which cannot or do not exercise control over the activities of their flagged vessels.

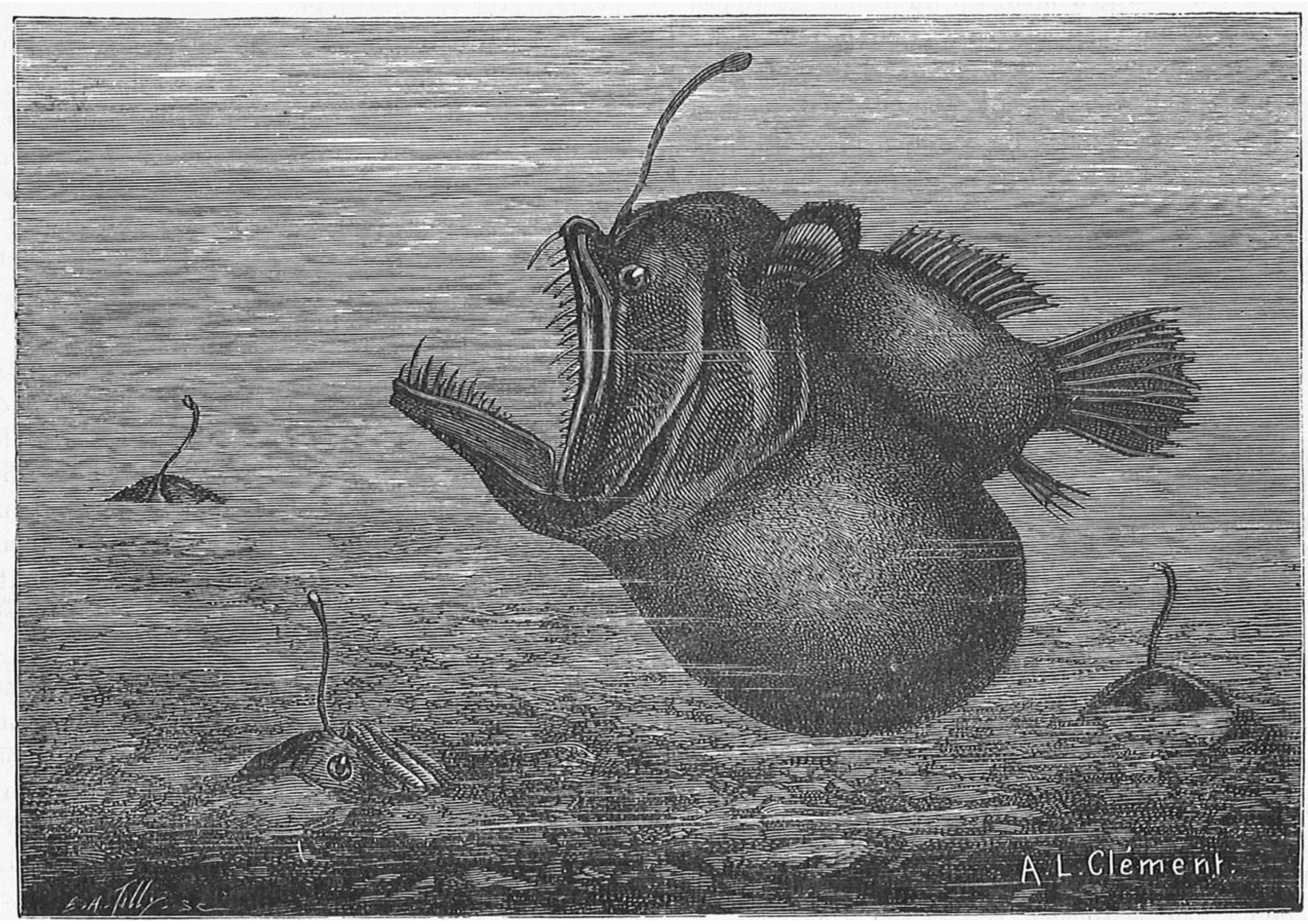
8. **Regular review and oversight of the actions taken by States and regional organizations:** The UN General Assembly has conducted two reviews of the actions taken by States and RFMOs to implement the deep-sea fisheries provisions of the UNGA resolutions in areas beyond national jurisdiction. These occurred in 2006 and 2009, with a third review scheduled for 2011. Furthermore, the implementation of the resolutions has been extensively discussed and debated at a number of annual meetings of the United National Open-ended Informal Consultative Process on Oceans and the Law of the Sea over the past several years, as noted in Chapter 2 of this report. The oversight exercised by the UN General Assembly has been critical to prompting States and RFMOs to take action to implement the provisions of the resolutions and has been essential to further elaborating and defining States obligations and the expectations of the international community with respect to the management of deep-sea fisheries and the protection of deep-ocean biodiversity on the high seas. Ongoing review by the UN General Assembly, and/or other bodies with the authority to do so, of the performance of States as well as regional and global bodies in the implementation of international agreements to conserve and protect biodiversity in areas beyond national jurisdiction, including EBSAs, is essential.

9. Institutional mechanisms for protecting EBSAs, including through establishing MPAs in areas beyond national jurisdiction: The UN General Assembly resolutions, like the UN Fish Stocks Agreement and the UN Convention on the Law of the Sea, establish flag States and regional fisheries management organizations and arrangements as the primary mechanisms for the implementation of fisheries conservation and management measures. This approach may not be entirely applicable to implement international agreements to protect EBSAs. While most fisheries and areas of the high seas are, or will soon be regulated by regional fisheries management organizations, regional seas conventions (e.g. OSPAR) for the protection of the marine environment are lacking in many areas. At the same time, there are a number of global bodies such as the International Maritime Organization (IMO) and the International Seabed Authority (ISA) which do have the legal competence to establish regulations with respect to shipping and mining applicable to all areas of the world's oceans beyond national jurisdiction, although compliance with the regulations is still largely the purview of the flag State. Regional and international initiatives to protect EBSAs in areas beyond national jurisdiction, through establishing MPAs and/or by other means, are likely to require enhanced institutional mechanisms and additional provisions or agreements under international law to ensure effective international implementation and compliance.

10. Enforcement: Monitoring, control and enforcement are essential to the effective management of fisheries and the same applies to other activities in areas beyond national jurisdiction. The conservation and management of high seas fisheries is often undermined by illegal, unregulated and unreported (IUU) fishing (Gianni & Simpson 2005, High Seas Task Force 2006, Marine Resources Assessment Group 2009). This problem is becoming apparent in the management of deep-sea fisheries on the high seas as States and RFMOs begin implementing measures to manage these fisheries in accordance with the UNGA resolutions. Japan reported sightings of bottom fishing vessels operating on the high seas of the Northwest Pacific flagged to Curaçao and Togo (Pers. Comm., Shingo Ota 2011).

Under international law, the flag State has the primary responsibility to ensure that its flagged vessels comply with multilaterally agreed measures for the management of fisheries on the high seas. The same holds true for the management of the activities of other types of vessels operating on the high seas. Where a vessel is in violation of regulations applicable to the conservation and protection of biodiversity on the high seas, the measures that non-flag States can take to penalize such vessels are relatively limited. The issue of flag State responsibility needs to be addressed more broadly to ensure that flag States exercise effective control over vessels registered to fly their flag through being able to monitor their vessel’s activities in areas beyond national jurisdiction and take appropriate enforcement action where necessary. This will be particularly important for the effective management of MPAs and other area based measures designed to ensure the conservation and protection of EBSAs on the high seas.

Part 2. Overview of deep-sea ecosystems



Deep-sea angler fish (Melanocetus johnsonii), caught in the Atlantic Ocean near Maroc (De Natuur, 1885)

6. The deep-sea

The deep-sea supports one of the largest levels of biodiversity on earth. In the 1840s it was believed that no life was present below 600 m (the 'azoic theory'). But in the 1870s Charles Thompson obtained evidence that animal life was abundant in the deep sea. In recent years, the development of remote sensing bathymetry mapping and submersible Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs) greatly contributed to the understanding of deep-sea ecosystems. In October 2010 the results of the Census of Marine Life have been released (http://www.coml.org). The Census was a massive 10-year global project to assess diversity, distribution and abundance of marine life in the oceans. The Census has given new insights in global marine biodiversity and will generate insights as to which areas should be protected. The Census resulted in the discovery of many new species and the total number of species present in the deep-sea is now estimated between 500,000 to 10 million (Crist et al. 2009, Ramirez-Llodra et al. 2010).

In the following paragraphs we provide an general overview of a number of important deep-sea habitat types.

Habitats of the deep sea

In total, since the 19th century, 27 new habitats/ecosystems such as hydrothermal vents (or black smokers), cold seeps and whale falls have been discovered (Table 1), the majority only in the past few decades. The habitats are described below. However, even today still less than 0.01% of the deep sea floor has been sampled and studied in detail (Ramirez-Llodra et al. 2010 and references therein).

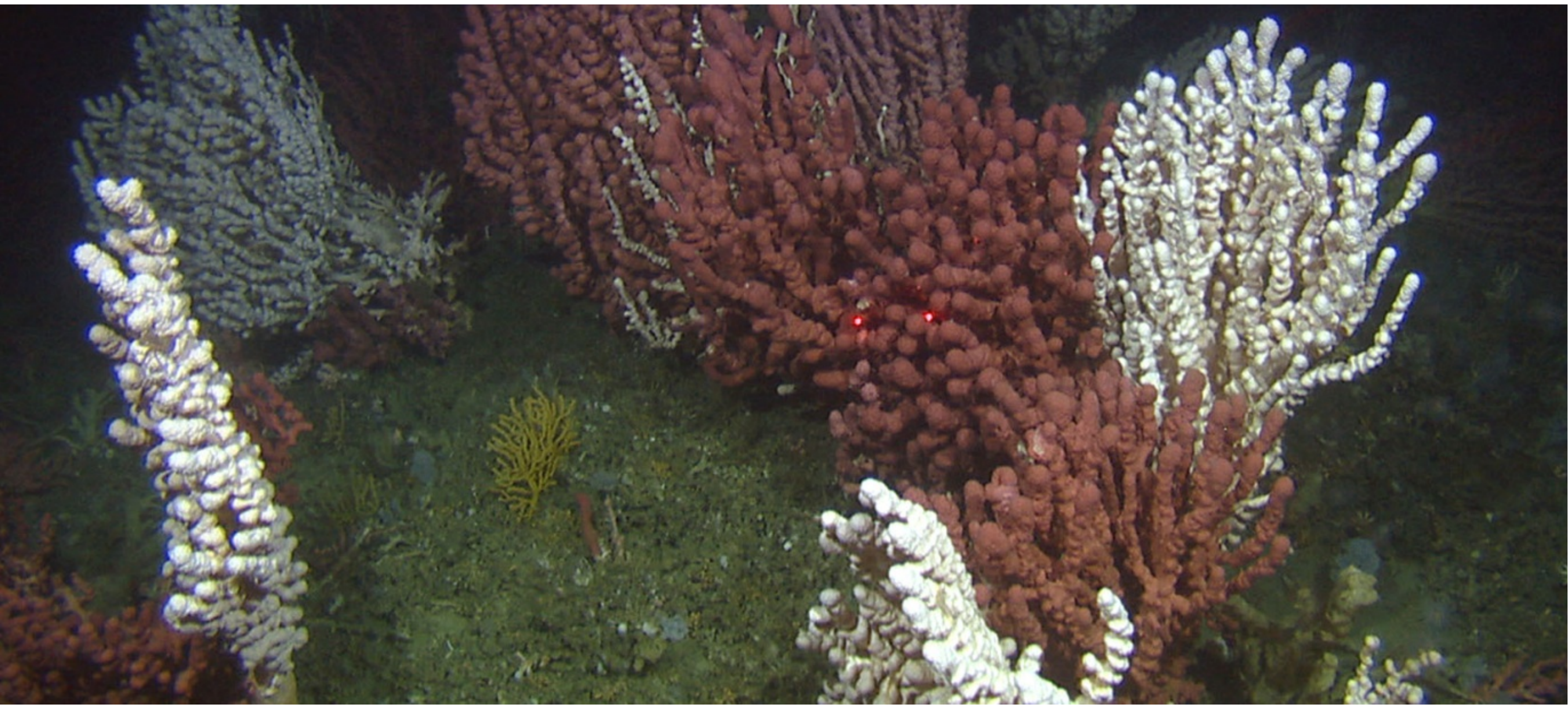


Figure 4. The gorgonian coral Paragorgia arborea (white and red) from 250 m in a fjord on the Norwegian coast (MAREANO-Institute of Marine Research, Norway).

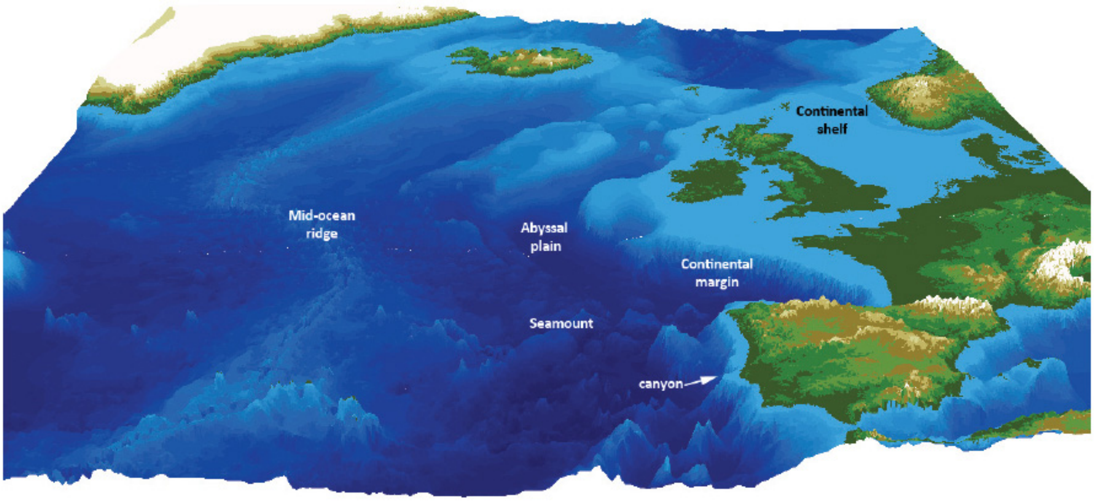


Figure 5. The Northeast Atlantic seafloor showing some of the distinct deep-sea ecosystems: continental margins – which can include canyons (arrow), cold seeps and cold water corals, abyssal plains, seamounts and the mid-ocean ridge, where hydrothermal vents are found. © Åge Høines MAR-ECO (with permission) (Ramirez-Llodra et al. 2010).

Abyssal plains

Abyssal plains form the extensive flattened out areas between the continental margins and ridges and are one of the least explored regions on earth (Figure 5). Abyssal plains stretch from approximately 4,000 to 6,000 m in water depth. The plains are covered with an inorganic sediment layer of thousands of meters. The sedimentation rates in remote ocean areas are typically low (2-3 cm / 1000y). The top layer receives organic input from the water column. Although abiotic parameters (temperature, salinity, etc.) are relatively uniform, some areas are more dynamic than previously thought due to strong flows (Crist et al. 2009, Ramirez-Llodra et al. 2010).

Abyssal plains have a desert like appearance, but support rich communities of macrofauna and meiofauna in the top centimeters of the sediment. These have high biodiversity levels. During the Census of Marine Life expeditions, a large-scale effort was undertaken to investigate abyssal plains, resulting in the discovery of many new species. At any sampling location in the deep sea, at any time, about 50% of the species encountered was new to science (Crist et al. 2009, Ramirez-Llodra et al. 2010).

A distinct habitat in the abyssal plain is formed by polymetallic manganese nodules, which contain valuable metals such as iron, nickel, cobalt and copper. Manganese nodules occur only in the deep sea and are about the shape and size of potatoes. They form a hard substrate, an important habitat for sessile animals. The nodules are wide spread in the Pacific and Indian Oceans (*Figure 19*). Future mining, regulated under the International Seabed Authority, may concentrate on these nodules (Crist et al. 2009).

Continental margin

The continental margin is the slope between the shallow continental shelf (200 m depth) and the deep abyssal plain (4,000-6000 m) (Figure 5). Once regarded as monotonous landscapes, continental margins are now acknowledged to be habitats with high heterogeneity, especially in subduction zones (Crist et al. 2009).

Table 1. Area coverage (known or estimated) of the major deep-sea habitats, with indications of the proportion of ocean floor covered and the proportion that has been investigated to date (table after Ramirez-Llodra et al. 2010).

Habitat	**Area (km^2)**	**% of ocean floor**	**Proportion investigated**	**References**
Deep water (pelagic)	1 000 000 000 km^3	73% of water in oceans	<<0.0001%	Herring (2002); Vecchione, pers. Comm.
Deep seafloor (Total)	326 000 000 km^2	100%	0.0001%	(Tyler et al. 2003)
Abyssal plains	244 360 000 km^2	75%	<1%	Gerlach (1994)*
Continental margin	4 000 000 km^2	11%	Minimal	L. Menot, unpubl data
Ridges	55 000 km long, 30 000 000 km^2 (young crest < 1 myr)	9.20%	10%	Area: German, estimated from German et al. (2004)*; Exploration: Baker and German (2004)*
Seamounts (> 1km above seabed)	8 500 000 km^2	2.6%	0.25-0.28% (250-280 seamounts samples of ca 100.000)	Seamounts online (2009), http://seamounts.sdsc.edu
Hadal zone (6000-11000m)	37 trenches (area not estimated)	1%	Minimal	Blankenship-Williams & Levin (2009)
Canyons	448 canyons, total estimated length 25 000 km2, area unknown	Unknown	Minimal	Estimated from Shepard and Dill (1966)* and GEBCO
Oxygen minimum zone (benthic)	1 148 000 km^2	0.35%	<1%	Helly and Levin (2004)
Cold-water coral reefs	Estimated 280 000 km^2	0.08%	Minimal	UNEP, http://www.unep.org/cold_water_reefs/comparison.htm
Hydrothermal vents	Approx 2000 vents, area unknown	Unknown	10% (200 known vents of ca 2000)	German et al. (2004)*
Cold seeps	10 000 km^2	0.003%	2%	Corders, pers. Com
Whale falls	~35 km^2	0.00001%	0.005% (~30 out of 690 000 estimated sulfide rich whale falls)	Smith and Baco (2003); Smith ((2006)); Treude et al. (2009)*.

* References mentioned in the article by Ramirez-Llodra et al. (2010) but not mentioned in their reference list.

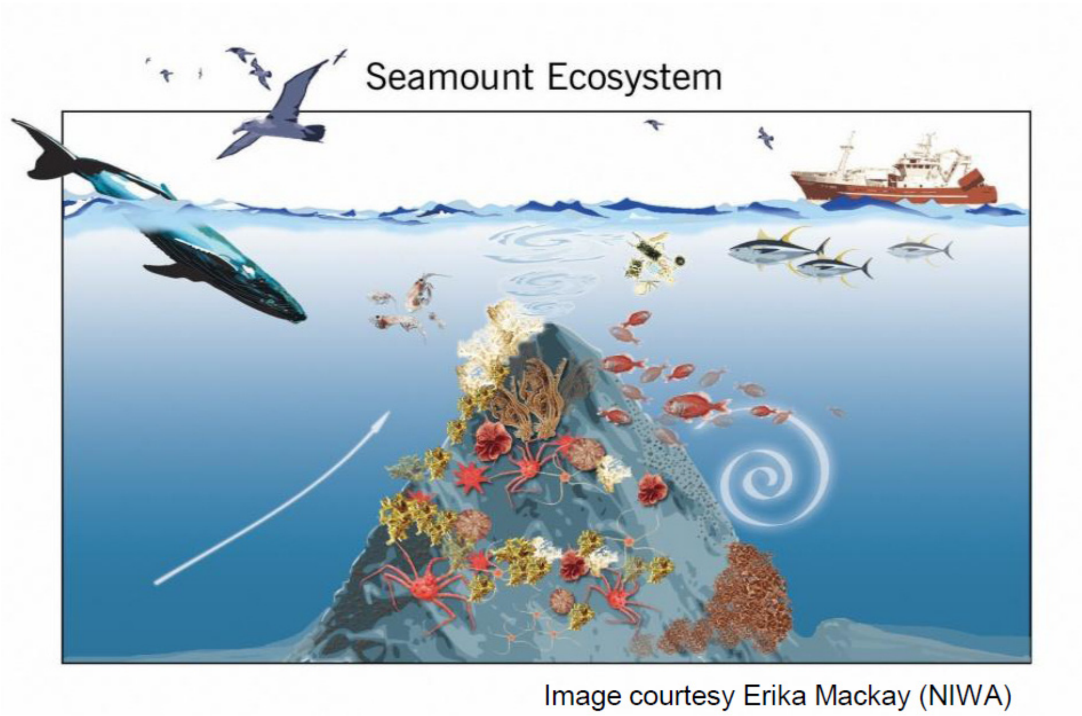


Figure 6. Seamount ecosystem (source: Census of Marine Life, http://comlmaps.org/mcintyre/ch7)

Ridges

Mid ocean ridges (MOR) are volcanic mountain ranges (Figure 5) that form 25% of the planet's surface. The variability of habitats is striking, with rocky substratum, in contrast to the sediments of the abyssal plains. Ridges are also home to hydrothermal vents (Ramirez-Llodra et al. 2010).

Seamounts

Seamounts are volcanic mountains with peaks rising more than 1000 m above the surrounding seabed (Figure 6). Worldwide more than 100,000 seamounts are estimated to exist and nearly half of the seamounts are found in the Pacific Ocean (Figure 7). Seamounts have a complex topography that may contribute to a high productivity. Fewer than 400 seamounts have been sampled and of these, fewer than 100 have been sampled in any detail. Seamounts can be hot spots for marine life and the species found on them are different from those on the surrounding seabed, but the concept of 'islands in sea' is not well supported. They may act as regional centers of speciation, stepping stones for dispersal and refuges for species with shrinking ranges. Seamounts may be home to a high endemism.
The Census of Marine Life research revealed a high biodiversity on seamounts, with 600 new species on just five investigated seamounts. The slopes of the mountains cause currents to flow upward, bringing nutrient-rich water to the top, where suspension feeders such as sponges and corals and sea fans filter the water and are home to a range of other species such as (commercial) fish. The benthic biological communities on seamounts are highly vulnerable to human activities, especially fishing. Many species are long-lived and slow growing and are therefore not resilient to human impact. Small seamounts are called 'knolls', while flattened seamounts are named 'guyots' (Crist et al. 2009, Clark et al. 2010, Ramirez-Llodra et al. 2010).

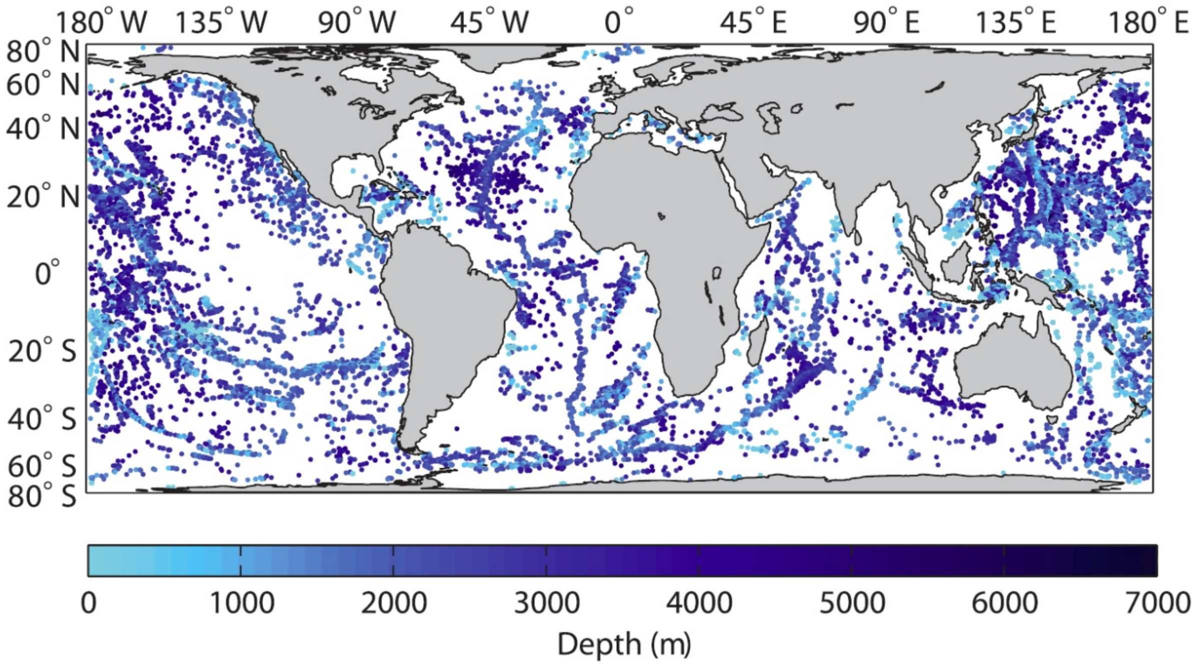


Figure 7. Potential locations of large (>1000 m height) seamounts (c 14,000) (Tittensor et al. 2009).

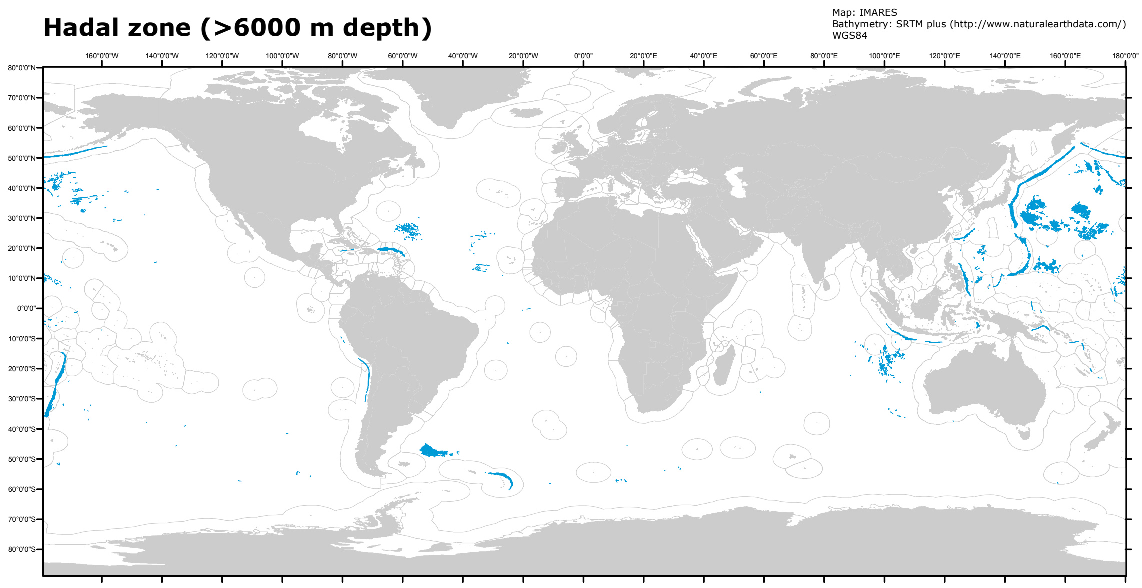


Figure 8. Hadal zone (below 6000 m).

