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Directorate General Internal Policies of the Union

Policy Department Structural and Cohesion Policies

FISHERIES

DEEP-SEA FISHERIES
RESOURCES AND ECOSYSTEM

NOTE

Content:
Deep-sea fisheries occur in the whole North-East Atlantic, most of them developed over the last 20 years but some are older. Depending on the area, they are operated by fleets of large trawlers or small artisanal fleets. Deep-sea fish are characterised by low biological productivity, which implies that they can only sustain low exploitation rates. Although they occur at varied depth ranges, species considered as deep-sea by ICES and EU share this character. The impact of bottom fishing gears is a threat to deep-sea habitats mainly where reefs and dense benthic communities occur. In areas where it has been quantified, the proportion of such reefs and communities impacted was high. There exist a few designated Protected Areas to conserve deep-sea habitats.

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Executive summary

In the North East Atlantic. Deep-sea fisheries operate with trawls, fixed nets and longlines. Vessels involved in deep-sea fisheries can be large modern trawlers or small artisanal boats using longlines and nets. Some fleets of large trawlers land fresh fish while others are freezer trawlers.

The deep-sea can be defined as the part of the ocean deeper than 400 m. However, for many species the status of deep-sea species is debatable as some species occur over a wide depth range or have variable depth range over their geographical distribution. Most of the species caught at great depth are long lived and their population have a low biological productivity. Following on-going process under the Food and Agriculture Organisation (FAO) framework, it is then proposed that species which deserve being treated with special caution for fishery assessment and management purposes are those 'with life histories that can sustain only low exploitation rates, (tending to be long lived, slow-growing, late maturing, etc.)'.

Fisheries imply normally to reduce the biomass of exploited stock. For any stock, deeps-ea or not, models predict that Maximum Sustainable Yield is achieved at biomass levels corresponding to 20-40% of the unexploited biomass. However, as deep-sea stocks have a low productivity, the proportion of the biomass that can be sustainably extracted annually is small. Several stocks in the NE Atlantic have been exploited unsustainably and ICES recommends measures to reduce some fisheries.

Deep-sea habitats are varied, the major concern in terms of impact of fishing on habitats are cold water corals, which form locally reefs, and sponges communities. Fishing gears towed on the seabed (trawls) have a major impact if they are used on such reefs. Where is has been estimated the proportion of coral impacted by fishing was high. Not only towed gears but also fixed nets and longlines may be detrimental to cold water corals. When lost on the bottom, nets are also presumed to keep catching fish, an effect known as ghost fishing. Cold water corals and other communities of benthic organism creating 3-dimensional structure on the seabed are associated with a high diversity of species. Both Marine Protected Areas (MPAs) designed to protect benthic habitat and spatial closure designed for fishery management purposes provide conservation of these habitats and diversity.

Glossary of abbreviations and acronyms

CPUE	Catch per Unit of Effort. Usually expressed in kg per hour fishing.
FAO	Food and Agriculture Organisation
ICES	International Council for the Exploration of the Sea
MPA	Marine Protected Area
MSY	Maximum Sustainable Yield, the maximum amount than can be fished sustainably from a fish stock
TAC	Total Allowable Catch
stock	
WGDEEP	Working Group on the biology and assessment of DEEP-sea fisheries resources. An ICES working group

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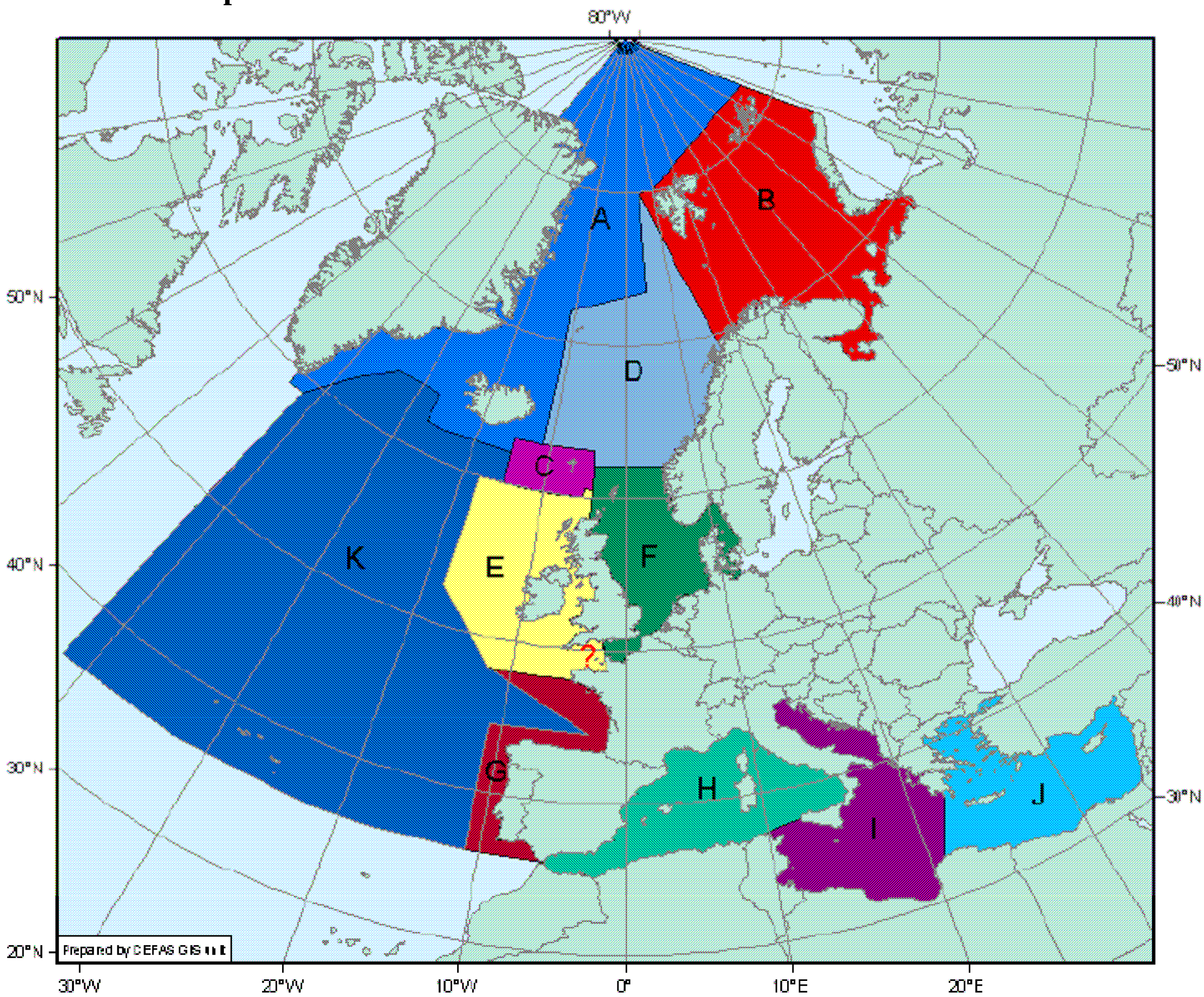
Chapter 1. Principal deep-sea fisheries in the North-East Atlantic