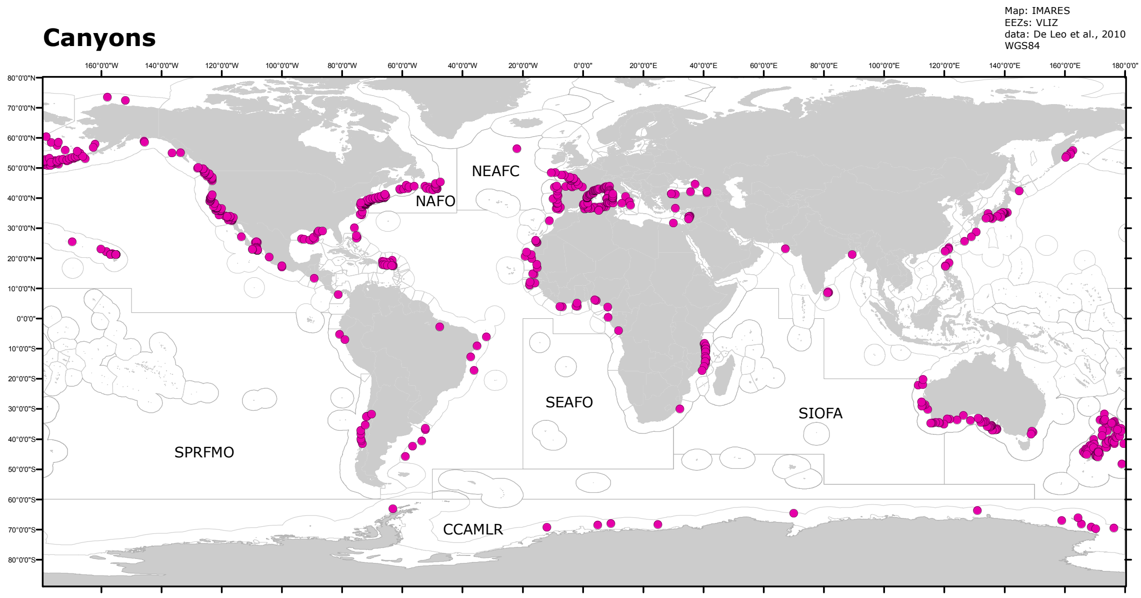


Figure 9. Locations of 660 canyons compiled from 3 datasets (data: De Leo et al. 2010).

Hadal zone

The hadal zone is the zone below 6000 m and is located almost exclusively within deep-sea trenches, which are giant sedimentation tanks of particles from the water column and the bottom sections adjoining the trenches. Trenches are typically V-shaped in cross profile with steep slopes (>45 degrees) and a width of typically less than 40 km. The hydrostatic pressure is not tolerated by most species of the abyssal plane. Still, species are present in trenches. Benthic microbial processes are accelerated as a result of organic enrichment (Blankenship-Williams & Levin 2009, Ramirez-Llodra et al. 2010).

Canyons

Canyons are deep incisions in the shelf and in continental margins (Figure 5) and form complex habitats with specific fauna that modify local current regimes. They conduct particles from the shelf to the deep basin. Their walls provide a hard substratum for filter feeders, while the axis of the canyon can accumulate soft sediment (Ramirez-Llodra et al. 2010). Most known canyons are situated relatively close to the continents (Figure 9).

Oxygen minimum zones

Oxygen minimum zones (OMZs) are mid-water regions with O_2 concentrations <0.5 ml l^{-1}. They cover about 8% of the ocean surface, persist over geological time scales and intercept continental margins at bathyal depths (100-1000m). OMZs result from a combination of factors, including high surface productivity and isolation of water masses. For the main species, such as commercial fish, the OMZs are considered as inhospitable. The northern Indian Ocean OMZ for example makes the area an unsuitable habitat for cold water corals. For organisms adapted to low O_2 conditions however, such as certain bacteria, OMZs may serve as a refugium. In the core regions of OMZs the benthic fauna typically exhibits depressed biodiversity, while at the edges, where oxygen is less limiting and a high abundance of food is present, diversity is high. Strong seafloor oxygen gradients are believed to stimulate biodiversity (Paulmier & Ruiz-Pino 2009, Tittensor et al. 2009, Gooday et al. 2010).

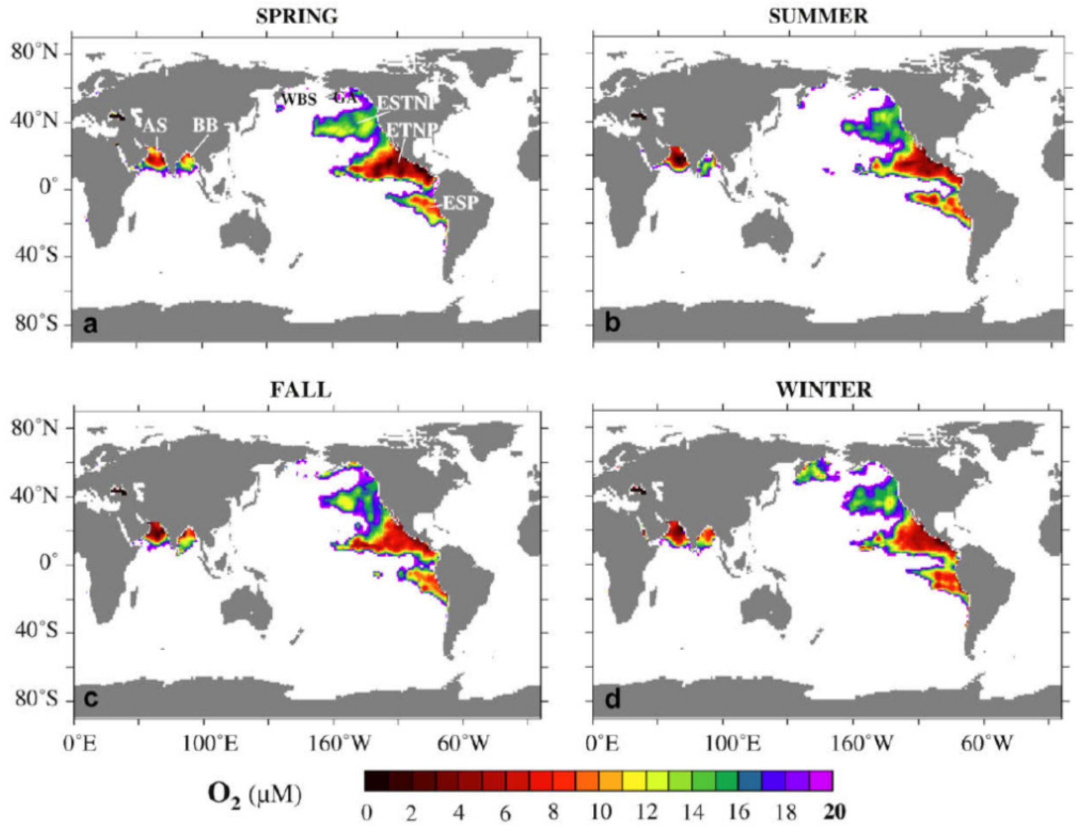


Figure 10. Distribution of oxygen minimum zones (OMZ). AS= Arabian Sea, BB=Bay of Bengal, WBS=West Bering Sea, GA= Gulf of Alaska, Estnp=Eastern Tropical North Pacific, Etnp=Eastern North Pacific, Esp=Eastern South Pacific (figure taken from: Paulmier & Ruiz-Pino 2009).

Cold water corals

Figure 11. Paragorgia coral from 250 m in a Norwegian fjord with associated fauna (MAREANO-Institute of Marine Research, Norway)

Deep water coral ecosystems are hotspots of biodiversity and provide habitats and refuges for several deep-sea species (Bongiorni et al. 2010). Cold water corals are estimated to cover at least 280,000 km^2 or 0.08% of the ocean floor (Table 1). This is about 7 times the size of the Netherlands and similar to the area covered by shallow coral reefs: 284,300 km^2 (Spalding et al. 2001).

Of the approximately 5080 known coral species worldwide, >65% occur below 50 m depth (>3300 species) (Cairns 2007). Only 6 of the deep-sea species are primary reef builders (Rogers 1999). *Lophelia pertusa*, probably the best known deep-sea coral species, may build highly complex structures that serve as biodiversity hotspots by providing a habitat for other species. For example, over 1300 species have been identified as living on or associated with *Lophelia* reefs in the northeast Atlantic (Roberts et al. 2003). In the Mediterranean, 222 different species were found at depths between 280-1121 m at the *Lophelia* reef of Cape Santa Maria da Lucia (Mastrototaro et al. 2010), an area declared off limits to bottom fishing by the General Fisheries Commission of the Mediterranean.

Corals are associated with seamounts and continental margins. Global distribution patterns of corals may be controlled by ocean chemistry: the distribution of scleractian cold-water corals appears to be strongly related to the depth of the aragonite saturation horizon, the transition depth between the supersaturated upper ocean and the undersaturated deep ocean. Aragonite is a carbonate ($CaCO_3$) mineral, needed for the coral internal skeleton (Davies et al. 2008). In the North Atlantic Ocean, the aragonite saturation horizon is much deeper than in the Pacific (Orr et al. 2005).

Table 2. Comparison of cold water and warm water coral reefs (Spalding et al. 2001, Cairns 2007) (table adapted from http://www.unep.org/cold_water_reefs/comparison.htm).

	Cold water corals	**Warm water corals**
Distribution	Global	Global (between 30°N and 30°S)
Area (km^2)	>280,000 km^2	284,300 km^2
Temperature range	4-13°C	20-29°C
Known number of coral species	>3300	>1740 (total number of coral species = 5080)
Number of reef building coral species	6 species	Around 800
Symbiotic algae	No	Yes

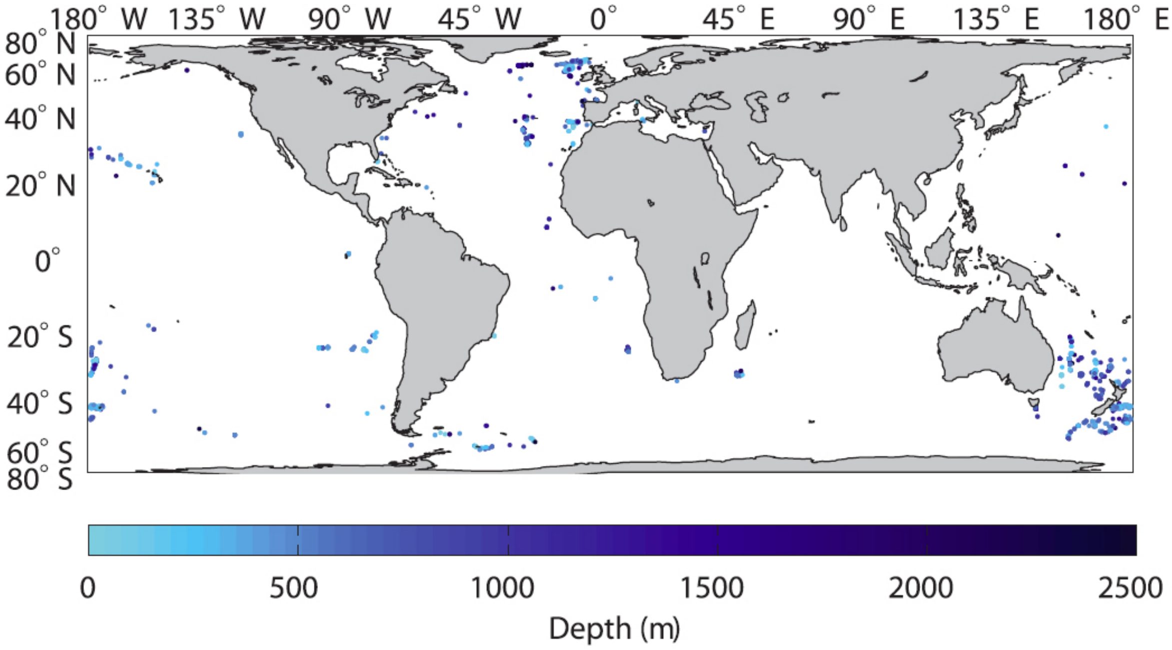


Figure 12. Locations of cold water stony coral (Scleractinia) samples from seamounts (figure taken from Tittensor et al. 2009).

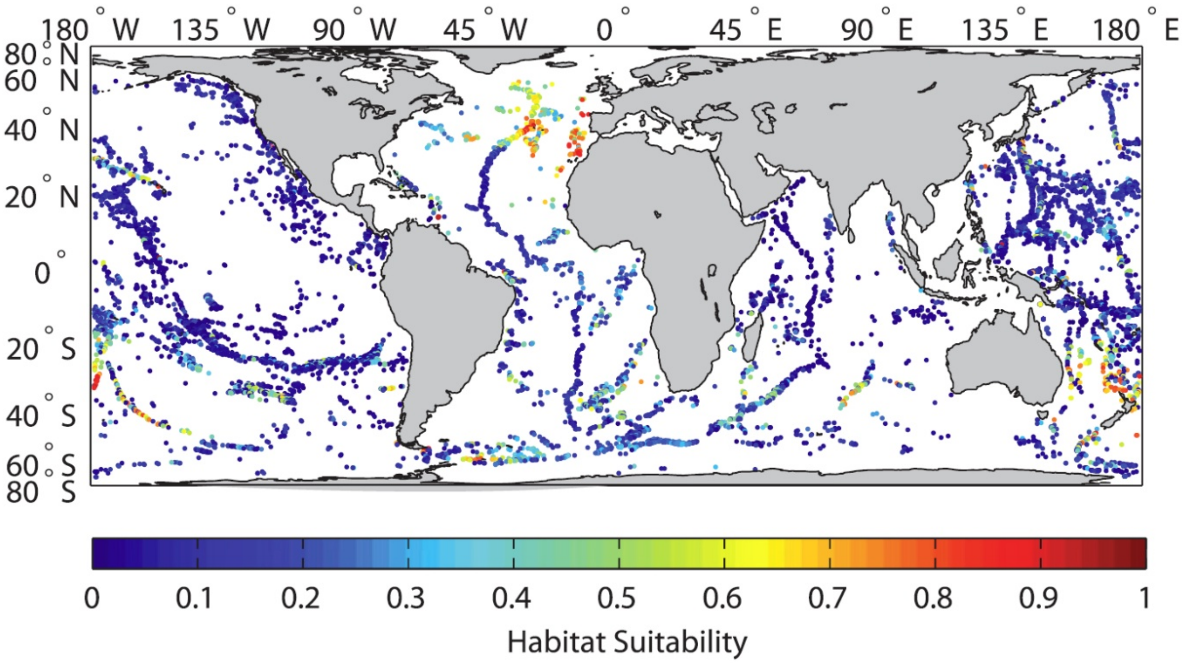


Figure 13. Predicted habitat suitability for cold water stony coral (Scleractinia) on seamounts. Top: results from the Maxent (maximum entropy modeling) model. Only seamounts with summit depths < 2500 m are included (figure taken from Tittensor et al. 2009).

Hydrothermal vents

Hydrothermal vents are fissures from which geothermally heated water emerges (up to 407°C) and are found near volcanically active places, such as the mid oceanic ridges (Bachraty et al. 2009, Crist et al. 2009, Ramirez-Llodra et al. 2010). Vent ecosystems, often several kilometers deep, do not directly depend on the sun's energy but are fueled by chemical energy instead. Bacteria play the role of primary consumers and they occur as microbial mats or as symbionts in many species, such as giant tube worms *Riftia pachyptila*. Over 600 species associated with hydrothermal vents have been described since the late 1970's, 70% of which are endemic to the vents. However, diversity is low compared to the surrounding deep-sea benthos. The animal community differs at different vent locations: for example in the East Pacific the giant tube worms *Riftia* are dominant, together with large white clams *Calyptogne magnifica* and the *Bathymodiolus* mussels, while in the Atlantic dense aggregations of shrimp and mussel beds are found. In the Indian Ocean the fauna is related to the Pacific and the Atlantic Ocean. During the Census expeditions the Arctic Sea revealed several new vent locations with possibly many new species awaiting discovery.

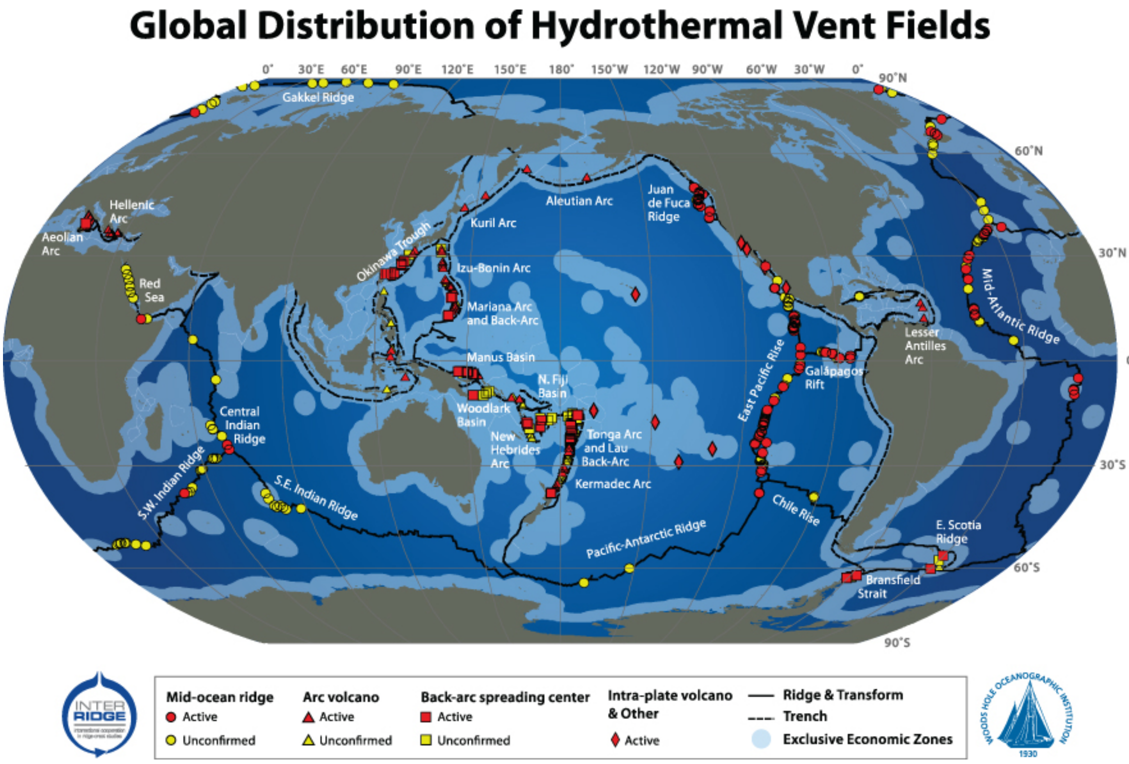


Figure 14. Locations of known hydrothermal vents from the Interridge Vents database (http://www.interridge.org/en/IRvents). Red: Active, Bleu: inactive, Yellow: unconfirmed.

Cold seeps

Just like hydrothermal vents, cold seep ecosystems are chemosynthesis-based communities that produce organic carbon through microbial chemosynthesis. In these ecosystems many organisms are found that are not found anywhere else on earth. At the seafloor, both methane (transported in fluids) and hydrogen sulphide provide energy. The synthesis of organic matter occurs in symbiotic relationships between bacteria and their invertebrate host, such as giant tubeworms and large bivalves. Cold seeps occur on active and passive continental margins and have been known since the 1980s. The seep communities have been found in 25 deep-sea areas in the Atlantic Ocean, eastern and western Pacific Ocean and the Mediterranean Sea at depths between 400 and 8,000 m depth. Many organisms are much

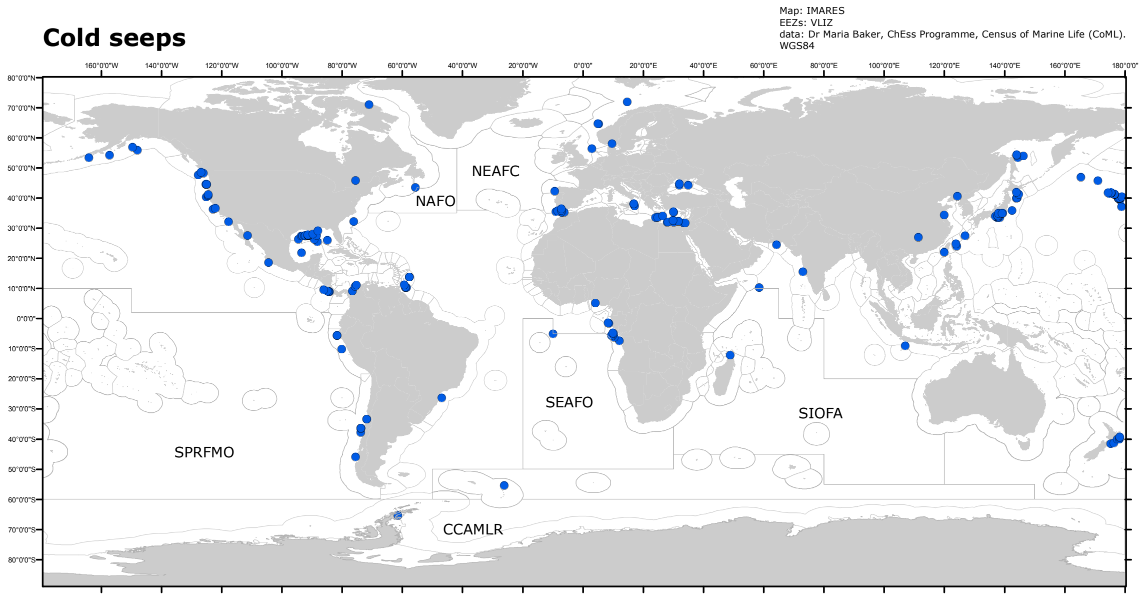


Figure 15. Locations of known cold seeps (Data: M. Baker, Census of Marine Life).

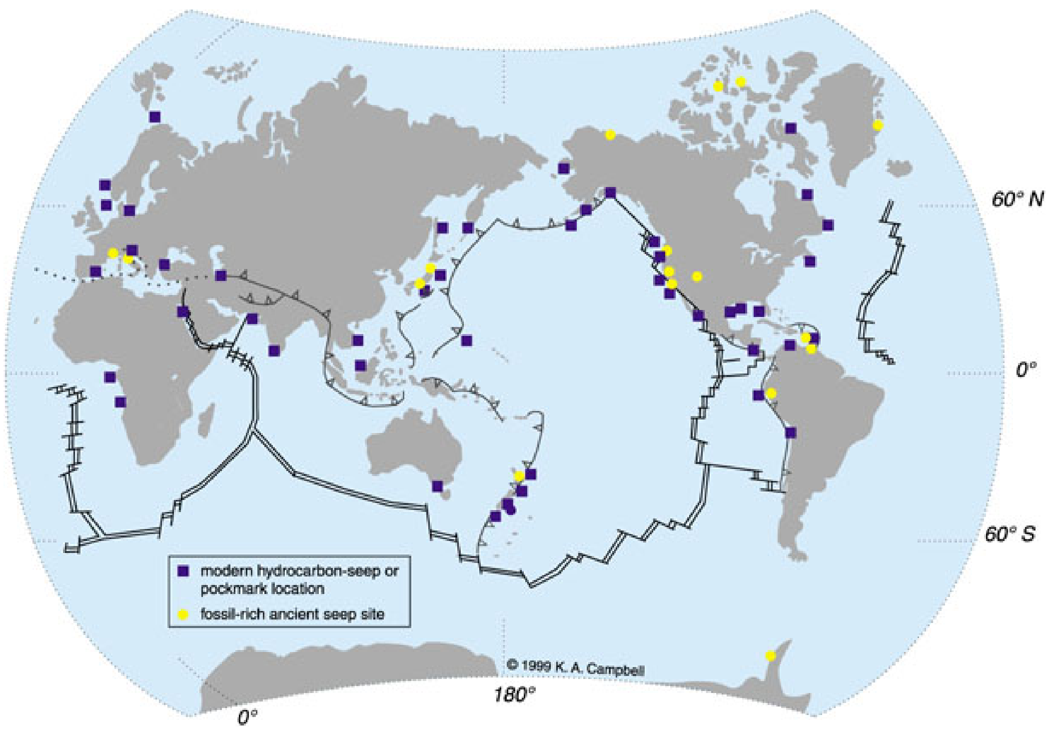


Figure 16. A number of shallow marine sites that only deposit Fe-oxyhydroxides at lower temperatures are clearly missing from the map. Global distribution of modern and ancient fluid seeps. Modern seep and pockmark distribution from Hovland and Judd, 1988, with additions (figure taken from http://www.noc.soton.ac.uk/chess/science/images/Seeps_global.jpg).

longer-lived than those inhabiting hydrothermal vents, probably because of the cooler temperature and the stability of the environment. For example, the seep tube worm *Lamellibrachia luymesi* has a life span between 170-250 years. Cold seeps develop carbonate rocks as byproducts of microbial metabolism precipitating from seep waters (Sibuet & Olu-Le Roy 2002, Crist et al. 2009, Boetius & Wenzhöfer 2010).

Whale falls

When a whale dies, an enormous amount of organic material sinks to the ocean floor, which is generally very poor in organic material. Such whale carcasses provide therefore a food rich oasis lasting for years to decades. The amount of organic matter that sinks to the sea floor through a whale fall is comparable to the amount that one hectare of the sea floor would receive in 100-200 years from primary production (Smith & Baco 2003, Yoshihiro et al. 2007).

First large scavengers remove whale soft tissue (sleeper sharks, hagfish, rat-tails, crabs) in the *mobile-scavenger stage*, then small opportunistic fauna (crustaceans, polychaetes) colonize the enriched sediments and exposed bones (*enrichment opportunity stage*) and finally the oil-rich skeleton is transformed into organic matter by chemosynthetic bacteria that attract other species (*sulphophylic stage*) (Smith & Baco 2003, Yoshihiro et al. 2007).

A whale fall can serve as a biodiversity hotspot for decades. Smith and Baco (2003) report a mean of 185 macrofaunal species in the sulphophylic stage for whale falls, which is very high, and 21 species are only known from whale falls and may be whale fall specialists. Whale falls share 11 species with hydrothermal vents and 20 with cold seeps and may therefore serve as 'stepping stones'. They further report that global species richness on whale falls is high compared with cold seeps and rivals that of hydrothermal vents, even though whale-fall habitats are very poorly sampled (Smith & Baco 2003).

At any given time, there may be > 500,000 sulfide-rich whale skeletons on the deep-sea floor. Whale falls may promote high biodiversity in the deep sea by providing hard substrates, organic enrichment and free sulfides. Prior to industrial whaling (before approx. 1800) the number of whale-falls may have been 2-5 fold higher (Baco & Smith 2003 and references therein).

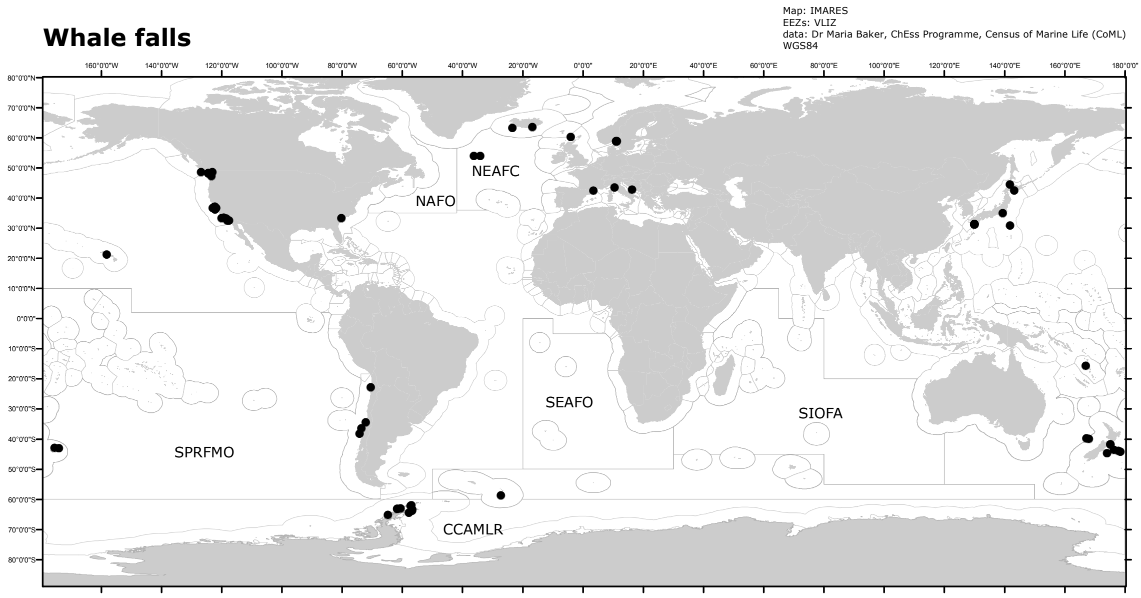


Figure 17. Locations of known deep-sea whale-fall sites studied (Data: M. Baker, Census of Marine Life).

Asphalt eruption habitats

Asphalt eruption habitats are a special kind of hydrocarbon seepage that deposits asphalt. They are only known from the Mexican gulf (21°54'N, 93°26'20''W) and are possibly a secondary result of salt tectonism. The asphalt deposits at the Chapopote knoll cover only 2,000 m^2. The deposits are inhabited by a number of species of tube worms and bivalves (Brüning et al. 2010).

Part 3. Threats to deep-sea biodiversity

The deep-sea Sea pen Umbellula encrinus *from 900 m depth at the continental slope off Norway (MAREANO-Institute of Marine Research, Norway).*

7. Overview of human impacts

Human activities in the high seas are increasing and threaten biodiversity. A comparison of activities shows that of all anthropogenic impacts in the deep-sea in areas beyond national jurisdiction, the impact of fishing is the largest and most direct and, in the case of the North East Atlantic, probably of at least an order of magnitude greater than all other activities combined (Freiwald et al. 2004, Rijnsdorp & Heessen 2008, Benn et al. 2010, Hogg et al. 2010). In the future, ocean acidification, oil and gas extraction, carbon capture and storage, and seabed mining may have important consequences for deep-sea biodiversity. At this moment, high seas fishing is generally concentrated in areas with high biomass of biodiversity, while shipping or infrastructure projects are probably not related to biodiversity hotspots (Glover & Smith 2003, Davies et al. 2007, Rijnsdorp & Heessen 2008). The main threats to deep-sea biodiversity are discussed below.

Fisheries

Development of deep-sea fisheries

There has been a long history of traditional and artisanal handline fisheries for deep-water species in the South Pacific and around Madeira and Azores in the Atlantic. Deep-sea longline fishing began in Norway and Sweden in the mid-1800s. Distant water deep-sea bottom trawl fisheries initially developed in the 1950s and 1960s with the advent of factory trawl fishing – a type of fishing technology which involves processing and freezing the catch onboard the fishing vessels. The dominant countries involved in developing deep-water bottom trawl fisheries were the countries of Eastern Europe and the former USSR. The widespread adoption of the EEZs in the late 1970s, steep declines in the catches of major deep-sea fisheries (e.g. grenadiers in the North Atlantic; pelagic armourhead *Pseudopentaceros richardsoni* in the Northwest Pacific) and the withdrawal of central government support for distant water fishing associated with the collapse of the Soviet Union in the late 1980s all combined, caused the decline of distant water deep-sea fishing by USSR and eastern European fleets. However, a number of countries began developing deep-sea bottom trawl fisheries within their EEZs along the continental slope and on seamounts during the 1980s and 1990s, and many of these fisheries have progressively expanded into deeper waters and further offshore. Amongst the most important of these were the development of the New Zealand fisheries for orange roughy *Hoplostethus atlanticus* beginning in the late 1970s, and the development of deep-water trawling for roundnose grenadier *Coryphaenoides rupestris,* blue ling *Molva dypterygia* and associated species by French trawlers in the northeast Atlantic in the 1980s (Gianni 2004).

Corals in fishing gear (Norway, photo P. van der Kamp, IMARES).

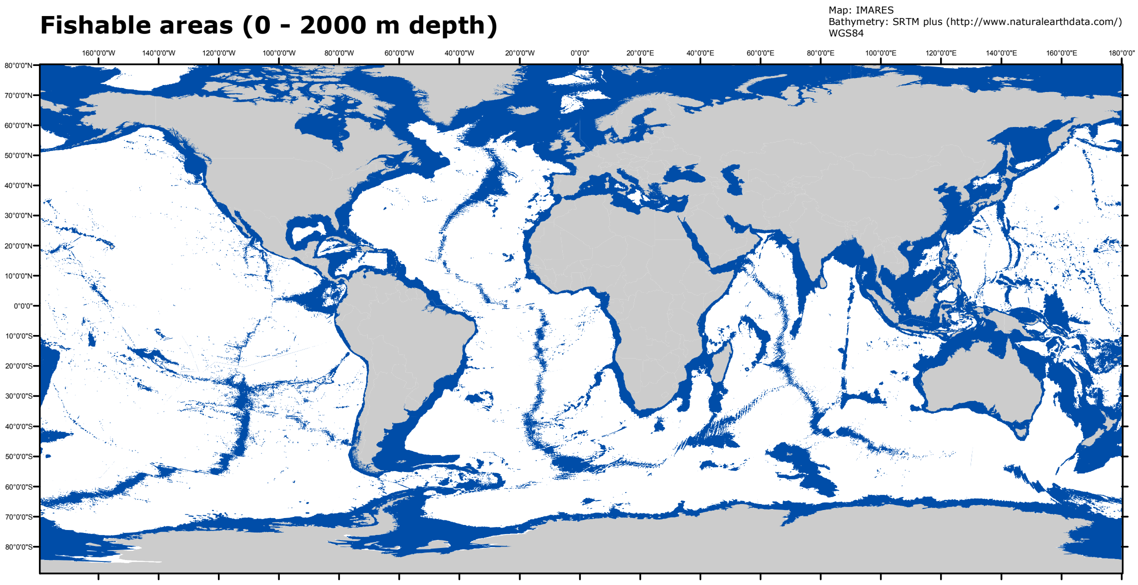


Figure 18. Areas that are theoretically fishable by deep-sea fisheries (i.e. areas < 2000 m depth).

Deep-sea fisheries progressively expanded into high seas areas in the 1990s. By 2000, bottom fishing was taking place on continental slopes, seamounts and other underwater features in much of the high seas at fishable depths (<2000 m) in the Atlantic, southern Indian Ocean, Southwest Pacific Ocean and elsewhere with around a dozen countries responsible for approximately 90% of the bottom fishing on the high seas over the course of the past decade. By far the majority of the vessels conducting deep-sea bottom fisheries on the high seas are bottom trawl vessels (Gianni 2004, Bensch et al. 2008). Deep-sea bottom trawling is one of the most physically damaging fishing methods. Bottom trawling scrapes and ploughs the sediment and damages benthic habitat forming species such as sponges, xenophyophores and cold water corals. A single tow of a trawl net can sweep across as much as several square kilometers of seafloor. In addition, deep-sea fishing targets and takes as bycatch low productivity species of fish; species which are highly susceptible to overexploitation and which cannot easily recover from over fishing. Moreover, deep-sea fishing not only causes the decline of fish populations at fishable depths, but may affect fish populations at depths well below or beyond the actual fishing grounds (Devine et al. 2006, Davies et al. 2007, Bailey et al. 2009).

Extent of deep-sea fisheries

In a review of high seas bottom fisheries by the FAO (Bensch et al. 2008) it was estimated that some 285 vessels were active in high seas bottom fisheries in 2006, with a catch roughly estimated at 250,000 tonnes and a landed value of 350 million Euros (450 million USD). Compared to the estimated world catch of marine fish of 73 million tonnes in 2006 (FAO 2010), high seas bottom fisheries constitute approximately 0.36 % of the global marine fish catch. Nonetheless, in spite of the relatively minor importance of bottom fisheries on the high seas, they are widely recognized as being the most significant direct threat to deep-sea biodiversity in areas beyond national jurisdiction.

Types of bottom fisheries on the high seas

Bottom fisheries on the high seas are generally conducted with four types of fishing gear – bottom trawls, bottom longlines, bottom set gillnets and pots or traps. Of the four main types of bottom fishing gear, bottom trawling is the most widespread, accounting for some 80% of the global reported catch in bottom fisheries on the high seas, with most of the remaining catch taken in bottom longline fisheries (Gianni 2004, Bensch et al. 2008). Over the past several years more detailed information on the relative impacts of various types of bottom fishing gear has emerged as a result of regional efforts to implement the UN General Assembly resolutions. In the next paragraphs, a comparison of bottom trawl fishing vs. bottom long lining from New Zealand's deep-sea bottom fisheries on the high seas in the South Pacific and Southern Ocean illustrates the differences in the spatial extent of the impacts of the two types of fishing gear on the seabed.

Case study: Impact of New Zealand's bottom trawl fisheries (South Pacific)

According to information submitted by the New Zealand Ministry of Fisheries to the South Pacific RFMO negotiating process, 40 New Zealand flagged vessels engaged in high seas bottom trawl fishing in the South Pacific during the period 2002-2006 (New Zealand Ministry of Fisheries 2009). The main target species were orange roughy (75% of the reported catch), deep-sea cardinal fish, oreos, and alfonsinos. The fleet conducted altogether 11,145 tows during this period with most of the fishing activity concentrated in the months of April-August. An average of 18 vessels participated in the fishery per year. A previous submission by New Zealand to the South Pacific RFMO negotiating process indicated that the high seas bottom trawl fleet fished a total of 4,379 days in the period 2002-2006. The total reported catch for the five year period was 12,352 t of "*retained*" catch, representing approximately 1.1 t per tow. The average number of tows per day would have been approximately 2.5 tows per day. Each vessel would have fished, on average, slightly less than 50 days per year.

Below we provide a number of 'worst case' estimates of the impact of bottom fisheries, calculated by multiplying the fished area per tow with the number of tows per fishing vessel per year. It is possible that areas are fished more than one, in which case the total impacted area is smaller.

To estimate the cumulative impact of New Zealand's trawl fishery in the South Pacific in the period 2002-2006 we used the following data (see also Table 3). The average distance per tow was 5.8 nautical miles or 10.8 kilometers, with an average towing time of 2.2 hours. According to the New Zealand Ministry of Fisheries, the optimum spread of the trawl doors or otter boards during towing is 120-150 m (with maximum spread at app. 200 m). Using 135 m as the mean optimal spread, the average area of seabed impacted by the gear would have been approximately 1.46 km2 per trawl tow. Thus, assuming a bottom trawl vessel targeting orange roughy averaged 2.5 tows per day, the vessel would have impacted approximately 3.65 km^2 of seabed per day of fishing. The cumulative area of impact on the seabed of the high seas bottom fleet for the five year period would have been approximately 16,000 square kilometers or 3,200 km^2 per year. Each vessel would have averaged a cumulative impact of approximately 180 km^2 of seabed for 1.5-2 months of bottom trawl fishing per year (see Table 3).

More generally, the New Zealand Ministry of the Environment estimated the seabed impact of large-scale bottom trawl fishing by New Zealand vessels in 2008, most if not all of which occurred within the New Zealand EEZ. A fleet of 68 large fishing vessels, primarily vessels longer than 28 m operating in waters deeper than 200 m, conducted 38,648 trawls with a cumulative impact of 85,222 km^2 on the seabed. Each tow would have impacted an average of 2.2 km^2 of the seabed with each of the 68 vessels making an average of 568 tows in 2008. Many of these vessels would have been targeting deep-sea species such as hoki *Macruronus novaezelandiae*, oreos, and orange roughy with at least some of the fishing targeting aggregations of fish associated with seamounts (or hills, knolls, or rises) where the tows are often shorter (in terms of length and time in contact with seabed) than in continental slope areas (Ministry of Environment New Zealand 2010).

The calculation of the average area impacted per trawl or tow by bottom trawlers based on the information provided by the New Zealand Ministry of the Environment results in a higher figure than the figure derived from using the information submitted by the New Zealand Ministry of Fisheries for the high seas bottom trawl fisheries in the South Pacific. However, this may be due to a relatively larger proportion of tows within New Zealand's EEZ occurring along continental slope areas or large plateaus and rises as opposed to trawling on seamounts (which tend to involve shorter tow times).

Case study: Impact of New Zealand's bottom longline fisheries (South Pacific and Southern Ocean)

In the South Pacific, New Zealand reports that for the average of approximately 1000 hooks per bottom longline set over 2002-2006, the maximum impacted area would be no more than 0.012 km^2 or *"two orders of magnitude less than maximum impacts of an average trawl tow"* (New Zealand Ministry of Fisheries 2009).

More detailed information on the potential impacts of bottom longline fishing in the Southern Ocean was provided to CCAMLR in 2008 by a number of countries fishing in the region (CCAMLR 2008). New Zealand, in its preliminary assessment of bottom fishing activities, calculated that the impact to the seabed of bottom longline fishing by New Zealand vessels in the Ross Sea was approximately 1,000 m^2 per 1 km of longline gear. The fleet targets toothfish and operates in depths of 600-2,000 meters. Soak times (the time the gear is fully deployed in the water and fishing) are approximately 12-36 hours with another several hours involved in setting and hauling back the gear. New Zealand reported that a total of 4,657 sets were made over the 12 year period averaging approximately 7 km of longline gear per set (a total of 32,666 km of gear set). The number of vessels involved in the fishery ranged from 1-6 per year with an average of 3.3 vessels fishing per year. New Zealand estimated that the cumulative area of seabed impacted by bottom longline fishing in the Ross Sea by New Zealand vessels over the period of 1997-2008 was approximately 35 km^2 or approximately 7,500 m^2 per set. New Zealand reports that the length of the fishing season is approximately 3 months per year and that in the period between 1998 and 2008 the number of sets per vessel per fishing year ranged from 82 to 185 sets per vessel per year, suggesting that, on average, longline vessels in the fishery average 1-2 sets per day during the fishing season (vessels may carry multiple lines while at the same time may not fish every day depending weather conditions and time spent steaming between fishing areas).

The New Zealand impact assessment states that the gear used by New Zealand vessels in the exploratory longline fisheries is similar to the gear used by Norwegian, South African and UK vessels. Spanish vessels use a different longline method with the average length of line per set approximately 13.5 km. Nonetheless, New Zealand estimates that the cumulative area of seabed impacted in the Ross Sea (CCAMLR areas 88.1 and 88.2) by bottom longline fleets from all countries combined since 1997 was approximately 93.19 km^2.

Table 3. Impact of New Zealand's bottom trawl and bottom longline fisheries

Parameter	**Value**
Impact of NZ bottom trawl fisheries in South Pacific	*Source data: NZ Ministry of Fisheries*
Average distance per tow	5.8 nautical miles (10.8 km)
Average towing time	2.2 hours
Spread of trawl doors (otter trawl)	120-150 m (max 200 m)
Mean spread (used for calculation)	135 meter
Number of trawls/day	2.5
Fishing time / year	1.5 to 2 months / year
Fishing time / year (used for calculation)	50 days
Impacted area/vessel/day	10.8 km x 0.135 km x 2.5 /d = 3.645 km^2/d
Impacted area/vessel/year	**3.645 km^2/d x 50 d = 182.25 km^2**
Average number of vessels / year	18
Cumulative impacted area / year	3.645 km^2/d/vessel x 50 d x 18 vessels = 3,281 km^2
Cumulative impacted area / 5 years (2002-2006)	5 years x 3,280 km^2 = 16,402 km^2
Impact of NZ bottom longline fisheries in Ross Sea (Southern Ocean)	*Source: Impact assessment submitted to CCAMLR*
Total number of sets	4,657 sets
Total length of sets	32,666 km
Period	12 y
Total impacted area in 12 y period	Approx. 35 km^2
Average length per longline set	Approx. 7 km (7014 m)
Number of vessels	1-6 per year (3.3 average)
Sets/ship/year	4,675 set /(3.3 vessels/12 years) =118 sets/year
Bottom impact per unit length longline	Approx. 0.001 km^2 / km line (1071 m^2)
Soak time (gear at bottom)	12-36 h
Fishing time per year	3 months / year
Impacted area/vessel/set	7 km x 1071 m^2/km = 0.0075 km^2
Impacted area/vessel/year	**0.0075 km^2 x 118 sets /vessel/y =0.89 km^2**

Other estimates of the seabed impact of bottom trawl fishing on the high seas

<u>Atlantic</u>

Information on the extent of seabed area impacted by deep-sea bottom trawling is not nearly as detailed in other high seas areas as that from New Zealand in the South Pacific. Nonetheless, available information suggests that the area impacted per vessel per fishing day may be similar. Hall-Spencer et al. (2002) estimated a trawler equipped with two trawls typical of the fleet fishing the West Ireland continental shelf-break area, operating in depths between 840-1300 m in the Northeast Atlantic with an average net spread of 22 metres, would sweep an area of seabed of approximately 33 km^2 in 15 days of fishing (the typical length of a fishing trip), or an average of 2.2 km^2 per day (Hall–Spencer et al. 2002). However this may be an underestimate in that the estimate of the spread of the gear may not have taken into consideration the distance between the otter boards or doors but only the spread of the mouth of the net.

Benn et al. (2010) estimated that a fleet of 28 bottom trawl vessels engaged in deep-sea fishing on the Hatton and Rockall Banks in the Northeast Atlantic in 2005 would have cumulatively impacted an area of seabed between 741 km^2 and 37,160 km^2 depending on the figures used to calculate the spread of the otter boards or doors during towing and the towing speed, with the most likely area of cumulative impact being somewhere between approximately 17,000 and 27,000 km^2 (assuming the spread between otter boards or doors is between 80-125 m and the VMS information indicating towing speed, including haulbacks, between 1.5-4.5 knots). In the Northeast Atlantic, the majority of the deep-sea bottom trawling occurs along continental slopes or large underwater features (e.g. Hatton Bank) allowing for much longer tows, on average, than on seamount features. In the Northwest Atlantic, for example, trawl tows along the slope of the Grand Banks in the NAFO Regulatory Area are reportedly as long as 20 nautical miles.

South Indian Ocean.

By contrast, in the South Indian Ocean, the majority of the bottom trawling takes place on seamounts or peaks along ridge systems. Tows on such areas are generally much shorter, sometimes as short as 1-5 minutes and rarely more than 10-15 minutes according to a report by the UN FAO (p32, Shotton 2006). A fleet of four trawlers makes an average of 2,000 bottom trawl tows per year. Assuming an average tow speed of 3 knots (or 1852 m/h) and a spread of approximately 50 metres between doors, the average area of seabed impacted per tow could be approximately 50,000 m^2 per vessel, or approximately 25 km^2 per vessel per year (for 500 tows) for the fleet during the year.

Table 4. Examples of the effect of deep-sea bottom trawling. This table does not intend to be exhaustive.

Region	**Impact of bottom trawling**	
NE Atlantic	• 33 km^2/trawler/15 days • 2.2 km^2/trawler/d	Hall-Spencer et al (2002)
	• 741 to 37,160 km^2 • 28 trawlers • 1 year (2005) • 27-1327 km^2/trawler/y	Benn et al. (2010)
South Indian Ocean	• 4 trawlers • 100 km^2/4 trawlers/y • 25 km^2/trawler/y	Shotton (2006)
South Pacific Ocean	• 3281 km^2/18 trawlers/year (see Table 3) • 3.6 km^2/trawler/day	New Zealand Ministry of Fisheries (2009)

Calculation of annual worldwide impact of deep-sea bottom trawling

Calculating the worldwide impacted area by deep-sea bottom trawling is not possible due to a lack of data. However, using the information from recent reviews of the extent of bottom trawl fishing on the high seas (Gianni 2004, Bensch et al. 2008), the cumulative impact of bottom trawling on the high seas per year could be in the range of several tens of thousands to several hundred thousand square kilometers per year. For example, an estimate of the order of magnitude can be obtained by assuming a worldwide, year-round operational fleet of 200 vessels (Gianni 2004), 100 days of fishing per year, and an impact of 2.2 km^2/d (Hall–Spencer et al. 2002). The impacted area of seafloor would in this case be in the order of 200 x 100 x 2.2 = 44,000 km^2, which is slightly more than the size of the Netherlands.

Bottom trawling versus bottom longlining

Accurate quantitative comparisons of the area of deep seabed habitat impacted by bottom trawling vs. bottom longlining and other gears are difficult to estimate. Nonetheless, it would appear that the area of deep seabed on the high seas in areas beyond national jurisdiction impacted by bottom trawling on a per set, per fishing day is substantially higher than longline fishing; two orders of magnitude higher would be a reasonable estimation.

Bycatch and other impacts

Nonetheless, it is important to recognize that bottom longlines can be used in areas, such as rocky areas, where trawlers may not be able to fish, with potential negative impacts on species for which these areas may have served as refugia from bottom trawl fishing. Durán Muñoz et al. (2011) reported that in addition to bycatch of a number of coral and sponge species in deep-sea bottom longline fisheries in the Northeast Atlantic, a number of species of deep-sea sharks were also taken as bycatch (Durán Muñoz et al. 2011). In this regard it is important to recognize that the impact of deep-sea fishing is not limited to seabed or sessile species. Bycatch levels in many deep-sea bottom fisheries are high as measured in terms of biomass and/or the number of species recorded in the catch. In one of the few studies of its kind, Bailey et al. concluded that deep-sea fisheries in the Northeast Atlantic off the coast of Ireland have substantially depleted communities of deep-sea fish stocks and populations, including species of no commercial value, as deep as 2500 meters - well below the lowest depths of approximately 1600 meters at which bottom fishing actually occurs (Bailey et al. 2009). Devine et al. (2006) concluded that the bycatch of five species of grenadiers, only two of which are reported as commercially valuable, in the deep-sea bottom trawl fisheries in the Northwest Atlantic had resulted in declines in the abundance of all five species sufficient to qualify them as critically endangered based on the IUCN Red List criteria (Devine et al. 2006).

The report of the UN FAO Expert Consultation on the International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (FAO 2007), convened in September 2007 in response to UNGA resolution 61/105, provides a summary of the particular challenges and difficulties in managing high seas bottom fisheries to protect vulnerable marine ecosystems (VMEs) and ensure the sustainability of populations of deep-sea fish:

"…many but not all marine living resources exploited by deep-sea fisheries (DSF) have biological characteristics that make management problematic. These include: maturation at relatively old ages; slow growth; long life expectancies; low natural mortality rates; intermittent recruitment of successful year classes; adults may not spawn every year. As a result, deep-sea marine living resources generally have low productivity and they are able to sustain only very low exploitation rates. Also, when these resources are depleted, recovery is expected to be long and not assured" (FAO 2007).

"The problems…with regard to sustainable use of the marine living resources targeted by DSF also apply to the protection of VMEs and marine biodiversity, and are often even greater. Particular concerns include: the sensitivity and vulnerability of some species, communities and habitats to direct and indirect impacts of fishing (easily perturbed); the extreme longevity (100s to >1000 years) of individuals of some types of organisms (e.g. octocorals) or the long times over which some habitats develop – up to >8,000 years for cold water coral reefs (slow recovery); the low resilience of species, communities and habitats as a result of low productivity, great longevity, unpredictable and usually low recruitment, and low growth rates (unpredictable recovery); a high proportion of species encountered within some deep-sea ecosystems are endemic, and are found nowhere else (high risk of loss of biodiversity, including extinctions); some vulnerable seafloor communities are distributed as spatially discrete units often within a small area relative to the overall area of the seabed (small perturbations may have significant

consequences); the connectivity between populations within geographic regions may be critical to the long-term sustainability of biodiversity (fragmentation and risk of loss of source populations); current knowledge of the ecosystem components and their relationships is generally poorly known and the gaps more difficult to fill (managing under greater uncertainty)" (FAO 2007).

Ocean acidification

The uptake of anthropogenic CO_2 by the oceans causes them to become more acidic. Acidification reduces the availability of carbonite minerals in seawater, which are important building blocks for shell forming and calcifying marine organisms (Secretariat of the Convention on Biological Diversity 2009). The surface ocean has an average pH of 8.2 units (±0.3 units due to local, regional and seasonal factors) and carbonate ion concentrations are now lower than at any other time during the last 800,000 years (refs in Davies et al. 2007, Secretariat of the Convention on Biological Diversity 2009). A further decline of 0.3-0.5 pH units is expected by 2100 (Hendriks et al. 2010). Models show that ca. 70% of current cold-water coral locations could become unsaturated with aragonite (a more soluble crystal form of calcium carbonate secreted by corals) by the end of this century (Guinotte et al. 2006).

Biological effects of acidification are variable and complex (Secretariat of the Convention on Biological Diversity 2009). It is feared that organisms such as cold water corals will become hindered in growth and will become vulnerable to dissolution below the saturation horizon (refs in Davies et al. 2007). Maier et al. (2009) indeed found a reduction of the calcification rate of 30 and 56%, when *Lophelia pertusa* polyps were confronted with a lowering of 0.15 and 0.3 pH units, respectively, but growth was still possible. A meta-analysis of acidification studies by Hendriks et al. (2010) revealed that marine biota in general may be more resistant to ocean acidification than previously suggested, but one has to keep in mind that such experiments are performed on short time scales and that their results cannot be directly extrapolated to gradually changing pH levels in the real world.

Oil and gas extraction

Due to diminishing oil and gas production in the shelf areas, deeper water are now explored. In the Gulf of Mexico deep-sea hydrocarbons have been exploited since 1979, mostly between 500 and 1500 m, although wells have been drilled at 3051 m water depth. Disasters such as the Louisiana oil rig explosion (20 April 2010) in the Gulf of Mexico show that drilling at large depths can result in huge environmental impacts (Schrope 2010). Until now, no oil and gas mining has occurred in the high seas, but there is potential for many other large reserves in other parts of the world (references in Davies et al. 2007).

Carbon capture and storage

Globally, 25 billons tonnes of CO_2 are released in the atmosphere each year. One solution to mitigate rising levels is to capture and store CO_2. Carbon dioxide (CO_2) can be stored in the ocean environment in 3 ways: in geological formations under the seabed, which is allowed since 2007, in the water column at depths exceeding 2500 m or in 'carbon lakes' at the see floor at depths greater than 3000 m where liquid CO_2 is denser than the surrounding water. Such lakes, that gradually dissolve in the water in the course of thousands of years, will have an impact on the benthic environment. At this moment, however, no CO_2 storage takes place in the high seas (Davies et al. 2007, Rijnsdorp & Heessen 2008, Ocean Acidification Network 2010).

Deep-sea mining

The International Seabed Authority (ISA) is the competent authority under UNCLOS that controls deep-sea mining (www.isa.org.jm). Deep-sea mining for minerals is an activity that is in rapid development because of the high economic potential with respect to scarce availability of (mineral) resources. Due to the unattractive financial arrangement under the ISA the focus is currently on mining projects on the (extended) continental shelf. At present, seven of the eight exploration contractors with the ISA have exploration contracts in the Clarion-Clipperton fracture zone (Pacific Ocean, 110-160°W, 0-20°N; see *Figure 19*), where the deposits are considered to be among the richest, containing high grade nodules in high abundance (ISA 2010). Mining of the nodules will result in the removal of the substrate and thus also of the attached animals, followed by the settlement of resuspended particles on the remaining benthos (Rijnsdorp & Heessen 2008). Other potential environmental impacts may result from the release of toxic plumes, light pollution and noise at site of mining or shading of phytoplankton in the upper water column in case of discharge of sediments in the upper water column. Furthermore, changes in redox conditions can lead to oxygen depletion in certain water layers (OMZ or bottom waters) and dissolution of heavy metals into the water column. It is expected that the relative shallow phosphate rock (<1000 m) will be extracted first, followed by manganese nodules (1000-2000 m) and seafloor massive sulfide (SMS) deposits (circa 3000 m) (Karman, IMARES, pers.com).

Other impacts

Other impacts on the deep-sea, which are considered less significant at this moment, include submarine cables and pipelines, research, bioprospecting and dumping of waste (Rijnsdorp & Heessen 2008).