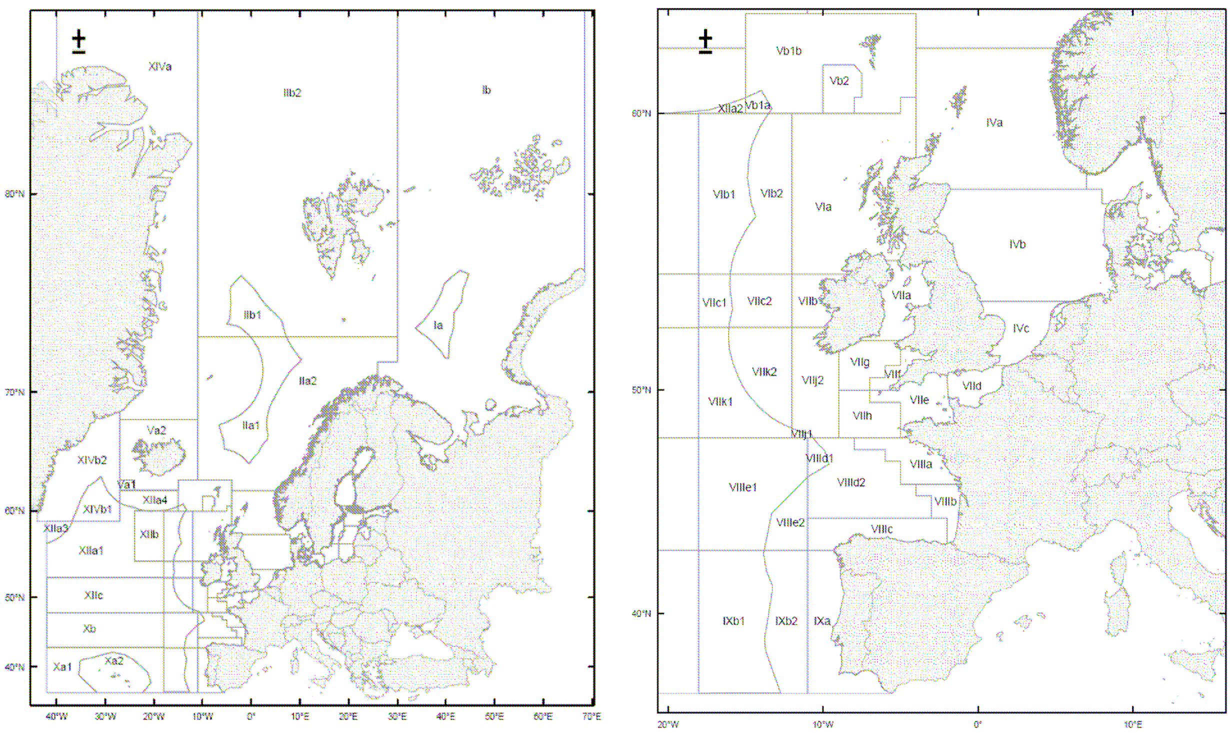
The most of the typical deep-sea fisheries conducted nowadays in the Northeast Atlantic started about 20 years ago. However, a few fisheries have a longer history. In this chapter the main deep-sea fisheries are reviewed in terms of areas, fleets and development over time. Target species are given but will be subject to a more biological analysis in chapter 2. The review is done by eco-regions as proposed by ICES for the implementation of an ecosystem approach to fisheries in European waters (Figure 1.1). ICES areas and divisions are also used to specify stocks distributions (Figure 1.2).

Figure 1.1. Proposed ecoregions for the implementation of the ecosystem approach in European waters.



The ecoregions are Greenland and Iceland Seas (A), Barents Sea (B), Faroes (C), Norwegian Sea (D), Celtic Seas (E), North Sea (F), South European Atlantic Shelf (G), Western Mediterranean Sea (H), Adriatic-Ionian Seas (I), Aegean-Levantine Seas (J) and Oceanic northeast Atlantic (K) (from ICES 2006a).