- *Communication cables* probably have a minor impact, because the ca 1 million kilometers of fibre-optic cables that have been laid (Figure 20) only have a diameter of 17-20 mm in deep water and about 50 mm in shallower areas, because of the addition of protective armouring. Usually, impacts are temporally, localized and infrequent. Electromagnetic radiation emitted by data cables is very low compared to the radiation emitted by power cables. Marine animals sensitive to weak electrical fields, swimming close to fibre-optical cables may be attracted to the electrical field emitted by the cable. However, there is no indication that submarine data cables disturb the orientation or navigation of marine animals. *Pipelines* and *power cables* are restricted to nations EEZs (Rijnsdorp & Heessen 2008, Carter et al. 2009).
- *Research and bioprospecting* will have only small scale effects (dm scale) on benthic fauna and habitats in e.g. hydrothermal vents habitats, cold seeps, and coral reefs, due to removal and disturbance by submersibles. Currently, there are no signs of overexploitation, except perhaps of some sponges locally, although future exploitation of marine organisms could pose a potential threat (Rijnsdorp & Heessen 2008).
- *Dumping of waste* could have physical impact on the seafloor, but dumping usually took place within the EEZs and is also banned since 2006, when the 1996 London Protocol went into force (Rijnsdorp & Heessen 2008).

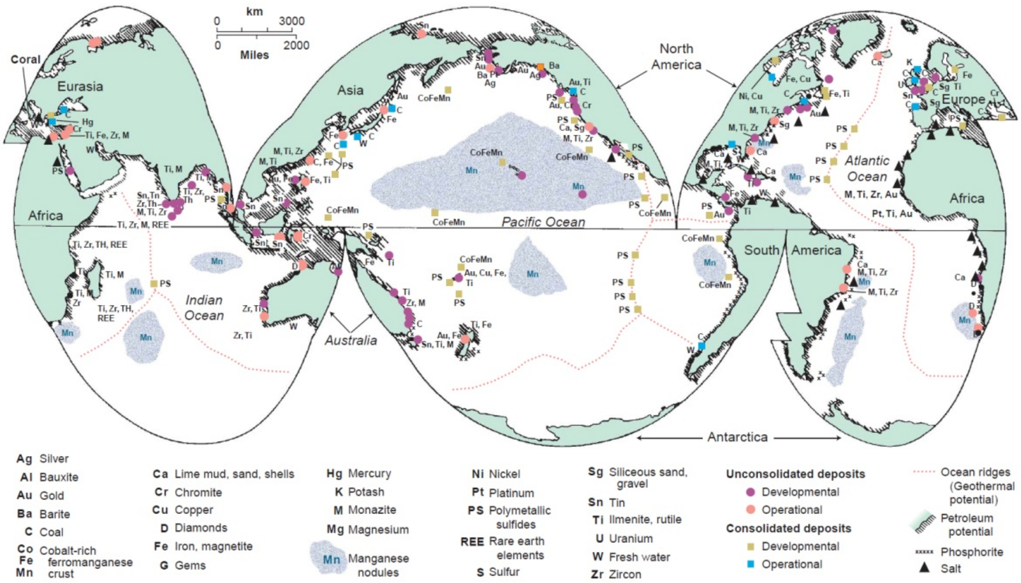


Figure 19. Global distribution of marine mineral resources known at this early stage of ocean exploration (Rona 2003).

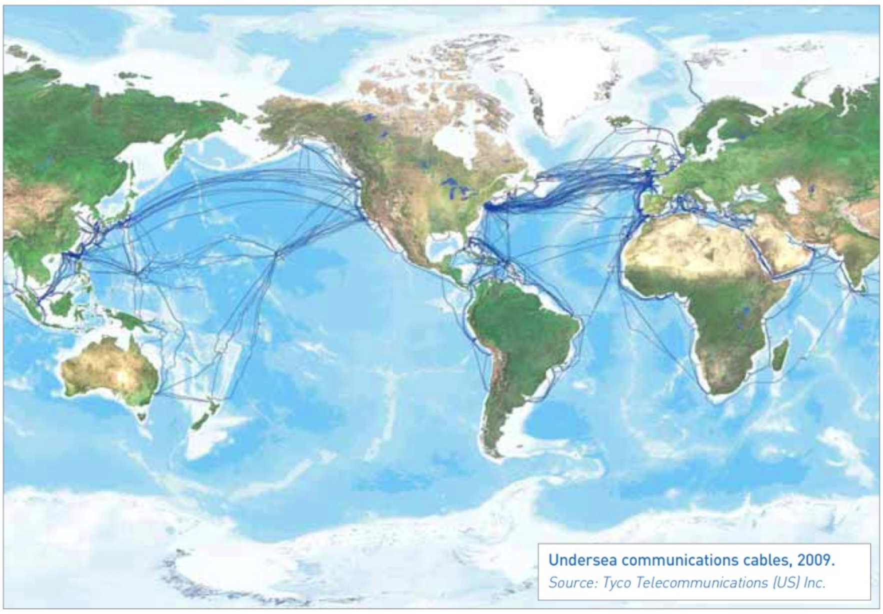


Figure 20. Undersea communication cables (Carter et al. 2009).

Assessment of the relative impacts of anthropogenic activities on deep-sea biodiversity

The impact of anthropogenic activities on the ecosystem and on marine biodiversity is difficult to assess due to the lack of quantitative information on activities such as fisheries, oil and gas extraction and carbon capture. Rijnsdorp & Heessen (2008) therefore used expert judgment in combination with an extensive literature research to compare the impact of different human activities. Acidification was not included. The impact was calculated as *severity* x *recoverability* (both on a scale from 1-3, where 0 = not applicable; 1 = negligible; 2 = significant and 3 = substantial). *Severity* is the probability that a benthic habitat is damaged or has reduced food availability higher up in the food chain, while recoverability evaluated as the time needed to recover after the activity has stopped. The impact assessment only concerns local impact, because the *extent* of the impact (the spatially affected area) is not taken into account, due to a lack of data.

Bottom trawl fisheries appeared to have the largest local impact on deep-sea ecosystems in the high seas (Table 5). The accumulation of effects due to multiple activities in the same area is even more complex and has therefore not been assessed (Rijnsdorp & Heessen 2008).

Table 5. Local ecosystem impact of different activities in the high seas as estimated by Rijnsdorp & Heessen (2008) in an extensive impact assessment of human activities in the high seas (see text).

	Activity	fish	benthos	benthic habitats	birds	marine mammals	turtles	food chain
Fisheries	Epipelagic longline	6	0	0	4	0	4	4
	Epipelagic gillnet	6	0	0	1	1	4	4
	Epipelagic purse seine	6	0	0	0	4	0	4
	Epipelagic trawl	6	0	0	0	1	1	4
	Demersal longline	9	2	2	4	0	1	4
	Demersal gillnet	9	2	2	1	1	0	4
	Demersal trawl	9	9	9	0	0	0	4
Mining	Mining	1	4	4	0	0	0	0
Shipping	Oil	0	0	0	3	0	0	0
	Chemicals	0	0	0	1	0	0	0
	Garbage	1	3	6	4	1	4	3
	Antifouling	0	0	0	0	0	0	0
	Exotic species	0	0	0	0	0	0	0
	Air pollution	0	0	0	0	0	0	0
	Noise	0	0	0	0	2	0	0
Iron fertilisation	fertilisation	0	2	2	0	0	0	1
CO2 storage	CO2	0	6	9	0	0	0	0
	Contaminants	0	1	1	0	0	0	0
Tourism	Tourism	0	0	0	4	4	0	4
Infrastructure	Data cables	0	1	1	0	0	0	0
	Power cables	1	0	1	0	1	0	0
	Pipelines	0	1	4	0	0	0	0
Bioprospecting	Exploration	0	2	2	0	0	0	0
	On shore isolation, testing	0	0	0	0	0	0	0
	Exploitation	0	9	9	0	0	0	0
	Bioprospecting MSR	0	4	4	0	0	0	0

legend	
0	
1-2	low impact
3-4	
5-6	
7-8	
9	high impact

More recently, Benn et al. (2010) reviewed the spatial extent of the impact on the seabed at depths below 200 meters of a variety of activities in the Northeast Atlantic. The study concluded that spatial extent of the impact on the seabed at depths greater than 200m from waste disposal, telecommunication cables, the hydrocarbon industry and marine research activities is relatively small by comparison to the impact of bottom trawling. The study concluded that the impact of deep-sea bottom trawling in just one area of the Northeast Atlantic (defined as the area covered by the OSPAR Convention) – the Rockall and Hatton Banks which straddle the EEZs of Ireland, Scotland and the Faroes Islands and the high seas – during the year 2005 was one to three orders of magnitude greater than the total extent of all other activities in the whole of the Northeast Atlantic which have impacted the seabed below 200 meters over the past several decades (Benn et al. 2010).

A number of other studies have come to conclusions similar to those of Benn et al. (2010) and Rijnsdorp & Heessen (2008) in regard to the extent of the impact of bottom trawling (Watling & Norse 1998, Robberts 2002, Freiwald et al. 2004, Gianni 2004, Davies et al. 2007, ICES 2008, Hogg et al. 2010). ICES states that while any fishing gear that has bottom contact has the potential to damage vulnerable deep-water habitats, the degree of impact depends on the type of gear, the degree of contact with the seabed and the frequency of contact and that even bottom gear with a low potential for damage per deployment can potentially cause significant impact if used intensively. However, ICES concludes that *"the greatest instantaneous physical impact on sensitive habitats is likely to be caused by towed otter trawls…"* (ICES 2008).

Summary of threats to deep-sea biodiversity

Table 6. Summary of threats to deep-sea biodiversity.

Threat	Summary
Fisheries	• Bottom trawling is one of the most physically damaging fishing methods • Bottom trawling damages non-target species (e.g. sponges, cold-water corals) • Deep-sea fishing is not sustainable: deep-sea predatory fish populations have declined with 10-50% from 1950. • Effects of fishing also manifest below fishing depths (Porcupine bight, SW of Ireland). • In 2006 high seas fisheries comprised at least 286 vessels flagged to 27 countries, a catch of 250 000 tonnes (0.36% of the world catch) and a value of EUR 450 million. The world catch of marine species in 2006 was 73 million tonnes.
Climate change and ocean acidification	• Acidification will take place • pH of the surface ocean: 8.2 units (±0.3) (note: pH has a logarithmic scale) • Compared to pre-industrial times, the pH has dropped with 0.1 pH unit • A decline with 0.3-0.5 pH units is expected by 2100 (IPCC scenario) • Calcifying organisms are expected to 'dissolve' when the water is not saturated anymore. • Effects on organisms and ecosystems are complex and variable • Marine biota may be more resistant to ocean acidification than expected (meta-analysis of experiments)
Oil and gas extraction	• No oil/gas mining is present in the high seas yet. • Oil/gas are exploited in deep-sea areas within EEZs since 1979 (Gulf of Mexico, max 3051 m). • Disasters (Deepwater Horizon spill 20 April 2010, Gulf of Mexico) show that deep-sea oil extraction cannot be done 100% safely and may have very large impacts.
CO_2 capture and storage	• CO_2 storage in the high seas does not take place yet. • Globally, 25 billons tonnes of CO_2 are released in the atmosphere each year. One solution to mitigate rising levels is to capture and store CO_2. • Since 2007 it is allowed to sequester CO_2 beneath the seabed, but the technology is currently expensive and difficult to implement. • CO_2 could be injected in underground geological formations and/or as a liquid in the deep-sea. • High concentrations of CO_2 at injection points can have local effects on deep-sea organisms.
Deep-sea mining	• Deep-sea mining for minerals is still in an experimental stage on the high seas because it is expensive. • There are large areas with mineral resources such as manganese nodules • Mining of the nodules will results in the removal of the hard substrate and thus also of the attached animals, followed by the settlement of resuspended particles on the remaining benthos.
Cables and pipelines	• About 1 million km of fibre-optic communication cables are present on the seafloor. • Diameter: 17-20mm (deep-sea), 50 mm (shallow water) • Impacts are temporally, localized and infrequent. • Electromagnetic radiation emitted by data cables is very low • Pipelines and power cables are restricted to nations EEZs
Research and bioprospecting	• Small scale effects (dm scale) on benthic fauna and due to removal and disturbance by submersibles. • Currently, there are few to no signs of overexploitation, • Future exploitation of marine organisms could pose a potential threat
Dumping of waste	• Could have physical impact on the seafloor • Usually within the EEZs • Banned since 2006.

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9. Quality Assurance

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 57846-2009-AQ-NLD-RvA). This certificate is valid until 15 December 2012. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2013 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

10. Acknowledgements

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Annex A Texts of relevant agreements

UNGA resolution 59/25 (paragraphs 67-69) (UNGA 2005)

The General Assembly

67. Calls upon regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries urgently to adopt, in their regulatory areas, appropriate conservation and management measures, in accordance with international law, to address the impact of destructive fishing practices, including bottom trawling that has adverse impacts on vulnerable marine ecosystems, and to ensure compliance with such measures;

68. Calls upon members of regional fisheries management organizations or arrangements without the competence to regulate bottom fisheries and the impacts of fishing on vulnerable marine ecosystems to expand the competence, where appropriate, of their organizations or arrangements in this regard;

69. Calls upon States urgently to cooperate in the establishment of new regional fisheries management organizations or arrangements, where necessary and appropriate, with the competence to regulate bottom fisheries and the impacts of fishing on vulnerable marine ecosystems in areas where no such relevant organization or arrangement exists;

UNGA resolution 61/105 (paragraphs 76-87) (UNGA 2006)

The General Assembly

76. Encourages States to apply by 2010 the ecosystem approach, notes the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem and decision VII/11 and other relevant decisions of the Conference of the Parties to the Convention on Biological Diversity, notes the work of the Food and Agriculture Organization of the United Nations related to guidelines for the implementation of the ecosystem approach to fisheries management, and also notes the importance to this approach of relevant provisions of the Agreement and the Code;

77. Also encourages States, individually or through regional fisheries management organizations and arrangements and other relevant international organizations, to work to ensure that fisheries and other ecosystem data collection is performed in a coordinated and integrated manner, facilitating incorporation into global observation initiatives, where appropriate;

78. Further encourages States to increase scientific research in accordance with international law on the marine ecosystem;

79. Calls upon States, the Food and Agriculture Organization of the United Nations and other specialized agencies of the United Nations, subregional and regional fisheries management organizations and *arrangements, where appropriate, and other appropriate intergovernmental bodies, to cooperate in achieving sustainable aquaculture, including through information exchange, developing equivalent standards on such issues as aquatic animal health and human health and safety concerns, assessing the potential positive and negative impacts of aquaculture, including socio-economics, on the marine and coastal environment, including biodiversity, and adopting relevant methods and techniques to minimize and mitigate adverse effects;*

80. Calls upon States to take action immediately, individually and through regional fisheries management organizations and arrangements, and consistent with the precautionary approach and ecosystem approaches, to sustainably manage fish stocks and protect vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals, from destructive fishing practices, recognizing the immense importance and value of deep sea ecosystems and the biodiversity they contain;

81. Reaffirms the importance it attaches to paragraphs 66 to 69 of its resolution 59/25 concerning the impacts of fishing on vulnerable marine ecosystems;

82. Welcomes the important progress made by States and regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries to give effect to paragraphs 66 to 69 of its resolution 59/25 to address the impacts of fishing on vulnerable marine ecosystems, including through initiating negotiations to establish new regional fisheries management organizations or arrangements, but on the basis of the review called for in paragraph 71 of that resolution, recognizes that additional actions are urgently needed;

83. Calls upon regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries to adopt and implement measures, in accordance with the precautionary approach, ecosystem approaches and international law, for their respective regulatory areas as a matter of priority, but not later than 31 December 2008:

- *a) To assess, on the basis of the best available scientific information, whether individual bottom fishing activities would have significant adverse impacts on vulnerable marine ecosystems, and to ensure that if it is assessed that these activities would have significant adverse impacts, they are managed to prevent such impacts, or not authorized to proceed;*
- *b) To identify vulnerable marine ecosystems and determine whether bottom fishing activities would cause significant adverse impacts to such ecosystems and the long-term sustainability of deep sea fish stocks, inter alia, by improving scientific research and data collection and sharing, and through new and exploratory fisheries;*
- *c) In respect of areas where vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals, are known to occur or are likely to occur based on the best available scientific information, to close such areas to bottom fishing and ensure that such activities do not proceed unless conservation and management measures have been established to prevent significant adverse impacts on vulnerable marine ecosystems;*
- *d) To require members of the regional fisheries management organizations or arrangements to require vessels flying their flag to cease bottom fishing activities in areas where, in the course of fishing operations, vulnerable marine ecosystems are encountered, and to report the encounter so that appropriate measures can be adopted in respect of the relevant site;*

84. Also calls upon regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries to make the measures adopted pursuant to paragraph 83 of the present resolution publicly available;

85. Calls upon those States participating in negotiations to establish a regional fisheries management *organization or arrangement competent to regulate bottom fisheries to expedite such negotiations and, by no later than 31 December 2007, to adopt and implement interim measures consistent with paragraph 83 of the present resolution and make these measures publicly available;*

86. Calls upon flag States to either adopt and implement measures in accordance with paragraph 83 of the present resolution, mutatis mutandis, or cease to authorize fishing vessels flying their flag to conduct bottom fisheries in areas beyond national jurisdiction where there is no regional fisheries management organization or arrangement with the competence to regulate such fisheries or interim measures in accordance with paragraph 85 of the present resolution, until measures are taken in accordance with paragraph 83 or 85 of the present resolution;

87. Further calls upon States to make publicly available through the Food and Agriculture Organization of the United Nations a list of those vessels flying their flag authorized to conduct bottom fisheries in areas beyond national jurisdiction, and the measures they have adopted pursuant to paragraph 86 of the present resolution;

UNGA Resolution 64/72 (paragraphs 116-122) (UNGA 2009)

The General Assembly

116. Welcomes the important progress made by States, regional fisheries management organizations or arrangements and those States participating in negotiations to establish a regional fisheries management organization or arrangement competent to regulate bottom fisheries to implement paragraphs 80 and 83 to 87 of resolution 61/105 and address the impacts of bottom fishing on vulnerable marine ecosystems;

117. Also welcomes the substantial work of the Food and Agriculture Organization of the United Nations related to the management of deep sea fisheries in the high seas and the protection of vulnerable marine ecosystems, in particular the development and adoption of the Guidelines, and urges States and regional fisheries management organizations or arrangements to ensure that their actions in sustainably managing deep sea fisheries and implementing paragraphs 80 and 83 to 87 of resolution 61/105 and paragraphs 119, 120 and 122 to 124 of the present resolution are consistent with the Guidelines;

118. Notes with concern that, despite the progress made, the urgent actions called for in paragraphs 80 and 83 to 87 of resolution 61/105 have not been sufficiently implemented in all cases;

119. Considers that, on the basis of the review carried out in accordance with paragraph 91 of resolution 61/105, further actions in accordance with the precautionary approach, ecosystem approaches and international law are needed to strengthen the implementation of paragraphs 80 and 83 to 87 of resolution 61/105, and in this regard calls upon regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries, States participating in negotiations to establish such organizations or arrangements, and flag States to take the following urgent actions in areas beyond national jurisdiction:

a) *Conduct the assessments called for in paragraph 83 (a) of resolution 61/105, consistent with the Guidelines, and ensure that vessels do not engage in bottom fishing until such assessments have been carried out;*
b) *Conduct further marine scientific research and use the best scientific and technical information*

available to identify where vulnerable marine ecosystems are known to occur or are likely to occur and adopt conservation and management measures to prevent significant adverse impacts on such ecosystems consistent with the Guidelines, or close such areas to bottom fishing until conservation and management measures have been established, as called for in paragraph 83 (c) of resolution 61/105;

c) *Establish and implement appropriate protocols for the implementation of paragraph 83 (d) of resolution 61/105, including definitions of what constitutes evidence of an encounter with a vulnerable marine ecosystem, in particular threshold levels and indicator species, based on the best available scientific information and consistent with the Guidelines, and taking into account any other conservation and management measures to prevent significant adverse impacts on vulnerable marine ecosystems, including those based on the results of assessments carried out pursuant to paragraph 83 (a) of resolution 61/105 and paragraph 119 (a) of the present resolution;*
d) *Adopt conservation and management measures, including monitoring, control and surveillance measures, on the basis of stock assessments and the best available scientific information, to ensure the long-term sustainability of deep sea fish stocks and non-target species, and the rebuilding of depleted stocks, consistent with the Guidelines; and, where scientific information is uncertain, unreliable, or inadequate, ensure that conservation and management measures are established consistent with the precautionary approach, including measures to ensure that fishing effort, fishing capacity and catch limits, as appropriate, are at levels commensurate with the long-term sustainability of such stocks;*

120. Calls upon flag States, members of regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries and States participating in negotiations to establish such organizations or arrangements to adopt and implement measures in accordance with paragraphs 83, 85 and 86 of resolution 61/105, paragraph 119 of the present resolution, and international law, and consistent with the Guidelines, and not to authorize bottom fishing activities until such measures have been adopted and implemented;

121. Recognizes the special circumstances and requirements of developing States and the specific challenges they may face in giving full effect to certain technical aspects of the Guidelines, and that implementation by such States of paragraphs 83 to 87 of resolution 61/105, paragraph 119 of the present resolution and the Guidelines should proceed in a manner that gives full consideration to section 6 of the Guidelines on special requirements of developing countries;

122. Calls upon States and regional fisheries management organizations or arrangements to enhance efforts to cooperate to collect and exchange scientific and technical data and information related to the implementation of the measures called for in the relevant paragraphs of resolution 61/105 and the present resolution to manage deep sea fisheries in areas beyond national jurisdiction and to protect vulnerable marine ecosystems from significant adverse impacts of bottom fishing by, inter alia:

a) *Exchanging best practices and developing, where appropriate, regional standards for use by States engaged in bottom fisheries in areas beyond national jurisdiction and regional fisheries management organizations or arrangements with a view to examining current scientific and technical protocols and promoting consistent implementation of best practices across fisheries and regions, including assistance to developing States in accomplishing these objectives;*
b) *Making publicly available, consistent with domestic law, assessments of whether individual bottom fishing activities would have significant adverse impacts on vulnerable marine ecosystems and the measures adopted in accordance with paragraphs 83, 85 and 86, as appropriate, of resolution 61/105, and promoting the inclusion of this information on the websites of regional fisheries management organizations or arrangements;*

c) Submission by flag States to the Food and Agriculture Organization of the United Nations of a list of those vessels flying their flag authorized to conduct bottom fisheries in areas beyond national jurisdiction, and the measures they have adopted to give effect to the relevant paragraphs of resolution 61/105 and the present resolution;

d) Sharing information on vessels that are engaged in bottom fishing operations in areas beyond national jurisdiction where the flag State responsible for such vessels cannot be determined;

Annex B VMEs: International guidelines for identifying vulnerable marine ecosystems

Identifying vulnerable marine ecosystems (VMEs) and assessing significant adverse impacts (FAO 2008)

42. A marine ecosystem should be classified as vulnerable based on the characteristics that it possesses. The following list of characteristics should be used as criteria in the identification of VMEs.

i. Uniqueness or rarity – an area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by similar areas or ecosystems. These include:

- *habitats that contain endemic species;*
- *habitats of rare, threatened or endangered species that occur only in discrete areas; or*
- *nurseries or discrete feeding, breeding, or spawning areas.*

ii. Functional significance of the habitat – discrete areas or habitats that are necessary for the survival, function, spawning/reproduction or recovery of fish stocks, particular life-history stages (e.g. nursery grounds or rearing areas), or of rare, threatened or endangered marine species.

iii. Fragility – an ecosystem that is highly susceptible to degradation by anthropogenic activities.

iv. Life-history traits of component species that make recovery difficult – ecosystems that are characterized by populations or assemblages of species with one or more of the following characteristics:

- *slow growth rates;*
- *late age of maturity;*
- *low or unpredictable recruitment; or*
- *long-lived.*

v. Structural complexity – an ecosystem that is characterized by complex physical structures created by significant concentrations of biotic and abiotic features. In these ecosystems, ecological processes are usually highly dependent on these structured systems. Further, such ecosystems often have high diversity, which is dependent on the structuring organisms. Examples of potentially vulnerable species groups, communities and habitats, as well as features that potentially support them are contained in Annex 1.

43. These criteria should be adapted and additional criteria should be developed as experience and knowledge accumulate, or to address particular local or regional needs.

44. As a necessary step toward the identification of VMEs, States and RFMO/As, and as appropriate FAO, should assemble and analyse relevant information on areas under the competence of such RFMO/As or where vessels under the jurisdiction of such States are engaged in DSFs or where new or expanded DSFs are contemplated.

45. Where site-specific information is lacking, other information that is relevant to inferring the likely presence of vulnerable populations, communities and habitats should be used.

46. When designating an ecosystem as vulnerable, habitats and ecosystems should be evaluated against the criteria presented in paragraph 42, individually or in combination, using the best available scientific and technical information. Characteristics should be weighted according to their relative contribution to an ecosystem's vulnerability.

47. Flag States and RFMO/As should conduct assessments to establish if deep-sea fishing activities are likely to produce significant adverse impacts in a given area. Such an impact assessment should address, inter alia:

- *i. type(s) of fishing conducted or contemplated, including vessels and gear types, fishing areas, target and potential bycatch species, fishing effort levels and duration of fishing (harvesting plan);*
- *ii. best available scientific and technical information on the current state of fishery resources and baseline information on the ecosystems, habitats and communities in the fishing area, against which future changes are to be compared;*
- *iii. identification, description and mapping of VMEs known or likely to occur in the fishing area;*
- *iv. data and methods used to identify, describe and assess the impacts of the activity, the identification of gaps in knowledge, and an evaluation of uncertainties in the information presented in the assessment;*
- *v. identification, description and evaluation of the occurrence, scale and duration of likely impacts, including cumulative impacts of activities covered by the assessment on VMEs and low-productivity fishery resources in the fishing area;*
- *vi. risk assessment of likely impacts by the fishing operations to determine which impacts are likely to be significant adverse impacts, particularly impacts on VMEs and low productivity fishery resources; and*
- *vii. the proposed mitigation and management measures to be used to prevent significant adverse impacts on VMEs and ensure long-term conservation and sustainable utilization of low-productivity fishery resources, and the measures to be used to monitor effects of the fishing operations.*

48. Risk assessments referred to in paragraph 47 (vi) above should take into account, as appropriate, differing conditions prevailing in areas where DSFs are well established and in areas where DSFs have not taken place or only occur occasionally.

49. In conducting impact assessments, States and RFMO/As should consider, as appropriate, the information referred to in these Guidelines, as well as relevant information from similar or related fisheries, species and ecosystems. Notwithstanding paragraph 34, it should be recognised that there may be circumstances in which States may have to rely on information and data obtained only from vessels flying their flags or their own research activities when assessing DSFs that take place in areas where no competent RFMO/A is in place.

50. RFMO/As should develop an appropriate mechanism for reviewing assessments, determinations and management measures, including evaluation and advice by a scientific committee, other appropriate body or, as appropriate, a relevant multi-lateral body, including on whether the deepsea fishing activity would have significant adverse impacts on VMEs and, if so, whether proposed or additional mitigation measures would prevent such impacts.

51. States, in accordance with domestic laws, and RFMO/As should make publicly available:

- *(i) impact assessments as described in paragraph 47;*
- *(ii) existing and proposed conservation and management measures; and*
- *(iii) advice and recommendations provided by the appropriate RFMO/A scientific or technical committee, or other relevant body.*

52. For areas not regulated by a RFMO/A, States should, on an annual basis, submit their impact assessments as well as any existing or proposed conservation and management measures to FAO, which *should make them publicly available.*

53. Where an assessment concludes that the area does not contain VMEs, or that significant adverse impacts are not likely, such assessments should be repeated when there have been significant changes to the fishery or other activities in the area, or when natural processes are thought to have undergone significant changes.