Figure 1.2. Charts of the ICES sub-areas and division used for fishery catch statistics and stock definition purposes



Source: http://www.ices.dk

Chapter 1.1. Deep-sea fisheries in Greenland and Iceland seas (eco-region A)

This eco-region includes the ICES sub-area XIV, the division Va and the Northern parts of subareas I and II. Directed trawl and longline fisheries for Greenland halibut and redfish occur in the south of the eco-region (ICES XIVb). Redfishes are a complex of three species (*Sebastes* spp.). These fisheries have small by-catches of roundnose grenadier, roughhead grenadier and tusk. There are significant fisheries for redfish in Icelandic waters. In particular for deep-sea redfish (*Sebastes mentella*), this species is caught by both bottom and midwater trawls. Greenland halibut is caught by bottom trawls. In all the eco-region, in 2006 about 100,000 t of redfish and 20,000 t of Greenland halibut were landed. Redfishes and Greenland halibut are not treated as deep-sea spcies by ICES but they could be considered as deep-sea (see chapter 2).

Ling blue, ling and tusk are target species of long standing deep-sea fisheries at Iceland. These fisheries have small by-catches of other deep-sea species. These three species combined have produced landings of 10,000 t to 15,000 t per year over the last 20 years. A directed fishery for Greater silver smelt has started in the late 1990s and produced landings of 3,000-5,000 t in recent years. Catches of other deep-sea species around Iceland are mainly minor by-catches.

The landings of deep-sea species around Iceland are managed under an Individual Transferable Quota (ITQ) system. In recent years, about 120 Icelandic vessels have been engaged in fisheries for ling, blue ling and tusk with annual landings per vessel ranging from 100 to 1,000 t. EU fleets have a marginal contribution to the catch of deep-sea species at Iceland (ICES division Va).

Chapter 1.2. Deep-sea fisheries in the Barents and Norwegian Seas (eco-regions B and D)

These eco-regions cover the southern part of ICES sub-areas I and II. Three species, ling (*Molva molva*), tusk (*Brosme brosme*) and Greater silver smelt (*Argentina silus*) make up almost 99 percent of the landed catches of deep-sea species from this area (ICES 2006c). The fisheries are mainly Norwegian with a minor contribution of EU, Russian and Faeroese fleets. The fishery for ling and tusk is mainly operated by Norwegian longliners and gillnetters. Greater silver smelt is exploited by both bottom and mid-water trawls. By-catch of other species is small. Fisheries for ling and tusk have been long-standing in these areas. Over the last twenty years, the total annual landings of ling have been fairly stable slightly above 5,000 t while those of tusk have decreased from almost 15,000 t to a current levels similar to that of ling. In 1988 there was a significant fishery for blue ling (about 3,000 t) but since then it has been continuously declining to a current level of under 200 t per year. Currently, blue ling is no longer a significant target species in the Barents and Norwegian Seas. The fishing activity of Norwegian longliners for blue ling depends upon the size of the cod stock (their main target species) and the quota allocated to this species. The fishery for greater silver smelt has varied over time between 4,000 and 16,000 t per year, mainly as a response to variations in market demand (ICES 2006c).

In these area there are also fisheries for redfishes and Greenland halibut, in 2006 39,000t of redfish and 18,000 t of Greenland halibut were landed.

Chapter 1.3. Deep-sea fisheries on the Faroes plateau (eco-region C)

In this eco-region, there is a longline fishery for ling and tusk. For Faroese vessels, these species represent only a minor part of their activity. In some years one Faroese longliner has been targeting deep-sea sharks (*Centroscymnus coelolepis* and *Centrophorus squamosus*). The main Faroese deep-sea trawling fleet consists of about 10 large bottom trawlers. They target mainly redfish, Greenland halibut and blue ling as well as black scabbardfish and roundnose grenadier. Since the 1990s, there is a gillnet fishery directed at monkfish and Greenland halibut with a by-catch of deep-sea red crab (*Chaceon affinis*) and blue ling. Lastly there is a trawl fishery for greater silver smelt operated by about three pairs of large trawlers (ICES 2006c).

Chapter 1.4. Deep-sea fisheries of the Celtic Seas (eco-region E)

This eco-region includes the waters around the British Isles (parts of ICES sub-areas VI and VII) and extends west to the Rockall bank and the eastern part of the Hatton bank. It includes part of the European Union Economic Exclusive Zone (EEZ) and international waters further west. In the EU EEZ, in ICES sub-areas VI and VII deep-sea trawl fisheries are conducted mainly by French, Irish and Scottish fleets (ICES 2006c). The French fleet having an EU license for deep-sea fishing consist of 45-50 large trawlers. These vessels are fresh fish trawlers (i.e. they are not freezer trawlers and carry out relatively short fishing trips of up to 12 days). The larger French trawlers (about 50 m or longer) tend to operate in the most Northern areas (northwest of Scotland, Faroes) while vessels of smaller size (25-40 m) operate to the west of Ireland (ICES division VII) and in the southern part of ICES division VI. Most of the fleet fishes both on the continental slope and on the continental shelf; only a handful of trawler land exclusively deep-sea species.

Since 1996, a fleet of Spanish bottom freezer trawlers fish in international waters off the Hatton Bank area (ICES XIIb & VIb1). In 2005, 29 trawlers were involved in this fishery. For most of them, their presence on the fishing grounds has been discontinuous. Vessels conduct fishing trips of variable duration. Fishing operations are conducted in a depth range of 800-1600m.

Up to 2005, a UK registered fleet of gill-netters has operated in areas VI and VII targeting hake, monkfisk and deep-sea sharks. In 2006, the European community introduced a temporary ban on deep-sea gillnetting at depths greater than 200 m (Council Regulation (EC) No 51/2006 of 22 December 2005). This measure was revised in 2007 and some gillnetting was allowed at depths shallower than 600 m (Council Regulation (EC) No 41/2007 of 21 December 2006). The status of this fishery in 2007 is not known.

French vessels operate a mixed deep-sea fishery mainly targeting roundnose grenadier, black scabbardfish and siki sharks on the continental slope and on offshore banks of sub-area VI and VII. The Irish deep-sea fishery targets orange roughy, black scabbardfish, roundnose grenadier and siki sharks. A number of Scottish vessels target monkfish (*Lophius spp)* on the continental slope of sub-area VIa and on the Rockall Bank with a bycatch of deep-sea species such as roundnose greandier, blue ling, black scabbardfish and deep-sea sharks (Gordon 2001), a small number of these vessels occasionally fish in deeper water targeting roundnose grenadier, black scabbardfish and siki sharks. The most important species in the catches of the Spanish freezer trawler are roundnose grenadier and Baird's smoothhead.

In addition to these fisheries for deep-sea species, Spanish trawlers targeting hake in areas VI and VII have a bycatch of deep-sea species including ling, blue ling, greater forkbeard and bluemouth.

The catch level of deep-sea species in this eco-regions has varied over time. Catch trends of ling and blue ling since the 1950s show a succession of national fleets exploiting these species. Since the 1980s, landings have clearly declined for both species. Roundnose grenadier, black scabbardfish, deep-sea sharks and orange roughy have almost not been landed before the late 1980s. Then fisheries have developed during the 1990s and landings have generally increased up to 2003 where TACs were introduced for several species. Since 2005 orange roughy is subject to Protection Areas from which no catch is allowed (Figure 5.2). In 2005, about 20,000 t of blue ling, orange roughy, roundnose grenadier black scabbardfish and deep-sea sharks were caught is the eco-region. There have also been significant landings of greater forkbeard (>2,000 t) as a by-catch of fisheries on both the shelf and the continental slope.

Based on on-board observation carried out in application of regulation (CE) 2347/2002, discards in the French trawl fishery for mixed deep-sea species represent about half the total catch (i.e. as much as the landings). However, this figure does not apply to targeted fishing on blue ling or orange roughy were less unwanted species are caught. The main species in the discards is the Baird's smoothhead a large fish usually not marketed due to its high water content (Okland et al. 2005). There are discards of juvenile commercial species only for the roundnose grenadier. The discards of juvenile roundnose grenadier amount to 20% to 25% of the total catch of this species. Juveniles of the other main commercial species are not caught, so there are no discards of blue ling, black scabbardfish and orange roughy. All the catch of the commercial deep-sea sharks are also landed. However, there are discards of other shark species that are not marketable (non commercial sharks in annex I). In addition to the dominant smoothhead discards also include some rays and chimaeras (not all species are commercial) and a series of small sized deep-sea species.

Chapter 1.5. Deep-sea fisheries in the North Sea (eco-region F)

This eco-region covers the North Sea, the Skagerrak and the Kattegat. Some fisheries in these regions have a by-catch of deep-sea species. This is the case of a small U.K. trawl fishery for Greenland halibut in the northern part of the North Sea west of the Shetland Isles. By-catches of ling and tusk are also taken in the U.K. demersal trawl fisheries. There are Danish, Norwegian and Swedish fisheries for deep-sea shrimp (*Pandalus borealis*) in the Skagerrak (ICES division IIIa) and in the Norwegian Deep (eastern part of the northern North Sea). The gears (trawls) used in these fisheries are small meshed (stretched mesh size 35-45 mm). Some by-catches of demersal and deep-sea fish species are landed. The by-catch of roundnose grenadier in this fishery has occasionally been landed for fish meal. The introduction of sorting grids in recent years has probably reduced the amounts of some of this by-catch (ICES 2006c). Some bottom trawl fisheries in the northeastern North Sea and the Skagerrak which are directed at mixed demersal species have also a by-catch of deep-sea species including ling and tusk.

The main deep-sea fishery is a Danish directed trawl fishery for roundnose grenadier in the deeper parts of the Skagerrak (400-650 m) This directed fishery began in 1987 and total annual landings were less than 2,500 t until 2001, but thereafter the fishery expanded and catches in excess of 10,000 t were landed in 2005. Only a few Danish vessels and in some years only a single vessel conducted this fishery, mainly in just three ICES rectangles (rectangles of 1 degree in longitude and half a degree in latitude defined for fishing catch and effort reporting). Although some marketing of gutted fish for human consumption does occur, the landings are mainly used for industrial purposes (oil and fish meal). This fishery provides also an example of a management loophole. The EU introduced TACs for roundnose grenadier in this area in 2004 and 2005. Since this restriction did not apply in the Norwegian Economic Exclusive Zone, the EU fleet could fish unrestricted by the EU TAC for grenadier in the Norwegian EEZ. The Skagerrak treaty signed by the EU and Norway, allows EU vessels to operate freely in the Norwegian EEZ, and no Norwegian TAC or other regulations applied to grenadier fishing in 2004-05, allowing total EU catches to increase to around 12,000 tonnes. Action was taken to limit the fishery in 2006, and the TAC now applies for the entire area and all fleets.