Annex C EBSAs: Convention on Biological Diversity, COP9 Decision IX/20

Annex I: Scientific criteria for identifying ecologically or biologically significant marine areas in need of protection in open-ocean waters and deep-sea habitats (CBD 2008)

Criteria	Definition	Rationale	Examples	Consideration in application
Uniqueness or rarity	Area contains either (i) unique ("the only one of its kind"), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features	-Irreplaceable -Loss would mean the probable permanent disappearance of diversity or a feature, or reduction of the diversity at any level.	*Open ocean waters* Sargasso Sea, Taylor column, persistent polynyas. *Deepsea habitats* endemic communities around submerged atolls; hydrothermal vents; sea mounts; pseudo-abyssal depression	-Risk of biased-view of the perceived uniqueness depending on the information availability -Scale dependency of features such that unique features at one scale may be typical at another, thus a global and regional perspective must be taken
Special importance for life history stages of species	Areas that are required for a population to survive and thrive.	Various biotic and abiotic conditions coupled with species-specific physiological constraints and preferences tend to make some parts of marine regions more suitable to particular life-stages and functions than other parts.	Area containing: (i) breeding grounds, spawning areas, nursery areas, juvenile habitat or other areas important for life history stages of species; or (ii) habitats of migratory species (feeding, wintering or resting areas, breeding, moulting, migratory routes).	-Connectivity between life-history stages and linkages between areas: trophic interactions, physical transport, physical oceanography, life history of species -Sources for information include: e.g. remote sensing, satellite tracking, historical catch and by-catch data, vessel monitoring system (VMS) data. -Spatial and temporal distribution and/or aggregation of the species.
Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.	To ensure the restoration and recovery of such species and habitats.	Areas critical for threatened, endangered or declining species and/or habitats, containing (i) breeding grounds, spawning areas, nursery areas, juvenile habitat or other areas important for life history stages of species; or (ii) habitats of migratory species (feeding, wintering or resting areas, breeding, moulting, migratory routes).	-Includes species with very large geographic ranges. -In many cases recovery will require reestablishment of the species in areas of its historic range. -Sources for information include: e.g. remote sensing, satellite tracking, historical catch and by-catch data, vessel monitoring system (VMS) data.
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.	The criteria indicate the degree of risk that will be incurred if human activities or natural events in the area or component cannot be managed effectively, or are pursued at an unsustainable rate.	*Vulnerability of species* -Inferred from the history of how species or populations in other similar areas responded to perturbations. -Species of low fecundity, slow growth, long time to sexual maturity, longevity (e.g. sharks, etc). -Species with structures providing biogenic habitats, such as deepwater corals, sponges and bryozoans; deep-water species. *Vulnerability of habitats* -Ice-covered areas susceptible to ship-based pollution. -Ocean acidification can make deepsea habitats more vulnerable to others, and increase susceptibility to humaninduced changes.	-Interactions between vulnerability to human impacts and natural events -Existing definition emphasizes site specific ideas and requires consideration for highly mobile species -Criteria can be used both in its own right and in conjunction with other criteria.
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.	Important role in fuelling ecosystems and increasing the growth rates of organisms and their capacity for reproduction	-Frontal areas -Upwellings -Hydrothermal vents -Seamounts polynyas	-Can be measured as the rate of growth of marine organisms and their populations, either through the fixation of inorganic carbon by photosynthesis, chemosynthesis, or through the ingestion of prey, dissolved organic matter or particulate organic matter -Can be inferred from remote-sensed products, e.g., ocean colour or process-based models -Time-series fisheries data can be used, but caution is required

Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.	Important for evolution and maintaining the resilience of marine species and ecosystems	-Sea-mounts -Fronts and convergence zones -Cold coral communities -Deep-water sponge communities	-Diversity needs to be seen in relation to the surrounding environment -Diversity indices are indifferent to species substitutions -Diversity indices are indifferent to which species may be contributing to the value of the index, and hence would not pick up areas important to species of special concern, such as endangered species -Can be inferred from habitat heterogeneity or diversity as a surrogate for species diversity in areas where biodiversity has not been sampled intensively.
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.	-To protect areas with near natural structure, processes and functions -To maintain these areas as reference sites -To safeguard and enhance ecosystem resilience	Most ecosystems and habitats have examples with varying levels of naturalness, and the intent is that the more natural examples should be selected.	-Priority should be given to areas having a low level of disturbance relative to their surroundings -In areas where no natural areas remain, areas that have successfully recovered, including reestablishment of species, should be considered. -Criteria can be used both in their own right and in conjunction with other criteria.

Annex II: Scientific guidance for selecting areas to establish a representative network of marine protected areas, including in open ocean waters and deep-sea habitats

Required network properties and components	**Definition**	**Applicable site specific considerations (*inter alia)***
Ecologically and biologically significant areas	Ecologically and biologically significant areas are geographically or oceanographically discrete areas that provide important services to one or more species/populations of an ecosystem or to the ecosystem as a whole, compared to other surrounding areas or areas of similar ecological characteristics, or otherwise meet the criteria as identified in annex I to decision IX/20.	• Uniqueness or rarity • Special importance for life history stages of species • Importance for threatened, endangered or declining species and/or habitats • Vulnerability, fragility, sensitivity or slow recovery • Biological productivity • Biological diversity • Naturalness
Representativity	Representativity is captured in a network when it consists of areas representing the different biogeographical subdivisions of the global oceans and regional seas that reasonably reflect the full range of ecosystems, including the biotic and habitat diversity of those marine ecosystems.	A full range of examples across a biogeographic habitat, or community classification; relative health of species and communities; relative intactness of habitat(s); naturalness
Connectivity	Connectivity in the design of a network allows for linkages whereby protected sites benefit from larval and/or species exchanges, and functional linkages from other network sites. In a connected network individual sites benefit one another.	Currents; gyres; physical bottlenecks; migration routes; species dispersal; detritus; functional linkages. Isolated sites, such as isolated seamount communities, may also be included.
Replicated ecological features	Replication of ecological features means that more than one site shall contain examples of a given feature in the given biogeographic area. The term "features" means "species, habitats and ecological processes" that naturally occur in the given biogeographic area.	Accounting for uncertainty, natural variation and the possibility of catastrophic events. Features that exhibit less natural variation or are precisely defined may require less replication than features that are inherently highly variable or are only very generally defined.
Adequate and viable sites	Adequate and viable sites indicate that all sites within a network should have size and protection sufficient to ensure the ecological viability and integrity of the feature(s) for which they were selected.	Adequacy and viability will depend on size; shape; buffers; persistence of features; threats; surrounding environment (context); physical constraints; scale of features/processes; spillover/compactness.

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Annex D Coordinates and maps of high seas areas closed to bottom fisheries

Coordinates of closed areas

Table 7. Positions of areas closed to bottom fishing on the high seas (December 2011)(for areas near New Zealand see Table 8) (FAO 2005, GFCM 2006, NEAFC 2006, SEAFO 2006, Shotton 2006, GFCM&RAC/SPA 2007, NEAFC 2007, NAFO 2008, CCAMLR 2009, NAFO 2009, NEAFC 2009, New Zealand Ministry of Fisheries 2009, NGDC 2010).

MPA_ID	RFMO	Ocean	MPA name	Corner	Longitude (original)	Latitude (original)	Longitude (E)	Latitude (N)
1	NEAFC	NE Atlantic	Northern MAR Area 2009	1	33°30'W	59°45'N	-33.5000	59.7500
1	NEAFC	NE Atlantic	Northern MAR Area 2009	2	27°30'W	57°30'N	-27.5000	57.5000
1	NEAFC	NE Atlantic	Northern MAR Area 2009	3	28°30'W	56°45'N	-28.5000	56.7500
1	NEAFC	NE Atlantic	Northern MAR Area 2009	4	34°30'W	59°15'N	-34.5000	59.2500
1	NEAFC	NE Atlantic	Northern MAR Area 2009	END	33°30'W	59°45'N	-33.5000	59.7500
2	NEAFC	NE Atlantic	Middle MAR Area 2009	1	38°W	53°30'N	-38.0000	53.5000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	2	36°49'W	53°30'N	-36.8167	53.5000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	3	36°49'W	55°04.5327'N	-36.8167	55.0755
2	NEAFC	NE Atlantic	Middle MAR Area 2009	4	34°41.3634'W	54°58.9914'N	-34.6894	54.9832
2	NEAFC	NE Atlantic	Middle MAR Area 2009	5	34°00'W	54°41.1841'N	-34.0000	54.6864
2	NEAFC	NE Atlantic	Middle MAR Area 2009	6	34°00'W	53°30'N	-34.0000	53.5000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	7	30°W	53°30'N	-30.0000	53.5000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	8	28°W	51°30'N	-28.0000	51.5000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	9	26°30'W	49°N	-26.5000	49.0000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	10	30°30'W	49°N	-30.5000	49.0000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	11	32°W	51°30'N	-32.0000	51.5000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	12	38°W	51°30'N	-38.0000	51.5000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	13	38°W	53°30'N	-38.0000	53.5000
2	NEAFC	NE Atlantic	Middle MAR Area 2009	END	38°W	53°30'N	-38.0000	53.5000
3	NEAFC	NE Atlantic	Southern MAR Area 2009	1	30°30'W	44°30'N	-30.5000	44.5000
3	NEAFC	NE Atlantic	Southern MAR Area 2009	2	27°W	44°30'N	-27.0000	44.5000
3	NEAFC	NE Atlantic	Southern MAR Area 2009	3	27°15'W	43°15'N	-27.2500	43.2500
3	NEAFC	NE Atlantic	Southern MAR Area 2009	4	31°W	43°15'N	-31.0000	43.2500
3	NEAFC	NE Atlantic	Southern MAR Area 2009	END	30°30'W	44°30'N	-30.5000	44.5000
4	NEAFC	NE Atlantic	Altair 2009	1	34°35'W	45°N	-34.5833	45.0000
4	NEAFC	NE Atlantic	Altair 2009	2	33°45'W	45°N	-33.7500	45.0000
4	NEAFC	NE Atlantic	Altair 2009	3	33°45'W	44°25'N	-33.7500	44.4167
4	NEAFC	NE Atlantic	Altair 2009	4	34°35'W	44°25'N	-34.5833	44.4167
4	NEAFC	NE Atlantic	Altair 2009	END	34°35'W	45°N	-34.5833	45.0000
5	NEAFC	NE Atlantic	Antialtair 2009	1	22°50'W	43°45'N	-22.8333	43.7500
5	NEAFC	NE Atlantic	Antialtair 2009	2	22°05'W	43°45'N	-22.0833	43.7500
5	NEAFC	NE Atlantic	Antialtair 2009	3	22°05'W	43°25'N	-22.0833	43.4167
5	NEAFC	NE Atlantic	Antialtair 2009	4	22°50'W	43°25'N	-22.8333	43.4167
5	NEAFC	NE Atlantic	Antialtair 2009	END	22°50'W	43°45'N	-22.8333	43.7500
6	NEAFC	NE Atlantic	Hatton Bank 2007	1	14°30'W	59°26′N	-14.5000	59.4333
6	NEAFC	NE Atlantic	Hatton Bank 2007	2	15°08'W	59°12′N	-15.1333	59.2000
6	NEAFC	NE Atlantic	Hatton Bank 2007	3	17°00'W	59°01′N	-17.0000	59.0167
6	NEAFC	NE Atlantic	Hatton Bank 2007	4	17°38'W	58°50′N	-17.6333	58.8333
6	NEAFC	NE Atlantic	Hatton Bank 2007	5	17°52'W	58°30′N	-17.8667	58.5000
6	NEAFC	NE Atlantic	Hatton Bank 2007	6	18°45'W	58°30′N	-18.7500	58.5000
6	NEAFC	NE Atlantic	Hatton Bank 2007	7	18°37'W	58°47′N	-18.6167	58.7833
6	NEAFC	NE Atlantic	Hatton Bank 2007	8	17°32'W	59°05′N	-17.5333	59.0833
6	NEAFC	NE Atlantic	Hatton Bank 2007	9	17°20'W	59°16′N	-17.3333	59.2667
6	NEAFC	NE Atlantic	Hatton Bank 2007	10	16°50'W	59°22′N	-16.8333	59.3667
6	NEAFC	NE Atlantic	Hatton Bank 2007	11	15°40'W	59°21′N	-15.6667	59.3500
6	NEAFC	NE Atlantic	Hatton Bank 2007	END	14°30'W	59°26′N	-14.5000	59.4333
7	NEAFC	NE Atlantic	North-West Rockall 2007	1	14°53′W	57°00′N	-14.8833	57.0000
7	NEAFC	NE Atlantic	North-West Rockall 2007	2	14°42′W	57°37′N	-14.7000	57.6167
7	NEAFC	NE Atlantic	North-West Rockall 2007	3	14°24′W	57°55′N	-14.4000	57.9167
7	NEAFC	NE Atlantic	North-West Rockall 2007	4	13°50′W	58°15′N	-13.8333	58.2500
7	NEAFC	NE Atlantic	North-West Rockall 2007	5	13°09′W	57°57′N	-13.1500	57.9500
7	NEAFC	NE Atlantic	North-West Rockall 2007	6	13°14′W	57°50′N	-13.2333	57.8333
7	NEAFC	NE Atlantic	North-West Rockall 2007	7	13°45′W	57°57′N	-13.7500	57.9500
7	NEAFC	NE Atlantic	North-West Rockall 2007	8	14°06′W	57°49′N	-14.1000	57.8167
7	NEAFC	NE Atlantic	North-West Rockall 2007	9	14°19′W	57°29′N	-14.3167	57.4833
7	NEAFC	NE Atlantic	North-West Rockall 2007	10	14°19′W	57°22′N	-14.3167	57.3667
7	NEAFC	NE Atlantic	North-West Rockall 2007	11	14°34′W	57°00′N	-14.5667	57.0000
7	NEAFC	NE Atlantic	North-West Rockall 2007	END	14°53′W	57°00′N	-14.8833	57.0000
8	NEAFC	NE Atlantic	Logachev Mounds 2007	1	16°10′W	55°17′N	-16.1667	55.2833
8	NEAFC	NE Atlantic	Logachev Mounds 2007	2	15°07′W	55°34′N	-15.1167	55.5667
8	NEAFC	NE Atlantic	Logachev Mounds 2007	3	15°15′W	55°50′N	-15.2500	55.8333
8	NEAFC	NE Atlantic	Logachev Mounds 2007	4	16°16′W	55°33′N	-16.2667	55.5500
8	NEAFC	NE Atlantic	Logachev Mounds 2007	END	16°10′W	55°17′N	-16.1667	55.2833
9	NEAFC	NE Atlantic	West Rockall Mounds 2007	1	16°30′W	57°20′N	-16.5000	57.3333
9	NEAFC	NE Atlantic	West Rockall Mounds 2007	2	15°58′W	57°05′N	-15.9667	57.0833
9	NEAFC	NE Atlantic	West Rockall Mounds 2007	3	17°17′W	56°21′N	-17.2833	56.3500
9	NEAFC	NE Atlantic	West Rockall Mounds 2007	4	17°50′W	56°40′N	-17.8333	56.6667
9	NEAFC	NE Atlantic	West Rockall Mounds 2007	END	16°30′W	57°20′N	-16.5000	57.3333
10	NAFO	NW Atlantic	area 1 2010	1	48.8193°W	44.0483°N	-48.8193	44.0483
10	NAFO	NW Atlantic	area 1 2010	2	48.78°W	44.3587°N	-48.7800	44.3587
10	NAFO	NW Atlantic	area 1 2010	3	48.8424°W	44.3596°N	-48.8424	44.3596
10	NAFO	NW Atlantic	area 1 2010	4	48.8424°W	44.1967°N	-48.8424	44.1967
10	NAFO	NW Atlantic	area 1 2010	5	48.8812°W	44.0485°N	-48.8812	44.0485
10	NAFO	NW Atlantic	area 1 2010	END	48.8193°W	44.0483°N	-48.8193	44.0483
11	NAFO	NW Atlantic	area 2 2010	1	48.7293°W	44.849°N	-48.7293	44.8490
11	NAFO	NW Atlantic	area 2 2010	2	46.7977°W	46.3152°N	-46.7977	46.3152
11	NAFO	NW Atlantic	area 2 2010	3	46.7977°W	46.4246°N	-46.7977	46.4246

MPA_ID	RFMO	Ocean	MPA name	Corner	Longitude (original)	Latitude (original)	Longitude (E)	Latitude (N)
11	NAFO	NW Atlantic	area 2 2010	4	46.9207°W	46.7756°N	-46.9207	46.7756
11	NAFO	NW Atlantic	area 2 2010	5	46.6679°W	47.0581°N	-46.6679	47.0581
11	NAFO	NW Atlantic	area 2 2010	6	46.9606°W	47.1964°N	-46.9606	47.1964
11	NAFO	NW Atlantic	area 2 2010	7	47.0513°W	46.678°N	-47.0513	46.6780
11	NAFO	NW Atlantic	area 2 2010	8	46.8564°W	46.4067°N	-46.8564	46.4067
11	NAFO	NW Atlantic	area 2 2010	9	47.51014°W	46.1171°N	-47.5101	46.1171
11	NAFO	NW Atlantic	area 2 2010	10	47.6883°W	45.8184°N	-47.6883	45.8184
11	NAFO	NW Atlantic	area 2 2010	11	48.4873°W	45.3287°N	-48.4873	45.3287
11	NAFO	NW Atlantic	area 2 2010	12	48.8257°W	44.8965°N	-48.8257	44.8965
11	NAFO	NW Atlantic	area 2 2010	END	48.7293°W	44.849°N	-48.7293	44.8490
12	NAFO	NW Atlantic	area 3 2010	1	46.1007°W	45.8195°N	-46.1007	45.8195
12	NAFO	NW Atlantic	area 3 2010	2	46.1007°W	45.9965°N	-46.1007	45.9965
12	NAFO	NW Atlantic	area 3 2010	3	46.3023°W	45.9965°N	-46.3023	45.9965
12	NAFO	NW Atlantic	area 3 2010	4	46.3023°W	45.8195°N	-46.3023	45.8195
12	NAFO	NW Atlantic	area 3 2010	END	46.1007°W	45.8195°N	-46.1007	45.8195
13	NAFO	NW Atlantic	area 4 2010	1	43.3477°W	46.8098°N	-43.3477	46.8098
13	NAFO	NW Atlantic	area 4 2010	2	43.3477°W	47.0663°N	-43.3477	47.0663
13	NAFO	NW Atlantic	area 4 2010	3	43.5712°W	47.0663°N	-43.5712	47.0663
13	NAFO	NW Atlantic	area 4 2010	4	43.5712°W	46.8098°N	-43.5712	46.8098
13	NAFO	NW Atlantic	area 4 2010	END	43.3477°W	46.8098°N	-43.3477	46.8098
14	NAFO	NW Atlantic	area 5 2010	1	43.6249°W	47.6284°N	-43.6249	47.6284
14	NAFO	NW Atlantic	area 5 2010	2	43.7646°W	47.9752°N	-43.7646	47.9752
14	NAFO	NW Atlantic	area 5 2010	3	44.2452°W	48.4979°N	-44.2452	48.4979
14	NAFO	NW Atlantic	area 5 2010	4	44.3522°W	48.4554°N	-44.3522	48.4554
14	NAFO	NW Atlantic	area 5 2010	5	43.8099°W	47.854°N	-43.8099	47.8540
14	NAFO	NW Atlantic	area 5 2010	6	43.7192°W	47.5993°N	-43.7192	47.5993
14	NAFO	NW Atlantic	area 5 2010	END	43.6249°W	47.6284°N	-43.6249	47.6284
15	NAFO	NW Atlantic	area 6 2010	1	46.6204°W	48.3142°N	-46.6204	48.3142
15	NAFO	NW Atlantic	area 6 2010	2	46.1427°W	48.4809°N	-46.1427	48.4809
15	NAFO	NW Atlantic	area 6 2010	3	45.4557°W	48.827°N	-45.4557	48.8270
15	NAFO	NW Atlantic	area 6 2010	4	45.15°W	48.9417°N	-45.1500	48.9417
15	NAFO	NW Atlantic	area 6 2010	5	45.2124°W	49.0027°N	-45.2124	49.0027
15	NAFO	NW Atlantic	area 6 2010	6	46.6531°W	48.3534°N	-46.6531	48.3534
15	NAFO	NW Atlantic	area 6 2010	END	46.6204°W	48.3142°N	-46.6204	48.3142
16	NAFO	NW Atlantic	area 7 2010	1	44.9106°W	48.3416°N	-44.9106	48.3416
16	NAFO	NW Atlantic	area 7 2010	2	44.9106°W	48.4173°N	-44.9106	48.4173
16	NAFO	NW Atlantic	area 7 2010	3	45.2879°W	48.4173°N	-45.2879	48.4173
16	NAFO	NW Atlantic	area 7 2010	4	45.2879°W	48.3416°N	-45.2879	48.3416
16	NAFO	NW Atlantic	area 7 2010	END	44.9106°W	48.3416°N	-44.9106	48.3416
17	NAFO	NW Atlantic	area 8 2010	1	45.0932°W	48.599°N	-45.0932	48.5990
17	NAFO	NW Atlantic	area 8 2010	2	45.0932°W	48.6694°N	-45.0932	48.6694
17	NAFO	NW Atlantic	area 8 2010	3	45.1958°W	48.6694°N	-45.1958	48.6694
17	NAFO	NW Atlantic	area 8 2010	4	45.1958°W	48.599°N	-45.1958	48.5990
17	NAFO	NW Atlantic	area 8 2010	END	45.0932°W	48.599°N	-45.0932	48.5990
18	NAFO	NW Atlantic	area 9 2010	1	45.4386°W	48.5732°N	-45.4386	48.5732
18	NAFO	NW Atlantic	area 9 2010	2	45.5211°W	48.6153°N	-45.5211	48.6153
18	NAFO	NW Atlantic	area 9 2010	3	45.6618°W	48.5051°N	-45.6618	48.5051
18	NAFO	NW Atlantic	area 9 2010	4	45.5779°W	48.4585°N	-45.5779	48.4585
18	NAFO	NW Atlantic	area 9 2010	END	45.4386°W	48.5732°N	-45.4386	48.5732
19	NAFO	NW Atlantic	area 10 2010	1	46.2911°W	47.7881°N	-46.2911	47.7881
19	NAFO	NW Atlantic	area 10 2010	2	46.1122°W	47.9784°N	-46.1122	47.9784
19	NAFO	NW Atlantic	area 10 2010	3	46.2011°W	48.0185°N	-46.2011	48.0185
19	NAFO	NW Atlantic	area 10 2010	4	46.38°W	47.8282°N	-46.3800	47.8282
19	NAFO	NW Atlantic	area 10 2010	END	46.2911°W	47.7881°N	-46.2911	47.7881
20	NAFO	NW Atlantic	area 11 2010	1	46.3566°W	47.43°N	-46.3566	47.4300
20	NAFO	NW Atlantic	area 11 2010	2	46.3566°W	47.5004°N	-46.3566	47.5004
20	NAFO	NW Atlantic	area 11 2010	3	46.4592°W	47.5004°N	-46.4592	47.5004
20	NAFO	NW Atlantic	area 11 2010	4	46.4592°W	47.43°N	-46.4592	47.4300
20	NAFO	NW Atlantic	area 11 2010	END	46.3566°W	47.43°N	-46.3566	47.4300
21	NEAFC	NW Atlantic	Hatton Bank 2008	1	18°45'W	58°30'N	-18.7500	58.5000
21	NEAFC	NW Atlantic	Hatton Bank 2008	2	19°15'W	57°45'N	-19.2500	57.7500
21	NEAFC	NW Atlantic	Hatton Bank 2008	3	17°30'W	57°55'N	-17.5000	57.9167
21	NEAFC	NW Atlantic	Hatton Bank 2008	4	17°30'W	58°03'N	-17.5000	58.0500
21	NEAFC	NW Atlantic	Hatton Bank 2008	5	18°22'W	58°03'N	-18.3667	58.0500
21	NEAFC	NW Atlantic	Hatton Bank 2008	6	18°22'W	58°30'N	-18.3667	58.5000
21	NEAFC	NW Atlantic	Hatton Bank 2008	END	18°45'W	58°30'N	-18.7500	58.5000
22	NEAFC	NW Atlantic	North-West Rockall 2008	1	14°53'W	57°00'N	-14.8833	57.0000
22	NEAFC	NW Atlantic	North-West Rockall 2008	2	14°42'W	57°37'N	-14.7000	57.6167
22	NEAFC	NW Atlantic	North-West Rockall 2008	3	14°24'W	57°55'N	-14.4000	57.9167
22	NEAFC	NW Atlantic	North-West Rockall 2008	4	13°50'W	58°15'N	-13.8333	58.2500
22	NEAFC	NW Atlantic	North-West Rockall 2008	5	13°09'W	57°57'N	-13.1500	57.9500
22	NEAFC	NW Atlantic	North-West Rockall 2008	6	13°14'W	57°50'N	-13.2333	57.8333
22	NEAFC	NW Atlantic	North-West Rockall 2008	7	13°45'W	57°57'N	-13.7500	57.9500
22	NEAFC	NW Atlantic	North-West Rockall 2008	8	14°06'W	57°49'N	-14.1000	57.8167
22	NEAFC	NW Atlantic	North-West Rockall 2008	9	14°19'W	57°29'N	-14.3167	57.4833
22	NEAFC	NW Atlantic	North-West Rockall 2008	10	14°19'W	57°22'N	-14.3167	57.3667
22	NEAFC	NW Atlantic	North-West Rockall 2008	11	14°34'W	57°00'N	-14.5667	57.0000
22	NEAFC	NW Atlantic	North-West Rockall 2008	12	14°36'W	56°56'N	-14.6000	57.9333
22	NEAFC	NW Atlantic	North-West Rockall 2008	13	14°51'W	56°56'N	-14.8500	57.9333
22	NEAFC	NW Atlantic	North-West Rockall 2008	END	14°53'W	57°00'N	-14.8833	57.0000
23	NEAFC	NW Atlantic	South-West Rockall 2008	1	15°37'W	56°24'N	-15.6167	56.4000
23	NEAFC	NW Atlantic	South-West Rockall 2008	2	14°58'W	56°21'N	-14.9667	56.3500
23	NEAFC	NW Atlantic	South-West Rockall 2008	3	15°10'W	56°04'N	-15.1667	56.0667
23	NEAFC	NW Atlantic	South-West Rockall 2008	4	15°37'W	55°51'N	-15.6167	55.8500
23	NEAFC	NW Atlantic	South-West Rockall 2008	5	15°52'W	56°10'N	-15.8667	56.1667
23	NEAFC	NW Atlantic	South-West Rockall 2008	END	15°37'W	56°24'N	-15.6167	56.4000
24	SEAFO	SE Atlantic	Dampier Seamount 2007	1	02°00’W	10°00’S	-2.0000	-10.0000
24	SEAFO	SE Atlantic	Dampier Seamount 2007	2	0°W	10°00’S	0.0000	-10.0000
24	SEAFO	SE Atlantic	Dampier Seamount 2007	3	0°W	10°00’S	0.0000	-12.0000
24	SEAFO	SE Atlantic	Dampier Seamount 2007	4	02°00’W	10°00’S	-2.0000	-12.0000
24	SEAFO	SE Atlantic	Dampier Seamount 2007	END	02°00’W	10°00’S	-2.0000	-10.0000
25	SEAFO	SE Atlantic	Malahit Guyot Seamount 2007	1	2°W	11°00’S	-2.0000	-11.0000
25	SEAFO	SE Atlantic	Malahit Guyot Seamount 2007	2	2°W	13°00’S	-2.0000	-13.0000
25	SEAFO	SE Atlantic	Malahit Guyot Seamount 2007	3	4°W	13°00’S	-4.0000	-13.0000
25	SEAFO	SE Atlantic	Malahit Guyot Seamount 2007	4	4°W	11°00’S	-4.0000	-11.0000
25	SEAFO	SE Atlantic	Malahit Guyot Seamount 2007	END	2°W	11°00’S	-2.0000	-11.0000
26	SEAFO	SE Atlantic	Molloy Seamount 2007	1	8°E	27°00’S	8.0000	-27.0000