Chapter 1.6. Deep-sea fisheries of the Bay of Biscay and Western Iberia (eco-region G)

In the Bay of Biscay (ICES sub-area VIII) and western Iberia, there is currently only one significant fishery for deep-sea species. It is an artisanal longline fishery for black scabbardfish, to the south east of Portugal (ICES sub-area IX). Landings have varied between 2,500 t and 4,000 t from 1988 to 2005. Discards are minor in this fishery: a few non-commercial sharks and smoothhead together with some black scabbardfish damaged by marine mammals (ICES 2006c).

In the past, red (blackspot) seabream (*Pagellus bogaraveo*) was an important target and by-catch species of several fleets and fishing gears in the Bay of Biscay. The stock is currently depleted after having collapsed between 1975 and 1985. The same species is still significantly exploited in the Gulf of Cadix.

The Gulf of Cadix fishery for red seabream is carried out by Spanish and Portuguese vessels. One fleet of Spanish vessels using a type of mechanized hook and line baited with sardine known as "*voracera*" is responsible for about 70% of all landings of red seabream in west Iberian waters (ICES division IXa). Almost the entire remainder is caught by Portuguese longliners. Since the 1990s, the Spanish fleet consists of about 100 small vessels (less than 10 m long). Information about the number and size of the Portuguese vessels is not available. Fishing takes place at 400-700 m depth. The total catch of red seabream in the Gulf of Cadix is around

500 t per year. There is no data on the discards of this fishery, however, such an artisanal longline fishery is not expected to generate high discarding rates. If discarded, fish removed from hooks may have a better survival than fish caught in trawls.

In the Bay of Biscay, red seabream was one of the main landed species up to the 1980s. The catch amounted to 15,000 to 20,000 t per year from 1960 to 1975. About 2/3 was caught by Spain and 1/3 by France. From 1975 to 1985, the total landings dropped to low levels (less than 1,000 t) in 1985 and remained low since then (FAO fishstat+ database, IFREMER fishery statistics database, Sanchez 1982, Guéguen 1969, ICES 2007). At the scale of the NE Atlantic, this stock was one of the first to collapse in the period 1970-2002 (Caddy and Surette 2005). At the time of this collapse, there were neither catch nor effort regulations in place for this area. The species is vulnerable to fishing because of its biological parameters. It was also a valuable species, those high price may have triggered over fishing. The current TAC in ICES sub-area VIII is caught as a by-catch of all fishing activities with some targeted fishing from a small scale fishery.

In the whole eco-region, catches of other deep-sea species are mainly by-catch in shelf fisheries. They amount to about 1,000 t per year, the main species being Alfonsinos, argentine, bluemouth, greater forkbeard, ling and wreckfish. For most of these species information on biology and stock status is sparse and will not be reviewed in detail here.

Chapter 1.7 Fisheries in oceanic areas

In addition to the stock components dealt with in previous sections, blue ling have also been exploited in sub-area XII. This sub-area includes the Northern Mid-Atlantic ridge and the Eastern mid-Atlantic ridge; data on catch locations are not available to scientists for years prior to the 2000s. Annual landings for this area in the last 20 years have fluctuated between a few tons and more than 3,000 tons (ICES 2006c). Blue ling has mainly been a by-catch of trawl fisheries for other deep-sea species.

A trawl fishery by former USSR vessels was particularly active on the Mid-Atlantic Ridge from 1973 to 1991 and the total catch peaked at about 30,000 t in 1975 (Troyanovsky and Lisovsky 1995, Merrett and Haedrich 1997). High catches were reported by Poland in 1996-98 and Latvia in 1991-94. At least a part of these catches are from the actual ridge and neighbouring seamounts, but some may have been taken on the western Hatton Bank. Russian vessels continued fishing after 1996, but activity declined in recent years and only a small number of vessels are currently operating. In recent years, less than 1,000 t per year was reported. However, concerns have been expressed by ICES that international catches may be under-reported.

In the Azores, ICES sub-area XII, a handline and longline artisanal fishery lands about 1,000 t of red seabream per year. Handliners are small (<12 m long) open deck boats that operate inshore with several types of lines. Longliner are closed deck boats (> 12m) that fish also offshore on banks and seamounts. This fishery catch several other species but the red seabream is its main target (ICES 2006c).

Chapter 1.8. Fisheries in combined eco-regions

Following ICES (2006c,2007a), some fisheries are dealt with here as combined over several eco-region due to insufficient knowledge of the spatial population structure and weak spatial structuring in fisheries.

Chapter 1.8.1 Ling

The population structure of ling within the NE Atlantic is not known. Based on limited data for differences in CPUE trends (Bergstad and Hareide 1996) and genetic analyses showing some population structure (Møller and Nævdal 1967 in ICES 2007a), the ICES working group for the biology and assessment of deep-sea fisheries resources (WGDEEP) considers four different ling units: Iceland (ICES division Va, in eco-region A), the Norwegian Coast (ICES sub-area II, in eco-region D), the Faroes and Faroe Bank (ICES division Vb, in eco-region C) and all other areas where ling occur. Fisheries for ling are dealt with in the relevant eco-region chapters for Iceland, the Norwegian coast and the Faroes. The fisheries addressed here are those for all other areas. In these areas ling occurs along the continental shelf west and north of the British Isles (ICES Sub-areas VI and VII), in the Skagerrak and the northern North Sea (ICES division IIIa and Sub-area IV) and in the Bay of Biscay (ICES sub-area VIII). Elsewhere the species occurrence is rare, which is probably the case for the West of the Iberian Peninsula (ICES sub-area IX) or the species does not occur (this maybe the case for the oceanic parts of the NE Atlantic like the mid-Atlantic Ridge, ICES sub-areas X and XII).

In the Skagerrak (IIIa), the North Sea (IV), West of the British Isles (VI and VII) and the Bay of Biscay, the main targeted fishery for ling is a Norwegian longlining fishery operating mainly in the Northern North Sea and West of Scotland. This fishery lands one third to one half of the total ling landings. Other catches are mainly by-catch in trawl fisheries from France, Ireland and UK. The total ling catches in these areas have declined from 40,000 t in 1988 to 15,000 t in 2004-05. In the northern North Sea, the Norwegian landings of ling have declined from about 7,000 t to 4,000 t over the last 20 years and the international landings have declined from more than 11,000 t to about 6,000t. To the West of Scotland from 1988 to 2004-05, the international landings have decreased from 16,000 t to 4,000 t and the Norwegian landings have decreased from 4,500t to 2,000 t. The French landings have decreased and the Scottish landings have increased over the last 20 years. The Norwegian fishery for ling has a by-catch of tusk and a smaller one of blue ling (Gordon 2001).

Ling have been a long standing component of fisheries on shelf areas. It might have been a by-catch of trawl fisheries in eco-region A-G during the entire XXth century and it was exploited well before at least in some areas. A recent historical analysis suggests that it was much more abundant than nowadays in the northeastern North Sea and Skagerrak in 1872 (Taudal Poulsen et al., 2007). No similar study is available for other areas and changes estimated for one relatively small area cannot be extrapolated to others. This old times fishery for ling shows that some species treated as deep-sea species might have already been exploited for a long time. In this case, time series covering only the last 20 years, as mainly used by WGDEEP, may not be sufficient to assess the rate of exploitation of the stocks. However, this limitation does not apply to species that were not exploited before the 1980s and where it would be appropriate to use a longer time perspective, the lack of reliable catch data most often prevent to do so. This lack of data is true for ling, as it was in most areas a by-catch that was not always properly recorded in catch statistics. There are cases where landings of ling and blue ling where not reported separately and by-catch may have often been reported to national and international authorities as "miscellaneous fish". However, declining trends in ling landings are observed over the last 20 years and CPUE are stable over recent years but much lower than in the 1970s. It is then likely that the stock(s) is (are) declining or at a low level.

Chapter 1.8.2 Orange roughy

Although anecdotal evidence indicate that there has been exploratory fishing and that orange roughy has attracted considerable interest, fisheries for orange roughy have been very small in the NE Atlantic. The only exception has been to the west of the British Isles (ICES sub-areas VI and VII dealt with in chapter 1.5) and, to a lesser extend, in ICES sub-area XII. As sub-area XII covers part of the Western Hatton bank and the Northern mid-Atlantic ridge, it is unclear to which area the fishery should be attributed. Such small fisheries might have been exploiting small local concentrations on seamounts or other oceanic features. It is well recognized now that orange roughy can only sustain low exploitation levels and that only 1 to 2 percent of the virgin biomass can be sustainably fished every year (Koslow et al. 2000, Clark et al. 2000, Hilborn et al. 2006). However, sustainable exploitation of orange roughy stocks is achievable and may have been almost obtained in New Zealand waters (Hilborn et al. 2006). All available evidence indicate that all populations of orange roughy in the NE Atlantic are small. Small catches that have occurred on the Mid-Atlantic Ridge and possibly on the western Hatton bank may represent significant depletion of small biomass in these areas.

Landings have been reported mainly by the Faroe Islands from sub-area XII. There is no information on the fleet but probably a few or on single trawler have been catching orange roughy on the Western Hatton bank and/or the Mid-Atlantic Ridge. In the 1990s 200 to 800 t were reported per year and less than 200 in 2004 and 2005.

Chapter 1.8.3 Greater silver smelt

The fishery at Iceland (chapter 1.1) is presumed to exploit a stock unit (ICES 2007a). In all other areas, the stock structure of this species is unclear and it is treated as a single stock. After fisheries in eco-regions A, B and D treated in the respective chapters, the main fishery for greater silver smelt is from large Dutch freezer trawlers, using pelagic trawls mainly in ICES sub-areas VI and VII. In some years high landings are also reported from Scotland in the same area. Probably because time series of landings from several countries are irregular, the landings data are not considered very reliable (ICES 2006c). According to available data are 2,000 to 20,000 t are caught per year to the West of the British Isles and around the Faroes. Variations from year to year may be driven by market demand. This fishery, for fish processing mainly from large pelagic trawlers is quite different from other deep-sea fisheries.

Chapter 1.9. Fisheries and geographical distributions of fish stocks

It should be born is mind that the geographical distribution of most deep-sea stocks is still hypothetical. What is best known is the geographical distribution of species. For example, roundnose grenadier occurs on the Mid-Atlantic Ridge, certainly north of 44°N (Troyanovsky and Lisovsky 1995, Hareide and Garnes 2001), around but primarily south of Iceland (Magnússon and Magnússon 1995) and the Faroe Islands, in the Norwegian deep and in the Skagerrak, in deep shelf areas along the west coast of Norway and in some fjords, and on the slope and banks to the west of the British Isles. It occurs in low densities in the Bay of Biscay and to the west of the Iberian Peninsula. It has been reported from west of Morocco to 20°N (Cohen et al. 1990). It is more abundant, what could be qualified as ‘commercially abundant’, in the Skagerrak, to the west of the British Isles and on the Northern Mid-Atlantic Ridge.