MPA_ID	RFMO	Ocean	MPA name	Corner	Longitude (original)	Latitude (original)	Longitude (E)	Latitude (N)
26	SEAFO	SE Atlantic	Molloy Seamount 2007	2	8°E	29°00'S	8.0000	-29.0000
26	SEAFO	SE Atlantic	Molloy Seamount 2007	3	10°E	29°00'S	10.0000	-29.0000
26	SEAFO	SE Atlantic	Molloy Seamount 2007	4	10°E	27°00'S	10.0000	-27.0000
26	SEAFO	SE Atlantic	Molloy Seamount 2007	END	8°E	27°00'S	8.0000	-27.0000
27	SEAFO	SE Atlantic	Schmidt-Ott Seamount & Erica Seamount 2007	1	13°E	37°00'S	13.0000	-37.0000
27	SEAFO	SE Atlantic	Schmidt-Ott Seamount & Erica Seamount 2007	2	13°E	40°00'S	13.0000	-40.0000
27	SEAFO	SE Atlantic	Schmidt-Ott Seamount & Erica Seamount 2007	3	17°E	40°00'S	17.0000	-40.0000
27	SEAFO	SE Atlantic	Schmidt-Ott Seamount & Erica Seamount 2007	4	17°E	37°00'S	17.0000	-37.0000
27	SEAFO	SE Atlantic	Schmidt-Ott Seamount & Erica Seamount 2007	END	13°E	37°00'S	13.0000	-37.0000
28	SEAFO	SE Atlantic	Africana seamount 2007	1	28°E	37°00'S	28.0000	-37.0000
28	SEAFO	SE Atlantic	Africana seamount 2007	2	28°E	38°00'S	28.0000	-38.0000
28	SEAFO	SE Atlantic	Africana seamount 2007	3	30°E	37°00'S	30.0000	-37.0000
28	SEAFO	SE Atlantic	Africana seamount 2007	4	30°E	38°00'S	30.0000	-38.0000
28	SEAFO	SE Atlantic	Africana seamount 2007	END	28°E	37°00'S	28.0000	-37.0000
29	SEAFO	SE Atlantic	Panzarini Seamount 2007	1	11°E	39°00'S	11.0000	-39.0000
29	SEAFO	SE Atlantic	Panzarini Seamount 2007	2	11°E	41°00'S	11.0000	-41.0000
29	SEAFO	SE Atlantic	Panzarini Seamount 2007	3	13°E	41°00'S	13.0000	-41.0000
29	SEAFO	SE Atlantic	Panzarini Seamount 2007	4	13°E	39°00'S	13.0000	-39.0000
29	SEAFO	SE Atlantic	Panzarini Seamount 2007	END	11°E	39°00'S	11.0000	-39.0000
30	SEAFO	SE Atlantic	Vema Seamount 2007	1	8°E	31°00'S	8.0000	-31.0000
30	SEAFO	SE Atlantic	Vema Seamount 2007	2	8°E	32°00'S	8.0000	-32.0000
30	SEAFO	SE Atlantic	Vema Seamount 2007	3	9°E	32°00'S	9.0000	-32.0000
30	SEAFO	SE Atlantic	Vema Seamount 2007	4	9°E	31°00'S	9.0000	-31.0000
30	SEAFO	SE Atlantic	Vema Seamount 2007	END	8°E	31°00'S	8.0000	-31.0000
31	SEAFO	SE Atlantic	Wust Seamount 2007	1	6°E	33°00'S	6.0000	-33.0000
31	SEAFO	SE Atlantic	Wust Seamount 2007	2	6°E	34°00'S	6.0000	-34.0000
31	SEAFO	SE Atlantic	Wust Seamount 2007	3	8°E	34°00'S	8.0000	-34.0000
31	SEAFO	SE Atlantic	Wust Seamount 2007	4	8°E	33°00'S	8.0000	-33.0000
31	SEAFO	SE Atlantic	Wust Seamount 2007	END	6°E	33°00'S	6.0000	-33.0000
32	SEAFO	SE Atlantic	Discovery, Junoy, Shannon Seamounts 2007	1	6°W	41°00'S	-6.0000	-41.0000
32	SEAFO	SE Atlantic	Discovery, Junoy, Shannon Seamounts 2007	2	6°W	44°00'S	-6.0000	-44.0000
32	SEAFO	SE Atlantic	Discovery, Junoy, Shannon Seamounts 2007	3	3°E	44°00'S	3.0000	-44.0000
32	SEAFO	SE Atlantic	Discovery, Junoy, Shannon Seamounts 2007	4	3°E	41°00'S	3.0000	-41.0000
32	SEAFO	SE Atlantic	Discovery, Junoy, Shannon Seamounts 2007	END	6°W	41°00'S	-6.0000	-41.0000
33	SEAFO	SE Atlantic	Schwabenland & Herdman Seamounts 2007	1	1°W	44°00'S	-1.0000	-44.0000
33	SEAFO	SE Atlantic	Schwabenland & Herdman Seamounts 2007	2	1°W	47°00'S	-1.0000	-47.0000
33	SEAFO	SE Atlantic	Schwabenland & Herdman Seamounts 2007	3	2°E	44°00'S	2.0000	-47.0000
33	SEAFO	SE Atlantic	Schwabenland & Herdman Seamounts 2007	4	2°E	47°00'S	2.0000	-44.0000
33	SEAFO	SE Atlantic	Schwabenland & Herdman Seamounts 2007	END	1°W	44°00'S	-1.0000	-44.0000
34	NAFO	NW Atlantic	Fogo Seamounts 1 2007	1	53°23'17''W	42°31'33''N	-53.3881	42.5258
34	NAFO	NW Atlantic	Fogo Seamounts 1 2007	2	52°33'37''W	42°31'33''N	-52.5603	42.5258
34	NAFO	NW Atlantic	Fogo Seamounts 1 2007	3	52°33'37''W	41°55'48''N	-52.5603	42.9300
34	NAFO	NW Atlantic	Fogo Seamounts 1 2007	4	53°23'17''W	41°55'48''N	-53.3881	42.9300
34	NAFO	NW Atlantic	Fogo Seamounts 1 2007	END	53°23'17''W	42°31'33''N	-53.3881	42.5258
35	NAFO	NW Atlantic	Fogo Seamounts 2 2007	1	52°27'49''W	41°07'22''N	-52.4636	42.1228
35	NAFO	NW Atlantic	Fogo Seamounts 2 2007	2	51°38'10''W	41°07'22''N	-51.6361	42.1228
35	NAFO	NW Atlantic	Fogo Seamounts 2 2007	3	51°38'10''W	40°31'37''N	-51.6361	40.5269
35	NAFO	NW Atlantic	Fogo Seamounts 2 2007	4	52°27'49'W	40°31'37''N	-52.4636	40.5269
35	NAFO	NW Atlantic	Fogo Seamounts 2 2007	END	52°27'49'W	41°07'22''N	-52.4636	42.1228
36	NAFO	NW Atlantic	Orphan Knoll 2007	1	45°00'30''W	50°00'30''N	-45.0083	50.0083
36	NAFO	NW Atlantic	Orphan Knoll 2007	2	45°00'30''W	51°00'30''N	-45.0083	51.0083
36	NAFO	NW Atlantic	Orphan Knoll 2007	3	47°00'30''W	51°00'30''N	-47.0083	51.0083
36	NAFO	NW Atlantic	Orphan Knoll 2007	4	47°00'30''W	50°00'30''N	-47.0083	50.0083
36	NAFO	NW Atlantic	Orphan Knoll 2007	END	45°00'30''W	50°00'30''N	-45.0083	50.0083
37	NAFO	NW Atlantic	Corner Seamounts 2007	1	48°W	35°N	-48.0000	35.0000
37	NAFO	NW Atlantic	Corner Seamounts 2007	2	48°W	36°N	-48.0000	36.0000
37	NAFO	NW Atlantic	Corner Seamounts 2007	3	52°W	36°N	-52.0000	36.0000
37	NAFO	NW Atlantic	Corner Seamounts 2007	4	52°W	35°N	-52.0000	35.0000
37	NAFO	NW Atlantic	Corner Seamounts 2007	END	48°W	35°N	-48.0000	35.0000
38	NAFO	NW Atlantic	Newfoundland Seamounts 2007	1	43°20'W	43°29'N	-43.3333	43.4833
38	NAFO	NW Atlantic	Newfoundland Seamounts 2007	2	43°20'W	44°N	-43.3333	44.0000
38	NAFO	NW Atlantic	Newfoundland Seamounts 2007	3	46°40'W	44°N	-46.6667	44.0000
38	NAFO	NW Atlantic	Newfoundland Seamounts 2007	4	46°40'W	43°29'N	-46.6667	43.4833
38	NAFO	NW Atlantic	Newfoundland Seamounts 2007	END	43°20'W	43°29'N	-43.3333	43.4833
39	NAFO	NW Atlantic	New England Seamounts 2007	1	57°W	35°N	-57.0000	35.0000
39	NAFO	NW Atlantic	New England Seamounts 2007	2	57°W	39°N	-57.0000	39.0000
39	NAFO	NW Atlantic	New England Seamounts 2007	3	64°W	39°N	-64.0000	39.0000
39	NAFO	NW Atlantic	New England Seamounts 2007	4	64°W	35°N	-64.0000	35.0000
39	NAFO	NW Atlantic	New England Seamounts 2007	END	57°W	35°N	-57.0000	35.0000
40	SIODFA	S Indian Ocean	Gulden Draak 2006	1	98°E	28°S	98.0000	-28.0000
40	SIODFA	S Indian Ocean	Gulden Draak 2006	2	98°E	29°S	98.0000	-29.0000
40	SIODFA	S Indian Ocean	Gulden Draak 2006	3	99°E	29°S	99.0000	-29.0000
40	SIODFA	S Indian Ocean	Gulden Draak 2006	4	99°E	28°S	99.0000	-28.0000
40	SIODFA	S Indian Ocean	Gulden Draak 2006	END	98°E	28°S	98.0000	-28.0000
41	SIODFA	S Indian Ocean	Rusky 2006	1	99°55'E	31°20'S	99.9167	-31.3333
41	SIODFA	S Indian Ocean	Rusky 2006	2	99°55'E	31°30'S	99.9167	-31.5000
41	SIODFA	S Indian Ocean	Rusky 2006	3	95°E	31°30'S	95.0000	-31.5000
41	SIODFA	S Indian Ocean	Rusky 2006	4	95°E	31°20'S	95.0000	-31.3333
41	SIODFA	S Indian Ocean	Rusky 2006	END	99°55'E	31°20'S	99.9167	-31.3333
42	SIODFA	S Indian Ocean	Fool's flat 2006	1	94°40'E	31°30'S	94.6667	-31.5000
42	SIODFA	S Indian Ocean	Fool's flat 2006	2	94°40'E	31°40'S	94.6667	-31.6667
42	SIODFA	S Indian Ocean	Fool's flat 2006	3	95°E	31°40'S	95.0000	-31.6667
42	SIODFA	S Indian Ocean	Fool's flat 2006	4	95°E	31°30'S	95.0000	-31.5000
42	SIODFA	S Indian Ocean	Fool's flat 2006	END	94°40'E	31°30'S	94.6667	-31.5000
43	SIODFA	S Indian Ocean	East Broken Ridge 2006	1	100°50'E	32°50'S	100.8333	-32.8333
43	SIODFA	S Indian Ocean	East Broken Ridge 2006	2	100°50'E	33°25'S	100.8333	-33.4167
43	SIODFA	S Indian Ocean	East Broken Ridge 2006	3	101°40'E	33°25'S	101.6667	-33.4167
43	SIODFA	S Indian Ocean	East Broken Ridge 2006	4	101°40'E	32°50'S	101.6667	-32.8333
43	SIODFA	S Indian Ocean	East Broken Ridge 2006	END	100°50'E	32°50'S	100.8333	-32.8333
44	SIODFA	S Indian Ocean	Mid-Indian Ridge 2006	1	64°E	13°S	64.0000	-13.0000
44	SIODFA	S Indian Ocean	Mid-Indian Ridge 2006	2	64°E	15°50'S	64.0000	-15.8333
44	SIODFA	S Indian Ocean	Mid-Indian Ridge 2006	3	68°E	15°50'S	68.0000	-15.8333
44	SIODFA	S Indian Ocean	Mid-Indian Ridge 2006	4	68°E	13°S	68.0000	-13.0000
44	SIODFA	S Indian Ocean	Mid-Indian Ridge 2006	END	64°E	13°S	64.0000	-13.0000
45	SIODFA	S Indian Ocean	Atlantis Bank 2006	1	57°E	32°S	57.0000	-32.0000
45	SIODFA	S Indian Ocean	Atlantis Bank 2006	2	57°E	32°50'S	57.0000	-32.8333
45	SIODFA	S Indian Ocean	Atlantis Bank 2006	3	58°E	32°50'S	58.0000	-32.8333

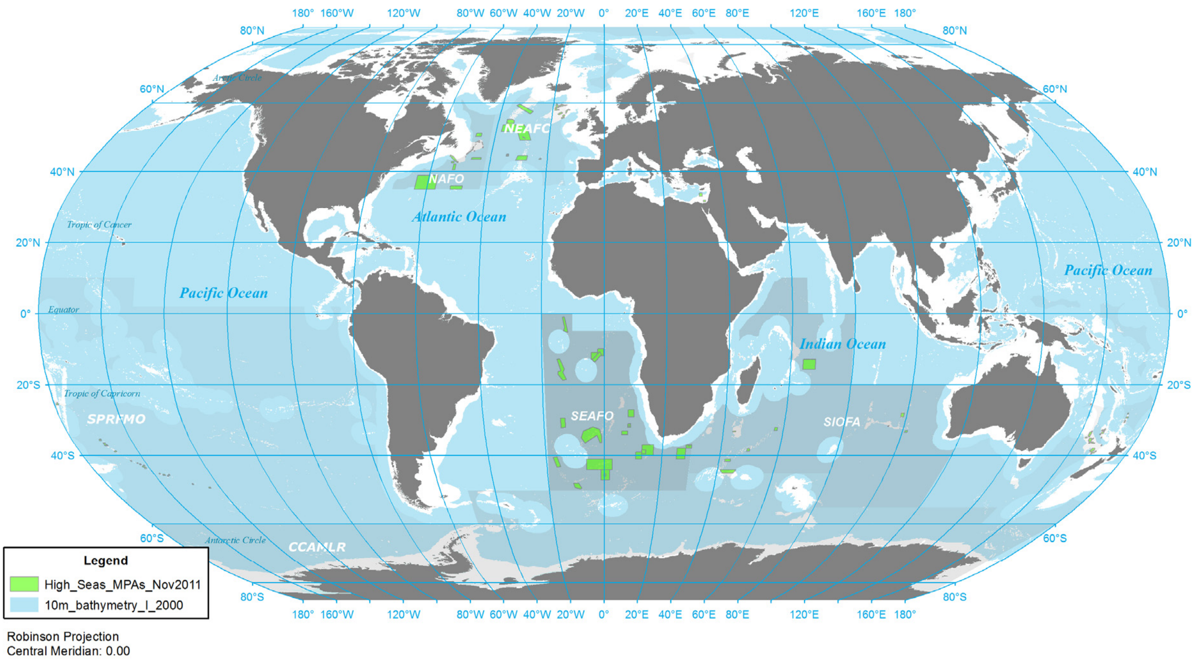
MPA_ID	RFMO	Ocean	MPA name	Corner	Longitude (original)	Latitude (original)	Longitude (E)	Latitude (N)
45	SIODFA	S Indian Ocean	Atlantis Bank 2006	4	58°E	32°S	58.0000	-32.0000
45	SIODFA	S Indian Ocean	Atlantis Bank 2006	END	57°E	32°S	57.0000	-32.0000
46	SIODFA	S Indian Ocean	Bridle 2006	1	49°E	38°03'S	49.0000	-38.0500
46	SIODFA	S Indian Ocean	Bridle 2006	2	49°E	38°45'S	49.0000	-38.7500
46	SIODFA	S Indian Ocean	Bridle 2006	3	50°E	38°45'S	50.0000	-38.7500
46	SIODFA	S Indian Ocean	Bridle 2006	4	50°E	38°03'S	50.0000	-38.0500
46	SIODFA	S Indian Ocean	Bridle 2006	END	49°E	38°03'S	49.0000	-38.0500
47	SIODFA	S Indian Ocean	Walters Shoal 2006	1	43°10'E	33°S	43.1667	-33.0000
47	SIODFA	S Indian Ocean	Walters Shoal 2006	2	43°10'E	33°20'S	43.1667	-33.3333
47	SIODFA	S Indian Ocean	Walters Shoal 2006	3	43°10'E	33°S	44.1667	-33.0000
47	SIODFA	S Indian Ocean	Walters Shoal 2006	4	43°10'E	33°20'S	44.1667	-33.3333
47	SIODFA	S Indian Ocean	Walters Shoal 2006	END	43°10'E	33°S	43.1667	-33.0000
48	SIODFA	S Indian Ocean	Coral 2006	1	42°E	41°S	42.0000	-41.0000
48	SIODFA	S Indian Ocean	Coral 2006	2	42°E	41°40'S	42.0000	-41.6667
48	SIODFA	S Indian Ocean	Coral 2006	3	44°E	41°40'S	44.0000	-41.6667
48	SIODFA	S Indian Ocean	Coral 2006	4	44°E	41°S	44.0000	-41.0000
48	SIODFA	S Indian Ocean	Coral 2006	END	42°E	41°S	42.0000	-41.0000
49	SIODFA	S Indian Ocean	South Indian Ridge (North/South) 2006	1	40.878°E	44°S	40.8780	-44.0000
49	SIODFA	S Indian Ocean	South Indian Ridge (North/South) 2006	2	46.544°E	44°S	46.5440	-44.0000
49	SIODFA	S Indian Ocean	South Indian Ridge (North/South) 2006	3	45.711°E	45°S	45.7110	-45.0000
49	SIODFA	S Indian Ocean	South Indian Ridge (North/South) 2006	4	42.124°E	45°S	42.1240	-45.0000
49	SIODFA	S Indian Ocean	South Indian Ridge (North/South) 2006	END	40.878°E	44°S	40.8780	-44.0000
50	SIODFA	S Indian Ocean	Agulhas Plateau 2006	1	25°E	38°S	25.0000	-38.0000
50	SIODFA	S Indian Ocean	Agulhas Plateau 2006	2	25°E	41°S	25.0000	-41.0000
50	SIODFA	S Indian Ocean	Agulhas Plateau 2006	3	28°E	41°S	28.0000	-41.0000
50	SIODFA	S Indian Ocean	Agulhas Plateau 2006	4	28°E	38°S	28.0000	-38.0000
50	SIODFA	S Indian Ocean	Agulhas Plateau 2006	END	25°E	38°S	25.0000	-38.0000
51	NAFO	NW Atlantic	Coral Protection Zone 2008	1	51°00'00"W	42°53'00"N	-51.0000	42.8833
51	NAFO	NW Atlantic	Coral Protection Zone 2008	2	51°31'44"W	42°52'04"N	-51.5289	42.8678
51	NAFO	NW Atlantic	Coral Protection Zone 2008	3	51°58'12"W	43°24'13"N	-51.9700	43.4036
51	NAFO	NW Atlantic	Coral Protection Zone 2008	4	51°58'18"W	43°24'20"N	-51.9717	43.4056
51	NAFO	NW Atlantic	Coral Protection Zone 2008	5	52°13'10"W	43°39'38"N	-52.2194	43.6606
51	NAFO	NW Atlantic	Coral Protection Zone 2008	6	52°27'52"W	43°40'59"N	-52.4644	43.6831
51	NAFO	NW Atlantic	Coral Protection Zone 2008	7	52°39'48"W	43°56'19"N	-52.6633	43.9386
51	NAFO	NW Atlantic	Coral Protection Zone 2008	8	52°58'12"W	44°04'53"N	-52.9700	44.0814
51	NAFO	NW Atlantic	Coral Protection Zone 2008	9	53°06'00"W	44°18'38"N	-53.1000	44.3106
51	NAFO	NW Atlantic	Coral Protection Zone 2008	10	53°24'07"W	44°18'36"N	-53.4019	44.3100
51	NAFO	NW Atlantic	Coral Protection Zone 2008	11	54°30'00"W	44°49'59"N	-54.5000	44.8331
51	NAFO	NW Atlantic	Coral Protection Zone 2008	12	54°30'00"W	44°29'55"N	-54.5000	44.4986
51	NAFO	NW Atlantic	Coral Protection Zone 2008	13	52°55'59"W	43°26'59"N	-52.9331	43.4497
51	NAFO	NW Atlantic	Coral Protection Zone 2008	14	51°41'06"W	42°48'00"N	-51.6850	42.8000
51	NAFO	NW Atlantic	Coral Protection Zone 2008	15	51°00'00"W	42°33'02"N	-51.0000	42.5506
51	NAFO	NW Atlantic	Coral Protection Zone 2008	END	51°00'00"W	42°53'00"N	-51.0000	42.8833
52	NEAFC	NE Atlantic	Hatton Bank 2010	1	14°30′W	59°26′N	-14.5000	59.4333
52	NEAFC	NE Atlantic	Hatton Bank 2010	2	15°08′W	59°12′N	-15.1333	59.2000
52	NEAFC	NE Atlantic	Hatton Bank 2010	3	17°00′W	59°01′N	-17.0000	59.0167
52	NEAFC	NE Atlantic	Hatton Bank 2010	4	17°38′W	58°50′N	-17.6333	58.8333
52	NEAFC	NE Atlantic	Hatton Bank 2010	5	17°52′W	58°30′N	-17.8667	58.5000
52	NEAFC	NE Atlantic	Hatton Bank 2010	6	18°22′W	58°30′N	-18.3667	58.5000
52	NEAFC	NE Atlantic	Hatton Bank 2010	7	18°22′W	58°03′N	-18.3667	58.0500
52	NEAFC	NE Atlantic	Hatton Bank 2010	8	17°30′W	58°03′N	-17.5000	58.0500
52	NEAFC	NE Atlantic	Hatton Bank 2010	9	17°30′W	57°55′N	-17.5000	57.9167
52	NEAFC	NE Atlantic	Hatton Bank 2010	10	19°15′W	57°45′N	-19.2500	57.7500
52	NEAFC	NE Atlantic	Hatton Bank 2010	11	18°57.51′W	58°11.15′N	-18.9585	58.1858
52	NEAFC	NE Atlantic	Hatton Bank 2010	12	19°11.97′W	58°11.57′N	-19.1995	58.1928
52	NEAFC	NE Atlantic	Hatton Bank 2010	13	19°11.65′W	58°27.75′N	-19.1942	58.4625
52	NEAFC	NE Atlantic	Hatton Bank 2010	14	19°14.28′W	58°39.09′N	-19.2380	58.6515
52	NEAFC	NE Atlantic	Hatton Bank 2010	15	19°01.29′W	58°38.11′N	-19.0215	58.6352
52	NEAFC	NE Atlantic	Hatton Bank 2010	16	18°43.54′W	59°53.14′N	-18.7257	59.8857
52	NEAFC	NE Atlantic	Hatton Bank 2010	17	18°01.31′W	59°00.29′N	-18.0218	59.0048
52	NEAFC	NE Atlantic	Hatton Bank 2010	18	17°49.31′W	59°08.01′N	-17.8218	59.1335
52	NEAFC	NE Atlantic	Hatton Bank 2010	19	18°01.47′W	59°08.75′N	-18.0245	59.1458
52	NEAFC	NE Atlantic	Hatton Bank 2010	20	18°01.56′W	59°15.16′N	-18.0260	59.2527
52	NEAFC	NE Atlantic	Hatton Bank 2010	21	17°31.22′W	59°24.17′N	-17.5203	59.4028
52	NEAFC	NE Atlantic	Hatton Bank 2010	22	17°15.36′W	59°21.77′N	-17.2560	59.3628
52	NEAFC	NE Atlantic	Hatton Bank 2010	23	17°01.66′W	59°26.91′N	-17.0277	59.4485
52	NEAFC	NE Atlantic	Hatton Bank 2010	24	16°45.96′W	59°42.69′N	-16.7660	59.7115
52	NEAFC	NE Atlantic	Hatton Bank 2010	25	15°44.75′W	59°20.97′N	-15.7458	59.3495
52	NEAFC	NE Atlantic	Hatton Bank 2010	26	15°40′W	59°21′N	-15.6667	59.3500
52	NEAFC	NE Atlantic	Hatton Bank 2010	END	14°30′W	59°26′N	-14.5000	59.4333
53	NEAFC	NE Atlantic	North-West Rockall 2010	1	14°53′W	57°00′N	-14.8833	57.0000
53	NEAFC	NE Atlantic	North-West Rockall 2010	2	14°42′W	57°37′N	-14.7000	57.6167
53	NEAFC	NE Atlantic	North-West Rockall 2010	3	14°24′W	57°55′N	-14.4000	57.9167
53	NEAFC	NE Atlantic	North-West Rockall 2010	4	13°50′W	58°15′N	-13.8333	58.2500
53	NEAFC	NE Atlantic	North-West Rockall 2010	5	13°09′W	57°57′N	-13.1500	57.9500
53	NEAFC	NE Atlantic	North-West Rockall 2010	6	13°14′W	57°50′N	-13.2333	57.8333
53	NEAFC	NE Atlantic	North-West Rockall 2010	7	13°45′W	57°57′N	-13.7500	57.9500
53	NEAFC	NE Atlantic	North-West Rockall 2010	8	14°06′W	57°49′N	-14.1000	57.8167
53	NEAFC	NE Atlantic	North-West Rockall 2010	9	14°19′W	57°29′N	-14.3167	57.4833
53	NEAFC	NE Atlantic	North-West Rockall 2010	10	14°19′W	57°22′N	-14.3167	57.3667
53	NEAFC	NE Atlantic	North-West Rockall 2010	11	14°34′W	57°00′N	-14.5667	57.0000
53	NEAFC	NE Atlantic	North-West Rockall 2010	12	14°36′W	56°56′N	-14.6000	56.9333
53	NEAFC	NE Atlantic	North-West Rockall 2010	13	14°51′W	56°56′N	-14.8500	56.9333
53	NEAFC	NE Atlantic	North-West Rockall 2010	END	14°53′W	57°00′N	-14.8833	57.0000
54	NEAFC	NE Atlantic	West Rockall Mounds 2010	1	16°30′W	57°20′N	-16.5000	57.3333
54	NEAFC	NE Atlantic	West Rockall Mounds 2010	2	15°58′W	57°05′N	-15.9667	57.0833
54	NEAFC	NE Atlantic	West Rockall Mounds 2010	3	17°17′W	56°21′N	-17.2833	56.3500
54	NEAFC	NE Atlantic	West Rockall Mounds 2010	4	17°50′W	56°40′N	-17.8333	56.6667
54	NEAFC	NE Atlantic	West Rockall Mounds 2010	END	16°30′W	57°20′N	-16.5000	57.3333
55	NEAFC	NE Atlantic	Logachev Mounds 2010	1	16°10′W	55°17′N	-16.1667	55.2833
55	NEAFC	NE Atlantic	Logachev Mounds 2010	2	15°07′W	55°34′N	-15.1167	55.5667
55	NEAFC	NE Atlantic	Logachev Mounds 2010	3	15°15′W	55°50′N	-15.2500	55.8333
55	NEAFC	NE Atlantic	Logachev Mounds 2010	4	16°16′W	55°33′N	-16.2667	55.5500
55	NEAFC	NE Atlantic	Logachev Mounds 2010	END	16°10′W	55°17′N	-16.1667	55.2833
56	NEAFC	NW Atlantic	South West Rockall 2010	1	15°37'W	56°24'N	-15.6167	56.4000
56	NEAFC	NW Atlantic	South West Rockall 2010	2	14°58'W	56°21'N	-14.9667	56.3500
56	NEAFC	NW Atlantic	South West Rockall 2010	3	15°10'W	56°04'N	-15.1667	56.0667

MPA_ID	RFMO	Ocean	MPA name	Corner	Longitude (original)	Latitude (original)	Longitude (E)	Latitude (N)
56	NEAFC	NW Atlantic	South West Rockall 2010	4	15°37'W	55°51'N	-15.6167	55.8500
56	NEAFC	NW Atlantic	South West Rockall 2010	5	15°52'W	56°10'N	-15.8667	56.1667
56	NEAFC	NW Atlantic	South West Rockall 2010	END	15°37'W	56°24'N	-15.6167	56.4000
57	GFCM	Mediterranean	Lophelia reef off Capo Santa Maria de Leuca 2006	1	18°18.684'E	39°39.318'N	18.3114	39.6553
57	GFCM	Mediterranean	Lophelia reef off Capo Santa Maria de Leuca 2006	2	18°40.980'E	39°39.789'N	18.6830	39.6632
57	GFCM	Mediterranean	Lophelia reef off Capo Santa Maria de Leuca 2006	3	18°41.550'E	39°22.704'N	18.6925	39.3784
57	GFCM	Mediterranean	Lophelia reef off Capo Santa Maria de Leuca 2006	4	18°19.524'E	39°22.230'N	18.3254	39.3705
57	GFCM	Mediterranean	Lophelia reef off Capo Santa Maria de Leuca 2006	END	18°18.684'E	39°39.318'N	18.3114	39.6553
58	GFCM	Mediterranean	The Nile delta area cold hydrocarbon seeps 2006	1	33°10.00’E	31°30.00’N	33.1667	31.5000
58	GFCM	Mediterranean	The Nile delta area cold hydrocarbon seeps 2006	2	34°00.00’E	31°30.00’N	34.0000	31.5000
58	GFCM	Mediterranean	The Nile delta area cold hydrocarbon seeps 2006	3	34°00.00’E	32°00.00’N	34.0000	32.0000
58	GFCM	Mediterranean	The Nile delta area cold hydrocarbon seeps 2006	4	33°10.00’E	32°00.00’N	33.1667	32.0000
58	GFCM	Mediterranean	The Nile delta area cold hydrocarbon seeps 2006	END	33°10.00’E	31°30.00’N	33.1667	31.5000
59	GFCM	Mediterranean	The Eratosthemes Seamount 2006	1	32°00.00’E	33°00.00’N	32.0000	33.0000
59	GFCM	Mediterranean	The Eratosthemes Seamount 2006	2	33°00.00’E	33°00.00’N	33.0000	33.0000
59	GFCM	Mediterranean	The Eratosthemes Seamount 2006	3	33°00.00’E	34°00.00’N	33.0000	34.0000
59	GFCM	Mediterranean	The Eratosthemes Seamount 2006	4	32°00.00’E	34°00.00’N	32.0000	34.0000
59	GFCM	Mediterranean	The Eratosthemes Seamount 2006	END	32°00.00’E	33°00.00’N	32.0000	33.0000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	1	41°W	61°30'S	-41.0000	-61.5000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	2	44°W	61°30'S	-44.0000	-61.5000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	3	44°W	62°S	-44.0000	-62.0000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	4	46°W	62°S	-46.0000	-62.0000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	5	46°W	61°30'S	-46.0000	-61.5000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	6	48°W	61°30'S	-48.0000	-61.5000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	7	48°W	64°S	-48.0000	-64.0000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	8	41°W	64°S	-41.0000	-64.0000
60	CCAMLR	Antarctica	South Orkney Islands Southern Shelf 2010?	END	41°W	61°30'S	-41.0000	-61.5000
69	NEAFC	NE Atlantic	Hatton Bank 2005	1	14°30’W	59°26’N	-14.5000	59.4333
69	NEAFC	NE Atlantic	Hatton Bank 2005	2	15°08’W	59°12’N	-15.1333	59.2000
69	NEAFC	NE Atlantic	Hatton Bank 2005	3	17°00’W	59°01’N	-17.0000	59.0167
69	NEAFC	NE Atlantic	Hatton Bank 2005	4	17°38’W	58°50’N	-17.6333	58.8333
69	NEAFC	NE Atlantic	Hatton Bank 2005	5	17°52’W	58°30’N	-17.8667	58.5000
69	NEAFC	NE Atlantic	Hatton Bank 2005	6	18°45’W	58°30’N	-18.7500	58.5000
69	NEAFC	NE Atlantic	Hatton Bank 2005	7	18°37’W	58°47’N	-18.6167	58.7833
69	NEAFC	NE Atlantic	Hatton Bank 2005	8	17°32’W	59°05’N	-17.5333	59.0833
69	NEAFC	NE Atlantic	Hatton Bank 2005	9	17°20’W	59°16’N	-17.3333	59.2667
69	NEAFC	NE Atlantic	Hatton Bank 2005	10	16°50’W	59°22’N	-16.8333	59.3667
69	NEAFC	NE Atlantic	Hatton Bank 2005	11	15°40’W	59°21’N	-15.6667	59.3500
69	NEAFC	NE Atlantic	Hatton Bank 2005	END	14°30'W	59°26’N	-14.5000	59.4333
70	NEAFC	NE Atlantic	Reykjanes Ridge 2005	1	36°49.0135'W	55°04.5327’N	-36.8169	55.0755
70	NEAFC	NE Atlantic	Reykjanes Ridge 2005	2	35°58.9784'W	55°05.4804’N	-35.9830	55.0913
70	NEAFC	NE Atlantic	Reykjanes Ridge 2005	3	34°41.3634'W	54°.58.9914’N	-34.6894	54.9832
70	NEAFC	NE Atlantic	Reykjanes Ridge 2005	4	34°00.0514'W	54°41.1841’N	-34.0009	54.6864
70	NEAFC	NE Atlantic	Reykjanes Ridge 2005	5	34°00.00'W	54°00.00’N	-34.0000	54.0000
70	NEAFC	NE Atlantic	Reykjanes Ridge 2005	6	34°49.9842'W	53°54.6406’N	-34.8331	53.9107
70	NEAFC	NE Atlantic	Reykjanes Ridge 2005	7	36°39.1260'W	53°58.9668’N	-36.6521	53.9828
70	NEAFC	NE Atlantic	Reykjanes Ridge 2005	END	36°49.0135'W	55°04.5327’N	-36.8169	55.0755
71	NEAFC	NE Atlantic	Hekate 2005	1	31°09.2688'W	52°21.2866’N	-31.1545	52.3548
71	NEAFC	NE Atlantic	Hekate 2005	2	30°51.5258'W	52°20.8167’N	-30.8588	52.3469
71	NEAFC	NE Atlantic	Hekate 2005	3	30°54.3824'W	52°12.0777’N	-30.9064	52.2013
71	NEAFC	NE Atlantic	Hekate 2005	4	31°14.8168'W	52°12.4144’N	-31.2469	52.2069
71	NEAFC	NE Atlantic	Hekate 2005	END	31°09.2688'W	52°21.2866’N	-31.1545	52.3548
72	NEAFC	NE Atlantic	Faraday 2005	1	29°37.8077'W	50°01.7968’N	-29.6301	50.0299
72	NEAFC	NE Atlantic	Faraday 2005	2	29°29.4580'W	49°59.1490’N	-29.4910	49.9858
72	NEAFC	NE Atlantic	Faraday 2005	3	29°30.2820'W	49°52.6429’N	-29.5047	49.8774
72	NEAFC	NE Atlantic	Faraday 2005	4	29°02.8711'W	49°44.3831’N	-29.0479	49.7397
72	NEAFC	NE Atlantic	Faraday 2005	5	28°52.4340'W	49°44.4186’N	-28.8739	49.7403
72	NEAFC	NE Atlantic	Faraday 2005	6	28°39.4703'W	49°36.4557’N	-28.6578	49.6076
72	NEAFC	NE Atlantic	Faraday 2005	7	28°45.0183'W	49°29.9701’N	-28.7503	49.4995
72	NEAFC	NE Atlantic	Faraday 2005	8	29°42.0923'W	49°49.4197’N	-29.7015	49.8237
72	NEAFC	NE Atlantic	Faraday 2005	END	29°37.8077'W	50°01.7968’N	-29.6301	50.0299
73	NEAFC	NE Atlantic	Altair 2005	1	34°26.9128'W	44°50.4953’N	-34.4485	44.8416
73	NEAFC	NE Atlantic	Altair 2005	2	33°48.5158'W	44°47.2611’N	-33.8086	44.7877
73	NEAFC	NE Atlantic	Altair 2005	3	33°50.1636'W	44°31.2006’N	-33.8361	44.5200
73	NEAFC	NE Atlantic	Altair 2005	4	34°11.9715'W	44°38.0481’N	-34.1995	44.6341
73	NEAFC	NE Atlantic	Altair 2005	5	34°27.6819'W	44°38.9470’N	-34.4614	44.6491
73	NEAFC	NE Atlantic	Altair 2005	END	34°26.9128'W	44°50.4953’N	-34.4485	44.8416
74	NEAFC	NE Atlantic	Antialtair 2005	1	22°44.1174'W	43°43.1307’N	-22.7353	43.7188
74	NEAFC	NE Atlantic	Antialtair 2005	2	22°19.2335'W	43°39.5557’N	-22.3206	43.6593
74	NEAFC	NE Atlantic	Antialtair 2005	3	22°08.7964'W	43°31.2802’N	-22.1466	43.5213
74	NEAFC	NE Atlantic	Antialtair 2005	4	22°14.6192'W	43°27.7335’N	-22.2437	43.4622
74	NEAFC	NE Atlantic	Antialtair 2005	5	22°32.0325'W	43°30.9616’N	-22.5339	43.5160
74	NEAFC	NE Atlantic	Antialtair 2005	6	22°47.0288'W	43°40.6286’N	-22.7838	43.6771
74	NEAFC	NE Atlantic	Antialtair 2005	END	22°44.1174'W	43°43.1307’N	-22.7353	43.7188
75	SEAFO	SE Atlantic	Kreps seamount 2011	1	15°05'W	13°00'S	-15.0833	-13.0000
75	SEAFO	SE Atlantic	Kreps seamount 2011	2	14°10'W	12°44'S	-14.1667	-12.7333
75	SEAFO	SE Atlantic	Kreps seamount 2011	3	12°40'W	15°43'S	-12.6667	-15.7167
75	SEAFO	SE Atlantic	Kreps seamount 2011	4	13°13'W	16°34'S	-13.2167	-16.5667
75	SEAFO	SE Atlantic	Kreps seamount 2011	5	12°10'W	18°32'S	-12.1667	-18.5333
75	SEAFO	SE Atlantic	Kreps seamount 2011	6	13°18'W	18°46'S	-13.3000	-18.7667
75	SEAFO	SE Atlantic	Kreps seamount 2011	7	14°46'W	17°10'S	-14.7667	-17.1667
75	SEAFO	SE Atlantic	Kreps seamount 2011	8	14°46'W	16°20'S	-14.7667	-16.3333
75	SEAFO	SE Atlantic	Kreps seamount 2011	9	13°50'W	16°05'S	-13.8333	-16.0833
75	SEAFO	SE Atlantic	Kreps seamount 2011	END	15°05'W	13°00'S	-15.0833	-13.0000
76	SEAFO	SE Atlantic	Unnamed seamount 2011	1	13°15'W	1°00'S	-13.2500	-1.0000
76	SEAFO	SE Atlantic	Unnamed seamount 2011	2	12°30'W	1°00'S	-12.5000	-1.0000
76	SEAFO	SE Atlantic	Unnamed seamount 2011	3	11°30'W	5°25'S	-11.5000	-5.4167
76	SEAFO	SE Atlantic	Unnamed seamount 2011	4	12°51'W	4°52'S	-12.8500	-4.8667
76	SEAFO	SE Atlantic	Unnamed seamount 2011	5	12°33'W	4°00'S	-12.5500	-4.0000
76	SEAFO	SE Atlantic	Unnamed seamount 2011	END	13°15'W	1°00'S	-13.2500	-1.0000
77	SEAFO	SE Atlantic	Malachit Guyot Seamount 2011	1	1°25'W	10°51'S	-1.4167	-10.8500
77	SEAFO	SE Atlantic	Malachit Guyot Seamount 2011	2	0°40'W	11°35'S	-0.6667	-11.5833
77	SEAFO	SE Atlantic	Malachit Guyot Seamount 2011	3	2°57'W	13°44'S	-2.9500	-13.7333
77	SEAFO	SE Atlantic	Malachit Guyot Seamount 2011	4	3°45'W	13°03'S	-3.7500	-13.0500
77	SEAFO	SE Atlantic	Malachit Guyot Seamount 2011	END	1°25'W	10°51'S	-1.4167	-10.8500
78	SEAFO	SE Atlantic	Wüst Seamount 2011	1	06°50'W	32°57'S	-6.8333	-32.9500
78	SEAFO	SE Atlantic	Wüst Seamount 2011	2	03°39'W	31°51'S	-3.6500	-31.8500

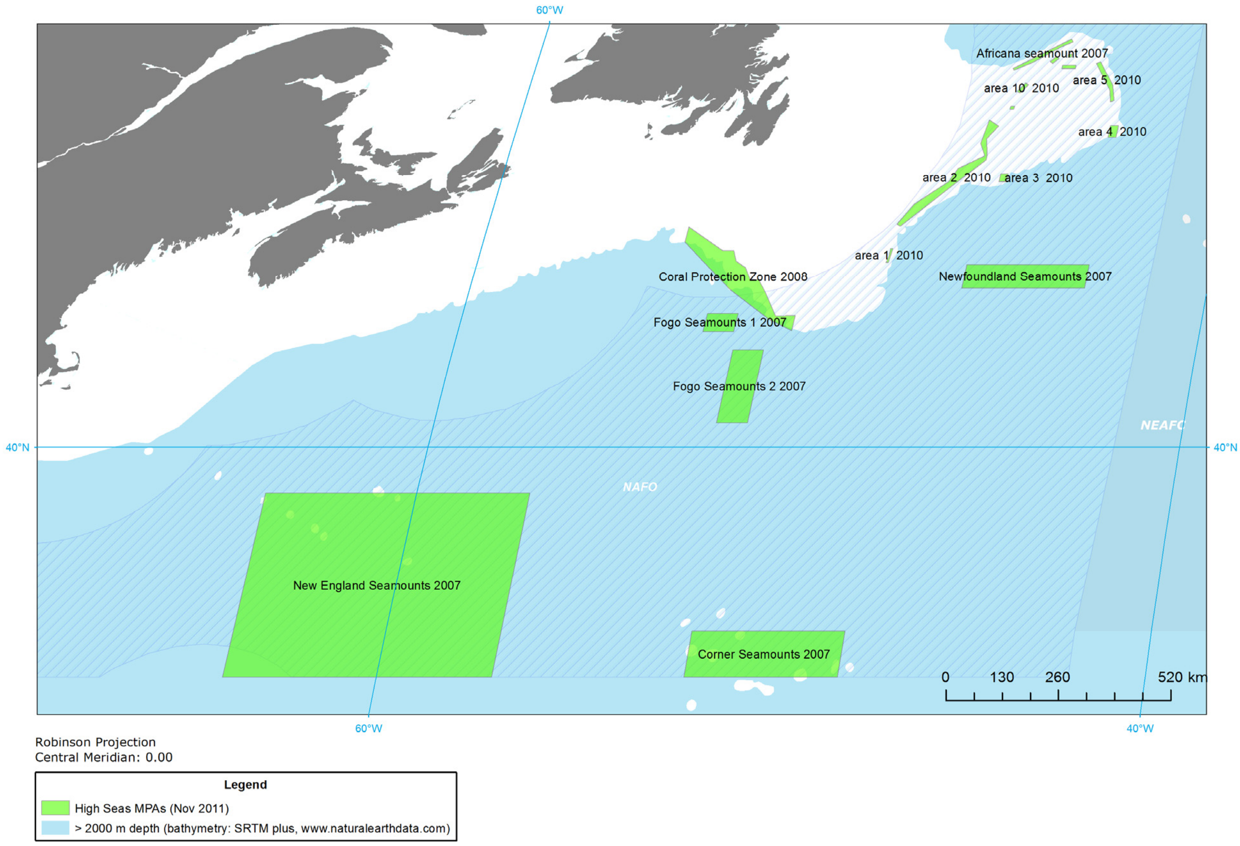
MPA_ID	RFMO	Ocean	MPA name	Corner	Longitude (original)	Latitude (original)	Longitude (E)	Latitude (N)
78	SEAFO	SE Atlantic	Wüst Seamount 2011	3	01°30'W	32°28'S	-1.5000	-32.4667
78	SEAFO	SE Atlantic	Wüst Seamount 2011	4	00°40'W	34°34'S	-0.6667	-34.5667
78	SEAFO	SE Atlantic	Wüst Seamount 2011	5	00°40'W	36°17'S	-0.6667	-36.2833
78	SEAFO	SE Atlantic	Wüst Seamount 2011	6	01°23'W	36°17'S	-1.3833	-36.2833
78	SEAFO	SE Atlantic	Wüst Seamount 2011	7	02°23'W	34°10'S	-2.3833	-34.1667
78	SEAFO	SE Atlantic	Wüst Seamount 2011	8	06°16'W	36°20'S	-6.2667	-36.3333
78	SEAFO	SE Atlantic	Wüst Seamount 2011	9	07°43'W	34°53'S	-7.7167	-34.8833
78	SEAFO	SE Atlantic	Wüst Seamount 2011	END	06°50'W	32°57'S	-6.8333	-32.9500
79	SEAFO	SE Atlantic	Africana Seamount 2011	1	28°45'E	37°00'S	28.7500	-37.0000
79	SEAFO	SE Atlantic	Africana Seamount 2011	2	29°21'E	37°00'S	29.3500	-37.0000
79	SEAFO	SE Atlantic	Africana Seamount 2011	3	29°21'E	37°25'S	29.3500	-37.4167
79	SEAFO	SE Atlantic	Africana Seamount 2011	4	28°45'E	37°25'S	28.7500	-37.4167
79	SEAFO	SE Atlantic	Africana Seamount 2011	END	28°45'E	37°00'S	28.7500	-37.0000
80	SEAFO	SE Atlantic	Schmidt-Ott Seamount 2011	1	13°00'E	38°20'S	13.0000	-38.3333
80	SEAFO	SE Atlantic	Schmidt-Ott Seamount 2011	2	14°24'E	38°20'S	14.4000	-38.3333
80	SEAFO	SE Atlantic	Schmidt-Ott Seamount 2011	3	14°24'E	39°32'S	14.4000	-39.5333
80	SEAFO	SE Atlantic	Schmidt-Ott Seamount 2011	4	13°00'E	39°32'S	13.0000	-39.5333
80	SEAFO	SE Atlantic	Schmidt-Ott Seamount 2011	END	13°00'E	38°20'S	13.0000	-38.3333
81	SEAFO	SE Atlantic	Unnamed 2011	1	14°22'E	29°19'S	14.3667	-29.3167
81	SEAFO	SE Atlantic	Unnamed 2011	2	12°54'E	29°17'S	12.9000	-29.2833
81	SEAFO	SE Atlantic	Unnamed 2011	3	12°47'E	31°57'S	12.7833	-31.9500
81	SEAFO	SE Atlantic	Unnamed 2011	4	14°18'E	32°08'S	14.3000	-32.1333
81	SEAFO	SE Atlantic	Unnamed 2011	END	14°22'E	29°19'S	14.3667	-29.3167
82	SEAFO	SE Atlantic	Vema Seamount 2011	1	08°06'E	31°27'S	8.1000	-31.4500
82	SEAFO	SE Atlantic	Vema Seamount 2011	2	08°35'E	31°27'S	8.5833	-31.4500
82	SEAFO	SE Atlantic	Vema Seamount 2011	3	08°35'E	31°53'S	8.5833	-31.8833
82	SEAFO	SE Atlantic	Vema Seamount 2011	4	08°06'E	31°53'S	8.1000	-31.8833
82	SEAFO	SE Atlantic	Vema Seamount 2011	END	08°06'E	31°27'S	8.1000	-31.4500
83	SEAFO	SE Atlantic	Herdman Seamounts 2011	1	00°05'E	45°10'S	0.0833	-45.1667
83	SEAFO	SE Atlantic	Herdman Seamounts 2011	2	00°42'E	45°10'S	0.7000	-45.1667
83	SEAFO	SE Atlantic	Herdman Seamounts 2011	3	00°42'E	45°50'S	0.7000	-45.8333
83	SEAFO	SE Atlantic	Herdman Seamounts 2011	4	00°05'E	45°50'S	0.0833	-45.8333
83	SEAFO	SE Atlantic	Herdman Seamounts 2011	END	00°05'E	45°10'S	0.0833	-45.1667
84	SEAFO	SE Atlantic	Unnamed Seamounts 2011	1	10°57'W	47°54'S	-10.9500	-47.9000
84	SEAFO	SE Atlantic	Unnamed Seamounts 2011	2	09°07'W	47°54'S	-9.1167	-47.9000
84	SEAFO	SE Atlantic	Unnamed Seamounts 2011	3	08°03'W	49°15'S	-8.0500	-49.2500
84	SEAFO	SE Atlantic	Unnamed Seamounts 2011	4	08°24'W	49°34'S	-8.4000	-49.5667
84	SEAFO	SE Atlantic	Unnamed Seamounts 2011	5	10°31'W	49°10'S	-10.5167	-49.1667
84	SEAFO	SE Atlantic	Unnamed Seamounts 2011	END	10°57'W	47°54'S	-10.9500	-47.9000
85	SEAFO	SE Atlantic	Unnamed Seamounts 2011	1	17°32'W	40°35'S	-17.5333	-40.5833
85	SEAFO	SE Atlantic	Unnamed Seamounts 2011	2	16°15'W	40°18'S	-16.2500	-40.3000
85	SEAFO	SE Atlantic	Unnamed Seamounts 2011	3	15°12'W	43°04'S	-15.2000	-43.0667
85	SEAFO	SE Atlantic	Unnamed Seamounts 2011	4	16°30'W	43°20'S	-16.5000	-43.3333
85	SEAFO	SE Atlantic	Unnamed Seamounts 2011	END	17°32'W	40°35'S	-17.5333	-40.5833

Maps of closed areas

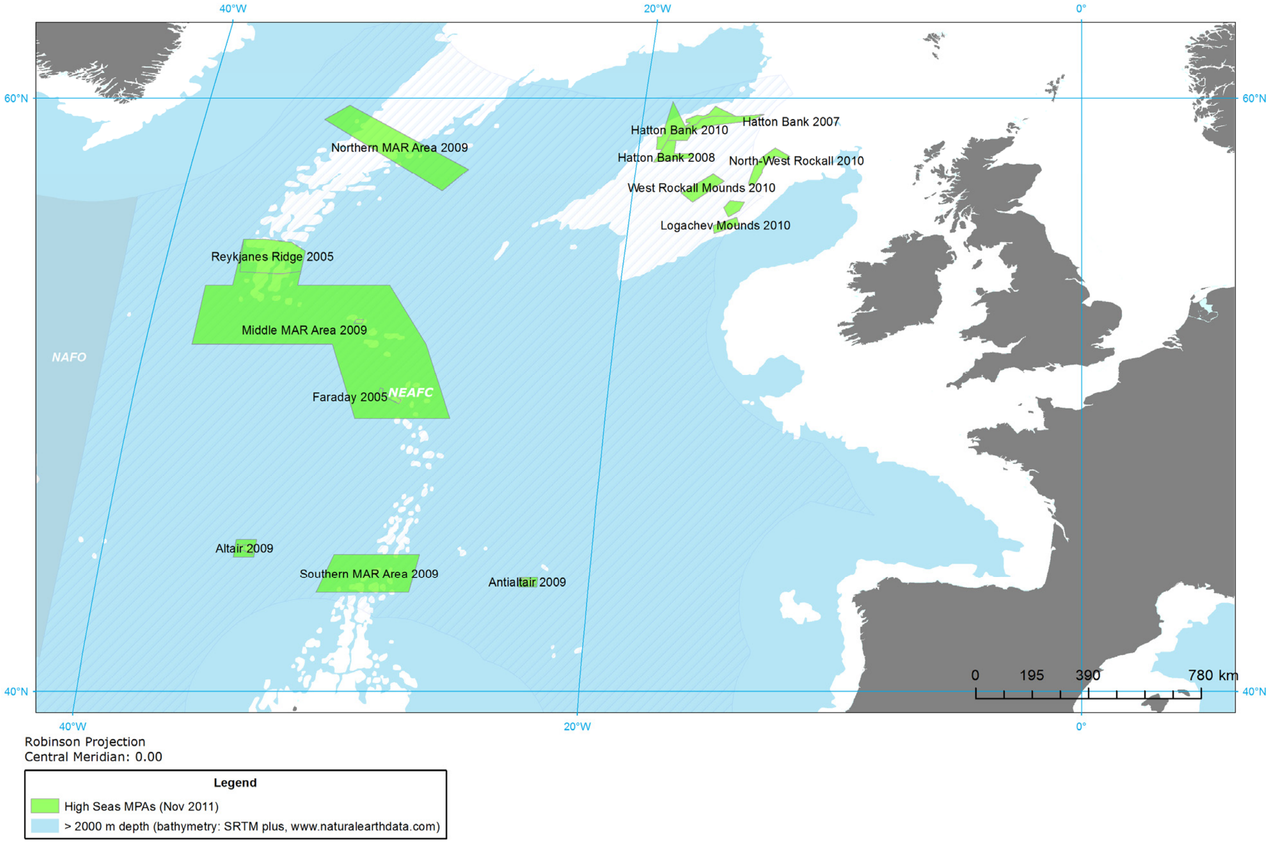
Figure 21 (see also following pages) Maps of areas (VMEs) closed to bottom fisheries (situation November 2011): RFMOs (grey or dashed) are indicated with names. Closed areas are indicated in green. A list of the areas is given in Table 7. In white, the area between 0 and 2000 m depth is indicated, showing the theoretically fishable area. In the Mediterranean the area below 1000 m that is closed for bottom trawling is indicated with a blue line. In the SEAFO area (South East Atlantic) the areas closed in 2011 (dark green) replace the previously closed areas (green). An interactive maps is available at www.highseaspmas.org. Maps: IMARES.