What is unclear for most species is the spatial structuring within the species distribution, in other words, do the fish mix over the whole geographical distribution of the species and form one single breeding population or are there distinct populations. Distinct populations may result from the physical environment (natural boundaries to the dispersal of larvae and the migration of adults) or from the behaviour of individuals and populations (e.g. different migration schemes resulting in separated breeding groups). For example, a bathymetric feature such as the Wyville-

Thomson Ridge, between Scotland and the Faroe Islands, is most likely to be an obstacle to the exchange between populations of roundnose grenadier from the Atlantic and those distributed to the north along Norway and in the Skagerrak because it is shallower than the usual bathymetric distribution of the species in this area. Moreover, to the North of the Wyville-Thomson Ridge, in the North Sea, roundnose grenadier does not occur. Therefore there is a clear geographical discontinuity in the distribution of the species. However, the boundary effect of such physical features depends on the species. Based on such considerations, the current perception for roundnose grenadier is the existence of three major adult stock units in the NE Atlantic (Mid-Atlantique Ridge, slope and banks to the west of the British Isles and Skagerrak). The populations and stocks (a fish stock is the exploited fraction of a fish population, usually the fraction of the population above the minimum size that fishing gears can catch) that are taken into account by ICES and presented here are based upon all available evidence and most likely hypotheses.

As the eco-regions were defined as much as possible as ecologically meaningful areas, some eco-region limits match certain population limits. However, some eco-regions limits are not supported by strong features in bathymetric or hydrological terms so that some populations might cross over eco-region limits. For example, blue ling is considered to form one single population (stock) over ICES division Vb and sub-areas VI and VII (i.e. eco-regions C, Faroes and E, Celtic Seas).

Chapter 2. Definition of deep-sea species following ICES and EU Regulations

ICES defines deep-sea fisheries as those operating deeper than 400m and deep-sea species are those normally occurring at such depths. ICES has also defined a list of about 35 fish and crustaceans deep-sea species together with some species which might be considered as deep-sea but are not treated as such within the ICES framework and advice (ICES 2005c).

To my knowledge, the EU regulation does not provide a definition of deep-sea species but two species lists are given as annex I and II of the regulation (EC) N° 2347/2002 of the council. This regulation also requires on-board observations of deep-sea fishing activities and specifies that information on the species listed should be collected by the observers. In annex 1, all species of the EC regulation are listed, together with those considered as deep-sea by ICES. Their commercial status in fisheries (target, by-catch, discard) is given where possible. A target species in one fishery can also be discarded in another.

Species such as roundnose grenadier *Coryphaenoides rupestris*, orange roughy *Hoplostethus atlanticus*, black scabbardfish *Aphanopus carbo* and deep-sea sharks, among which two species the leafscale gulper shark *Centrophorus squamosus* and the Portuguese dogfish *Centroscymnus coelolepis* are commercially known as siki sharks are clearly deep-sea species. They occur normally at depths below 400m in the NE Atlantic they are fished along the continental slope and on other deep bathymetric features such as sea mounts. Unfortunately, nature makes it often hard to classify its objects into categories. Whatever limit is chosen to distinguish between deep and shallow waters, there will always be taken some species whose bathymetric distribution will cross over. Species such as monkfishes (*Lophius* spp.) or conger (*Conger conger*) can be found from the intertidal zone down to the mid-continental slope at 1000 m depth; a Scottish trawler fleet currently targets monkfishes on the continental slope (chapter 1.4). However, the bulk of landings of monkfish and conger from the NE Atlantic come from long-standing shelf fisheries and their stocks are treated as shelf demersal stocks by ICES. Red seabream has the same type of wide bathymetric distribution. In the Bay of Biscay, juveniles are found along the coast during the summer and adults are fished on the shelf at 30 m depth. In winter the fish are distributed much deeper. However, the overexploitation that drove the stock to collapse in the 1970-80s (chapter 1.6) was not due to deep-sea fisheries. For some other stocks of the same species, in the Mediterranean and the Azores, exploitation takes place in quite deep waters so that the species has been treated as a deep-sea fish by scientist working on fish and ecosystems (Menezes et al. 2001, Moura 1995) and the responsibility of the assessment of these stocks has been allocated to WGDEEP. These examples show that scientists and managers, as well as to some extend fishers have classed species as deep-sea in a quite an ad hoc way.

The depth range of species may also vary between regions. For example in the Skagerak where the maximum depth is around 700 m, roundnose grenadier occurs in all areas deeper than 300 m (Bergstad 1990). To the west of the British Isles, it occurs down to 2000 m and its peak abundance is at 1000 m or more.

Nevertheless, the fuzzy set of 'deep-sea' species tend to share a common character as they all have low biological productivity. There is an on-going process from the Food and Agriculture Organisation (FAO) to define guidelines for the management of deep-sea fisheries on the high seas (international waters). In the draft of these guideline, as adopted by the expert consultation on international guidelines on the management of deep-sea fisheries in the high seas (Bangkok, Thailand, 11-14 September 2007), species taken into account are proposed to be those 'with life histories that can sustain only low exploitation rates, (tending to be long lived, slow-growing, late maturing, etc.), are represented in the total catch (everything brought up by the gear) and/or suffer incidental mortality'. We have seen that the exploitation of low productivity species is not fundamentally different from that of more productive species in terms of how stocks could be exploited if they were accurately assessed (chapter 1.4). Unfortunately, assessments are not accurate so that much caution is required for their management. Therefore, the option to manage low productive species with more caution seems quite reasonable. In this way the group of species treated as deep-sea by ICES is quite consistent. In this group the species which bathymetric range is shallowest might be red seabream and ling, both might have rather low productivity. For the red seabream, in addition to a moderate growth, this species is hermaphroditic, these fish are male first, and less half of a year class then turns into females at about 8 years.