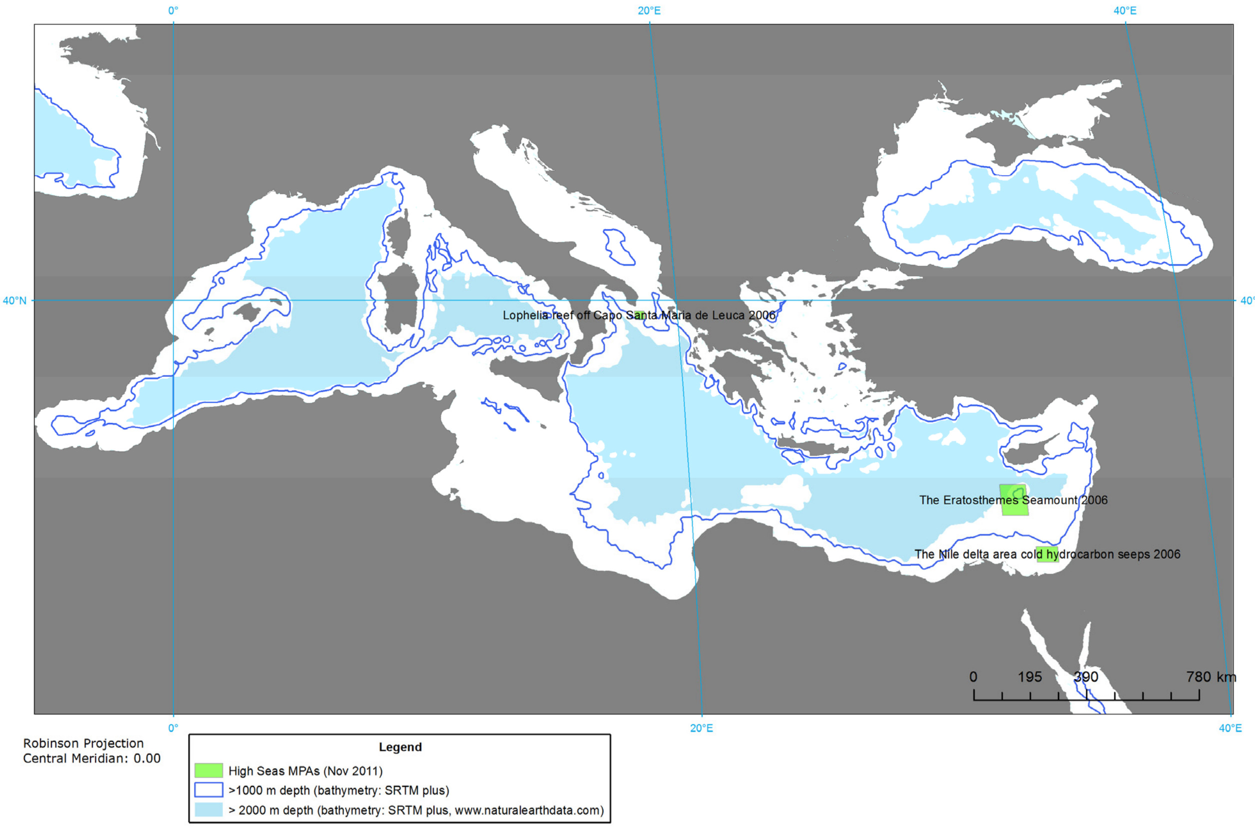
North West Atlantic (NAFO area)



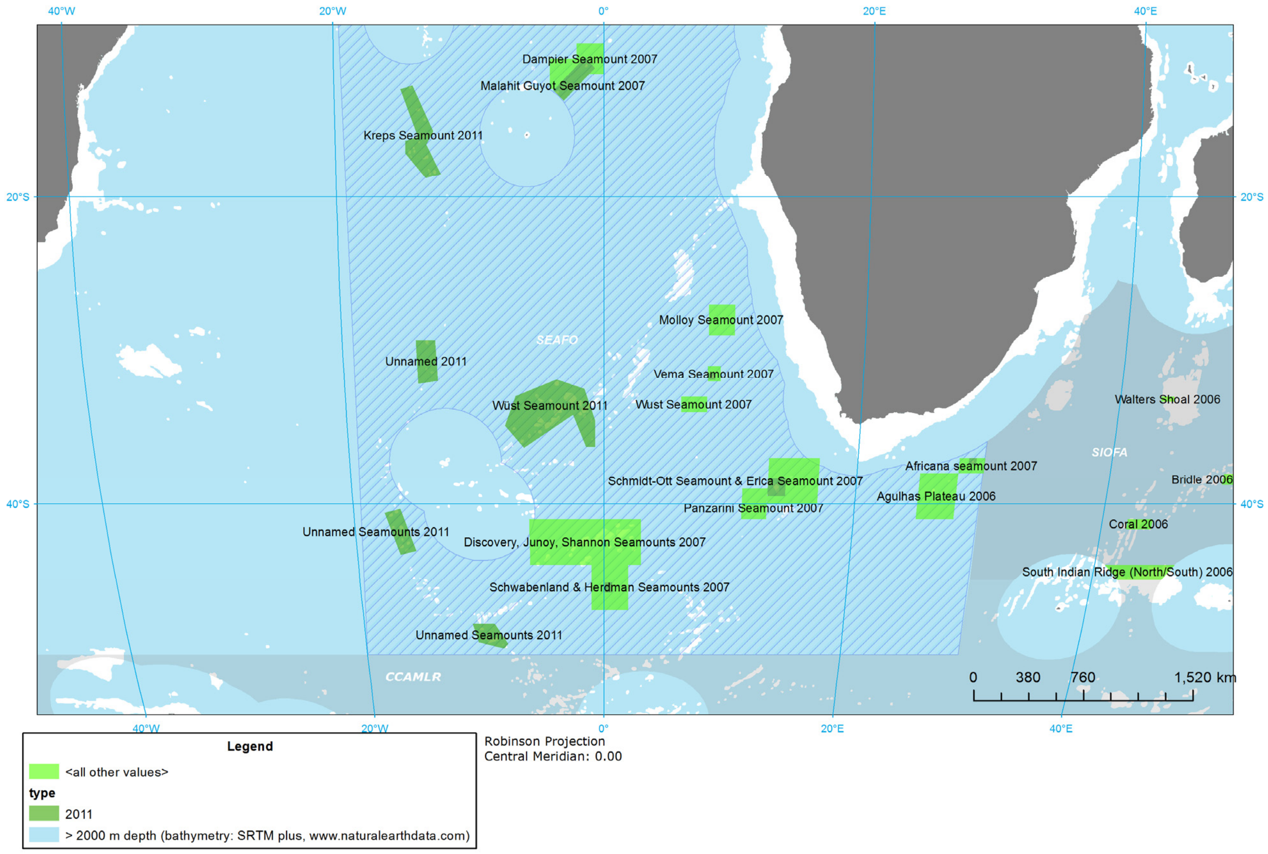
North East Atlantic Ocean (NEAFC area)



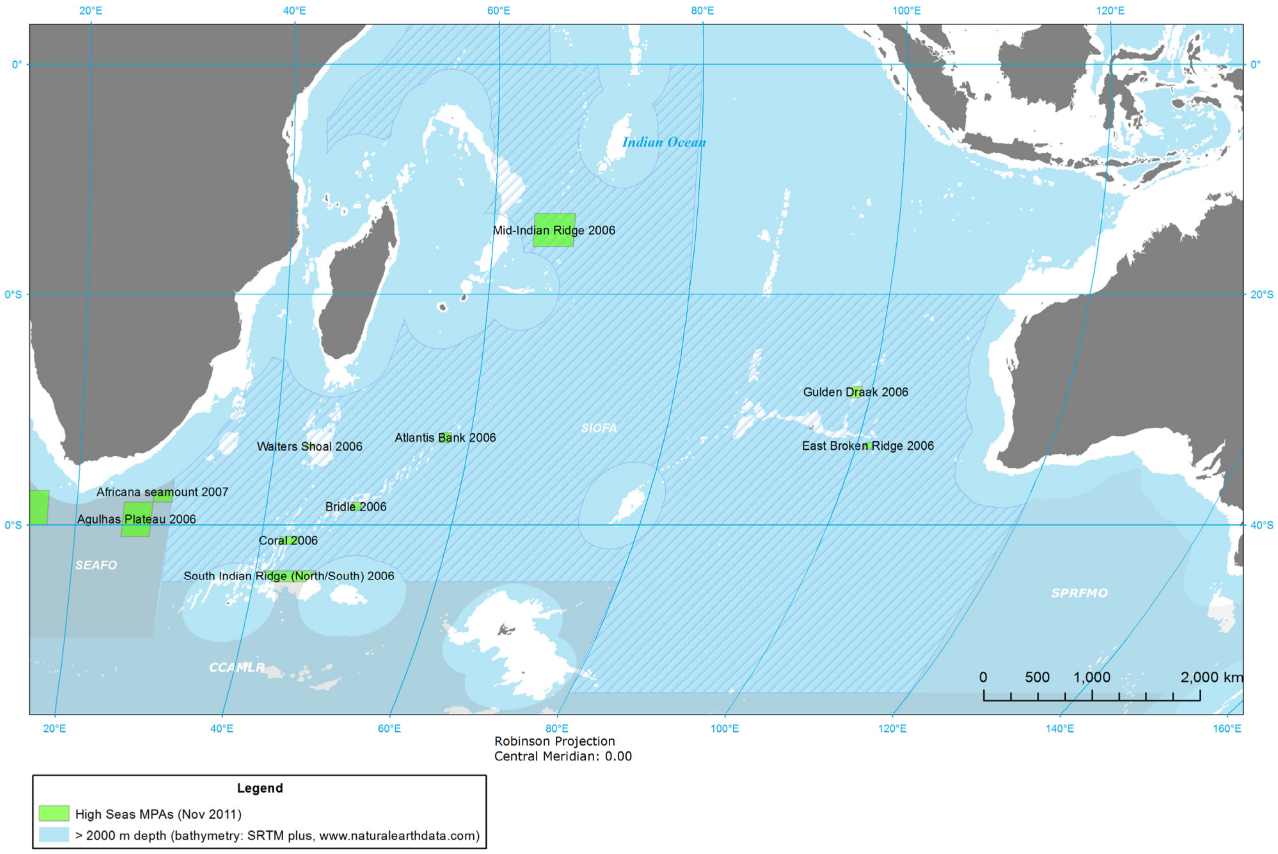
Mediterranean (GFCM area)



South East Atlantic Ocean (SEAFO area)



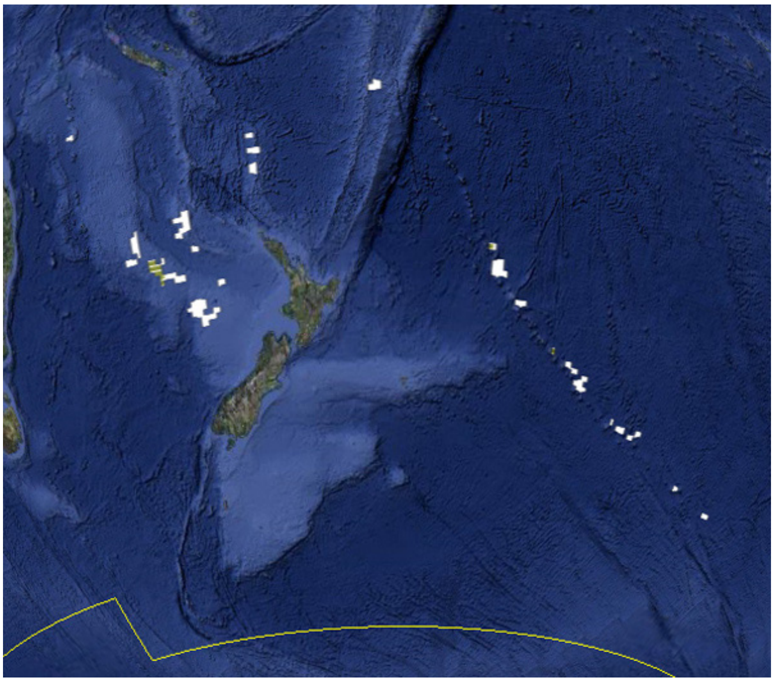
Indian Ocean (SIOFA area)



South West Pacific Ocean (SPRFMO area)

Table 8. New Zealand closed areas *(Source: SPRFMO).*

ID	Fishing_Area	Centre_Lat	Centre_Lon	NW Lon	NW Lat	NE Lon	NE Lat	SE Lon	SE Lat	SW Lon	SW Lat	Block_Area
5	Lord Howe N	-34.8333	162.5000	162.3333	-34.6667	162.6667	-34.6667	162.6667	-35.0000	162.3333	-35.0000	1127.64
11	Lord Howe N	-34.8333	162.8330	162.6667	-34.6667	163.0000	-34.6667	163.0000	-35.0000	162.6667	-35.0000	1127.64
14	Lord Howe N	-33.5000	163.1670	163.0000	-33.3333	163.3333	-33.3333	163.3333	-33.6667	163.0000	-33.6667	1145.6
15	Lord Howe N	-33.8333	163.1670	163.0000	-33.6667	163.3333	-33.6667	163.3333	-34.0000	163.0000	-34.0000	1141.17
16	Lord Howe N	-34.1666	163.1670	163.0000	-34.0000	163.3333	-34.0000	163.3333	-34.3333	163.0000	-34.3333	1136.7
18	Lord Howe N	-33.1666	163.5000	163.3333	-33.0000	163.6667	-33.0000	163.6667	-33.3333	163.3333	-33.3333	1149.99
19	Lord Howe N	-33.5000	163.5000	163.3333	-33.3333	163.6667	-33.3333	163.6667	-33.6667	163.3333	-33.6667	1145.6
20	Lord Howe N	-33.8333	163.5000	163.3333	-33.6667	163.6667	-33.6667	163.6667	-34.0000	163.3333	-34.0000	1141.17
21	Lord Howe N	-34.1666	163.5000	163.3333	-34.0000	163.6667	-34.0000	163.6667	-34.3333	163.3333	-34.3333	1136.7
22	Lord Howe N	-34.5000	163.5000	163.3333	-34.3333	163.6667	-34.3333	163.6667	-34.6667	163.3333	-34.6667	1132.19
23	Lord Howe S	-35.1666	164.1670	164.0000	-35.0000	164.3333	-35.0000	164.3333	-35.3333	164.0000	-35.3333	1123.06
24	Lord Howe S	-35.5000	164.1670	164.0000	-35.3333	164.3333	-35.3333	164.3333	-35.6667	164.0000	-35.6667	1118.44
25	Lord Howe S	-35.1666	164.5000	164.3333	-35.0000	164.6667	-35.0000	164.6667	-35.3333	164.3333	-35.3333	1123.06
26	Lord Howe S	-35.5000	164.5000	164.3333	-35.3333	164.6667	-35.3333	164.6667	-35.6667	164.3333	-35.6667	1118.44
27	Lord Howe S	-35.8333	164.5000	164.3333	-35.6667	164.6667	-35.6667	164.6667	-36.0000	164.3333	-36.0000	1113.78
28	Lord Howe S	-35.5000	164.8330	164.6667	-35.3333	165.0000	-35.3333	165.0000	-35.6667	164.6667	-35.6667	1118.44
29	Lord Howe S	-35.8333	164.8330	164.6667	-35.6667	165.0000	-35.6667	165.0000	-36.0000	164.6667	-36.0000	1113.78
30	Lord Howe S	-36.1666	164.8330	164.6667	-36.0000	165.0000	-36.0000	165.0000	-36.3333	164.6667	-36.3333	1109.08
31	Lord Howe S	-36.5000	164.8330	164.6667	-36.3333	165.0000	-36.3333	165.0000	-36.6667	164.6667	-36.6667	1104.34
32	Lord Howe S	-35.1666	165.1670	165.0000	-35.0000	165.3333	-35.0000	165.3333	-35.3333	165.0000	-35.3333	1123.06
37	Lord Howe S	-36.1666	165.5000	165.3333	-36.0000	165.6667	-36.0000	165.6667	-36.3333	165.3333	-36.3333	1109.08
40	Lord Howe S	-36.1666	165.8330	165.6667	-36.0000	166.0000	-36.0000	166.0000	-36.3333	165.6667	-36.3333	1109.08
44	Lord Howe S	-36.5000	166.1670	166.0000	-36.3333	166.3333	-36.3333	166.3333	-36.6667	166.0000	-36.6667	1104.34
45	Lord Howe S	-36.5000	166.5000	166.3333	-36.3333	166.6667	-36.3333	166.6667	-36.6667	166.3333	-36.6667	1104.34
46	West Norfolk	-32.8333	166.8330	166.6667	-32.6667	167.0000	-32.6667	167.0000	-33.0000	166.6667	-33.0000	1154.34
49	West Norfolk	-33.8333	166.8330	166.6667	-33.6667	167.0000	-33.6667	167.0000	-34.0000	166.6667	-34.0000	1141.17
53	Challenger	-38.5000	166.8330	166.6667	-38.3333	167.0000	-38.3333	167.0000	-38.6667	166.6667	-38.6667	1075.15
54	West Norfolk	-33.5000	167.1670	167.0000	-33.3333	167.3333	-33.3333	167.3333	-33.6667	167.0000	-33.6667	1145.6
60	Challenger	-38.1666	167.1670	167.0000	-38.0000	167.3333	-38.0000	167.3333	-38.3333	167.0000	-38.3333	1080.11
61	Challenger	-38.5000	167.1670	167.0000	-38.3333	167.3333	-38.3333	167.3333	-38.6667	167.0000	-38.6667	1075.15
62	Challenger	-38.8333	167.1670	167.0000	-38.6667	167.3333	-38.6667	167.3333	-39.0000	167.0000	-39.0000	1070.16
63	West Norfolk	-32.5000	167.5000	167.3333	-32.3333	167.6667	-32.3333	167.6667	-32.6667	167.3333	-32.6667	1158.66
64	West Norfolk	-32.8333	167.5000	167.3333	-32.6667	167.6667	-32.6667	167.6667	-33.0000	167.3333	-33.0000	1154.34
65	West Norfolk	-33.1666	167.5000	167.3333	-33.0000	167.6667	-33.0000	167.6667	-33.3333	167.3333	-33.3333	1149.99
66	West Norfolk	-33.5000	167.5000	167.3333	-33.3333	167.6667	-33.3333	167.6667	-33.6667	167.3333	-33.6667	1145.6
72	Challenger	-38.1666	167.5000	167.3333	-38.0000	167.6667	-38.0000	167.6667	-38.3333	167.3333	-38.3333	1080.11
73	Challenger	-38.5000	167.5000	167.3333	-38.3333	167.6667	-38.3333	167.6667	-38.6667	167.3333	-38.6667	1075.15
74	Challenger	-38.8333	167.5000	167.3333	-38.6667	167.6667	-38.6667	167.6667	-39.0000	167.3333	-39.0000	1070.16
81	Challenger	-38.1666	167.8330	167.6667	-38.0000	168.0000	-38.0000	168.0000	-38.3333	167.6667	-38.3333	1080.11
82	Challenger	-38.5000	167.8330	167.6667	-38.3333	168.0000	-38.3333	168.0000	-38.6667	167.6667	-38.6667	1075.15
84	Challenger	-39.1666	167.8330	167.6667	-39.0000	168.0000	-39.0000	168.0000	-39.3333	167.6667	-39.3333	1065.13
85	Challenger	-39.5000	167.8330	167.6667	-39.3333	168.0000	-39.3333	168.0000	-39.6667	167.6667	-39.6667	1060.06
93	Challenger	-39.1666	168.1660	168.0000	-39.0000	168.3333	-39.0000	168.3333	-39.3333	168.0000	-39.3333	1065.13
100	Challenger	-39.1666	168.5000	168.3333	-39.0000	168.6667	-39.0000	168.6667	-39.3333	168.3333	-39.3333	1065.13
106	Challenger	-38.8333	168.8330	168.6667	-38.6667	169.0000	-38.6667	169.0000	-39.0000	168.6667	-39.0000	1070.16
112	Challenger	-37.1666	169.5000	169.3333	-37.0000	169.6667	-37.0000	169.6667	-37.3333	169.3333	-37.3333	1094.76
120	Louisville N	-35.5000	189.5000	189.3333	-35.3333	189.6667	-35.3333	189.6667	-35.6667	189.3333	-35.6667	1118.44
121	Louisville N	-35.5000	189.8330	189.6667	-35.3333	190.0000	-35.3333	190.0000	-35.6667	189.6667	-35.6667	1118.44
122	Louisville N	-36.5000	190.1660	190.0000	-36.3333	190.3333	-36.3333	190.3333	-36.6667	190.0000	-36.6667	1104.34
123	Louisville N	-36.8333	190.1660	190.0000	-36.6667	190.3333	-36.6667	190.3333	-37.0000	190.0000	-37.0000	1099.57
124	Louisville N	-37.1666	190.1660	190.0000	-37.0000	190.3333	-37.0000	190.3333	-37.3333	190.0000	-37.3333	1094.76
126	Louisville N	-36.5000	190.5000	190.3333	-36.3333	190.6667	-36.3333	190.6667	-36.6667	190.3333	-36.6667	1104.34
127	Louisville N	-36.8333	190.5000	190.3333	-36.6667	190.6667	-36.6667	190.6667	-37.0000	190.3333	-37.0000	1099.57
129	Louisville N	-37.1666	190.8330	190.6667	-37.0000	191.0000	-37.0000	191.0000	-37.3333	190.6667	-37.3333	1094.76
138	Louisville N	-38.8333	192.5000	192.3333	-38.6667	192.6667	-38.6667	192.6667	-39.0000	192.3333	-39.0000	1070.16
149	Louisville C	-41.5000	195.5000	195.3333	-41.3333	195.6667	-41.3333	195.6667	-41.6667	195.3333	-41.6667	1028.92
154	Louisville C	-42.1666	197.1660	197.0000	-42.0000	197.3333	-42.0000	197.3333	-42.3333	197.0000	-42.3333	1018.26
155	Louisville C	-42.5000	197.8330	197.6667	-42.3333	198.0000	-42.3333	198.0000	-42.6667	197.6667	-42.6667	1012.88
157	Louisville C	-43.1666	198.1660	198.0000	-43.0000	198.3333	-43.0000	198.3333	-43.3333	198.0000	-43.3333	1002.01
158	Louisville C	-43.1666	198.5000	198.3333	-43.0000	198.6667	-43.0000	198.6667	-43.3333	198.3333	-43.3333	1002.01
159	Louisville C	-43.5000	198.5000	198.3333	-43.3333	198.6667	-43.3333	198.6667	-43.6667	198.3333	-43.6667	996.525
160	Louisville C	-42.8333	198.8330	198.6667	-42.6667	199.0000	-42.6667	199.0000	-43.0000	198.6667	-43.0000	1007.46
161	Louisville C	-43.5000	198.8330	198.6667	-43.3333	199.0000	-43.3333	199.0000	-43.6667	198.6667	-43.6667	996.525
170	Louisville S	-45.1666	202.1660	202.0000	-45.0000	202.3333	-45.0000	202.3333	-45.3333	202.0000	-45.3333	968.599
173	Louisville S	-45.5000	203.1660	203.0000	-45.3333	203.3333	-45.3333	203.3333	-45.6667	203.0000	-45.6667	962.914
174	Louisville S	-45.5000	203.5000	203.3333	-45.3333	203.6667	-45.3333	203.6667	-45.6667	203.3333	-45.6667	962.914
176	Louisville S	-45.8333	204.5000	204.3333	-45.6667	204.6667	-45.6667	204.6667	-46.0000	204.3333	-46.0000	957.197
177	Louisville S	-45.5000	205.1660	205.0000	-45.3333	205.3333	-45.3333	205.3333	-45.6667	205.0000	-45.6667	962.914
182	Louisville S	-48.1666	211.1660	211.0000	-48.0000	211.3333	-48.0000	211.3333	-48.3333	211.0000	-48.3333	916.283
183	Louisville N	-38.8333	192.1660	192.0000	-38.6667	192.3333	-38.6667	192.3333	-39.0000	192.0000	-39.0000	1070.4
184	New Caledonia	-25.5000	159.5000	159.3333	-25.3333	159.6667	-25.3333	159.6667	-25.6667	159.3333	-25.6667	1239.98
185	Three Kings	-28.1666	172.8330	172.6667	-28.0000	173.0000	-28.0000	173.0000	-28.3333	172.6667	-28.3333	1211.12
188	Three Kings	-29.1666	172.8330	172.6667	-29.0000	173.0000	-29.0000	173.0000	-29.3333	172.6667	-29.3333	1199.62
189	Three Kings	-30.1666	172.8330	172.6667	-30.0000	173.0000	-30.0000	173.0000	-30.3333	172.6667	-30.3333	1187.75
190	Three Kings	-30.5000	172.8330	172.6667	-30.3333	173.0000	-30.3333	173.0000	-30.6667	172.6667	-30.6667	1183.71
192	Three Kings	-29.1666	173.1660	173.0000	-29.0000	173.3333	-29.0000	173.3333	-29.3333	173.0000	-29.3333	1199.62
195	Kermadec	-25.5000	180.8330	180.6667	-25.3333	181.0000	-25.3333	181.0000	-25.6667	180.6667	-25.6667	1239.98
196	Kermadec	-25.1666	181.1660	181.0000	-25.0000	181.3333	-25.0000	181.3333	-25.3333	181.0000	-25.3333	1243.4
197	Kermadec	-25.5000	181.1660	181.0000	-25.3333	181.3333	-25.3333	181.3333	-25.6667	181.0000	-25.6667	1239.98
198	West Norfolk	-34.8333	167.8330	167.6667	-34.6667	168.0000	-34.6667	168.0000	-35.0000	167.6667	-35.0000	1127.64
199	Louisville S	-49.1666	216.1660	216.0000	-49.0000	216.3333	-49.0000	216.3333	-49.3333	216.0000	-49.3333	898.277
200	Louisville S	-49.1666	216.5000	216.3333	-49.0000	216.6667	-49.0000	216.6667	-49.3333	216.3333	-49.3333	898.277



New Zealand closed areas (Source: SPRFMO) (map: Google)

Annex E Research programs and databases on ocean biodiversity

Research programs on high seas biodiversity

- **Census of Marine Life (CoML).** The Census of Marine Life program (2000-2010) is a global network of researchers in more than 80 nations engaged in a 10-year scientific initiative to assess and explain the diversity, distribution, and abundance of life in the oceans. The world's first comprehensive Census of Marine Life - past, present, and future – has been released in 2010 (http://www.coml.org). Data are stored in the Ocean Biogeographic Information System (OBIS).

- The **HERMIONE** (Hotspot Ecosystem Research and Man's Impact on European Seas) project is a EU FP7 project. HERMIONE is the successor to the highly successful HERMES project, which finished in March 2009. It is designed to make a major advance in our knowledge of the functioning of deep-sea ecosystems and their contribution to the production of goods and services (http://www.eu-hermione.net).

- The **Global Ocean Biodiversity Initiative (GOBI)** represents a collaborative international partnership as an example of international cooperation and coordination through which biodiversity in the deep seas and open oceans can be conserved. The aim of GOBI is to bring together the best available scientific information in a collaborative fashion to help identify significant areas in need of protection in the open ocean and deep seabed beyond national jurisdiction (http://www.gobi.org). GOBI identifies EBSAs.

Databases on Biodiversity

- The Ocean Biogeographic Information System (OBIS) is a metadatabase of marine species: it covers >740 databases with >22 million records of species and is part of Census of Marine Life (http://iobis.org/)
- Sea around us project (SAUP) gives a worldwide overview of Fisheries, ecosystems and biodiversity (Daniel Pauly et al.) (http://www.seaaroundus.org/)
- Global Biodiversity Information Facility makes the world's biodiversity data accessible (http://data.gbif.org/welcome.htm)
- Aquamaps: biodiversity maps for 9000 species of fishes, marine mammals and invertebrates. (http://www.aquamaps.org/)

Databases on Species

- FishBase is a global database on fish (http://www.fishbase.org/)
- LarvalBase is a global database on fish larvae (http://www.larvalbase.org/)
- SeaLifeBase is a global database of marine species (http://www.sealifebase.org/)
- AquaMaps provides standardized distribution maps for 9000 species of fishes, marine mammals and invertebrates. Based on Fishmaps (http://www.aquamaps.org/)
- CephBase is a database on all living cephalopods (octopus, squid, cuttlefish and nautilus) (http://www.cephbase.utmb.edu/)
- AlgaeBase is a database of algae (http://www.algaebase.org/)
- Avibase is a global database on birds (http://avibase.bsc-eoc.org/)
- ICOMM (International Census OF Marine Microbes) is a database on marine microbes (http://icomm.mbl.edu/)

- OBIS is a metadatabase of > 740 databases (see above) (http://iobis.org/)

Databases on Habitats

SeamountsOnline is an information system for the biology of seamounts (http://seamounts.sdsc.edu/)
InterRidge Vents database is a database on hydrothermal vents (http://www.interridge.org/en/IRvents)

Databases of Marine Protected Areas (MPAs)

- World Database on Marine Protected Areas (http://www.wdpa-marine.org/)
- Google earth file with high seas areas protected to bottom fisheries (http://www.highseasmpas.org ; this project)

EBSAs (Ecologically and Biologically Significant Areas)

- Global Ocean Biodiversity Initiative (GOBI) is a collaborative international partnership and shows suggestions for EBSAs (http://openoceansdeepseas.org/).
- EBSA Repository (http://ebsa-review.cbd.int/)

Ocean maps

- UN Atlas of the oceans contains general ocean information (http://www.oceansatlas.org/)
- iMAPS displays maps of high seas + species distributions and many user functions (http://bure.unep-wcmc.org/marine/highseas/viewer.htm)
- Large marine ecosystems (http://www.lme.noaa.gov/)

Justification

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The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Prof. Dr. A.D. Rijnsdorp
Senior scientist

Signature: 

Date: 25 April 2012

Approved: F. Groenendijk
Head Maritime department

Signature: 

Date: 25 April 2012