Chapter 3. Fisheries impact on deep-sea stocks

Chapter 3.1. Virgin biomass and MSY (maximum sustainable yield)

The biomass of any stock is expected to decrease under exploitation. '[...] it is an unfortunate fact of harvesting natural populations that one cannot produce harvest from pristine ecosystems, the more one attempts to maximize yield, the lower the stock will be. It is not widely understood [...] that depleting a stock to 20-40% of its original state is required to achieve the management objective of MSY' (Hilborn 2006). This statement comes from an analysis of management strategies for orange roughy in New Zealand. The ratio of the virgin biomass that produces MSY is not different in deep-sea stock than in other stocks.

The difference between deep-sea stocks and shallower stocks is that they are most often less productive. Clearly deep-sea fishes grow more slowly than shallow water fishes and produce less offspring per year. A given biomass of deep-sea fish grows less in a year than the same biomass of shallow water fish. As a consequence, to extract MSY from a deep-sea stock, the proportion of the current biomass (20-40% of the virgin biomass) that can be extracted every year is much smaller than for shallow water fish. In the extreme case of orange roughy, which is the most long lived and the most slow growing species exploited in the NE Atlantic, the annual catch cannot exceed 2% of the virgin biomass. Thus deep-sea stocks might be seen as stocks which can be sustainably exploited but can only support low exploitation levels and exploited biomass is necessarily less than virgin biomass.

It is worth noting here that the fisheries advice provided by ICES to its clients currently is not based on the objective of extracting MSY from fish stocks but is provided according to the precautionary approach. In practice the precautionary approach followed by ICES is based on four reference points: B_{lim} (the limit biomass below which fisheries should be reduced to the lowest possible level), F_{lim}, B_{pa} (the precautionary approach reference point) and F_{pa} 'below B_{lim} there is a high risk that the stock could "collapse"[...]. The limit reference point for fishing mortality, F_{lim}, is the fishing mortality that is expected to drive the stock to the biomass limit when it is maintained over time' (ICES 2006a). Spawning stock biomass and fishing mortality can only be estimated with uncertainty. Precautionary reference points B_{pa} and F_{pa} are levels above which there is a low probability that the stock is actually belowr B_{lim} or exploited above F_{lim}, respectively. For deep-sea species, F_{lim} and F_{pa} cannot be used because estimates of fishing mortality F cannot be obtained. Biomass estimates are rarely available either, therefore advice is given in terms of U_{pa}=0.50*U_{max} and U_{lim}=0.20*U_{max} where U_{max} is an index of the unexploited or highest biomass in the available time series.

Lastly, if stock biomass is close to or below B_{lim} (or U_{lim}) and/or fishing mortality is above F_{lim}, following a MSY exploitation strategy would require a reduction of the fishery as the precautionary approach does.

Chapter 3.2. Information provided by scientific surveys

To the west of the British Isles, available survey data indicate without doubt that the biomass of deep-sea fish species has been reduced since the start of their exploitation. Over a relatively small area to the west of Scotland (the Hebridean continental slope at latitudes from 54° 30' to 58° 45' North and up to 12°West in longitude), where research vessels survey data is available for the years 1973 to 1999, interannual variations in biomass were estimated for all commercial species combined and for all non commercial species (either not caught by commercial fishing gears or discarded at sea). The same analysis was done for roundnose grenadier separately, as it was the most abundant commercial species in the survey data; it was the only species for which the separate analysis was possible. The estimated total biomass of all commercial species in 1999 was about 20 % of the biomass before exploitation. For non commercial species the biomass in 1999 was estimated slightly above 40 % of the biomass before exploitation. For roundnose grenadier it was estimated at around 15 to 20 % of the biomass before exploitation (Basson et al. 2000). All these estimates were rather imprecise because the data were quite heterogeneous and unbalanced over depths and years. However, they clearly showed that deep-sea fisheries can significantly reduce deep-sea fish biomass in a few years. These results should not be extrapolated outside the study area, because commercial trawling for deep-sea species was very active in the 1990s on the Hebridean continental slope so that the results may not represent population depletion because the study area was smaller than the distribution area of exploited deep-sea fish populations.

The deep-sea fishery to the west of the British Isles has now spread over larger areas. Due to regulations, catch levels are lower than in the late 1990s as exploitation levels in this period were not sustainable.

There are no other areas in the NE Atlantic where survey data have been used to estimate deep-sea biomass depletion due to fishing, but clear depletion have also been observed based on survey data in Canadian waters (Devine et al. 2006).

Chapter 3.3. ICES assessments of the main stoscks

The stock assessments provided by ICES represent the best estimates of the status of stocks exploited by fisheries. WGDEEP analyses stock status every second year, the last time in 2006 (ICES 2006c) and the ICES advice is based on this work (ICES 2006b). Unfortunately, for most stocks, the advice has been based upon limited data. Only for one stock, blue ling from the Faroes shelf and Celtic Seas, WGDEEP could apply a mathematical assessment model (such model is designed to estimate fishing mortality and stock biomass) in 2006, but for a series of technical reasons the result should be treated with considerable caution (ICES 2006c). For a few other stocks, roundnose grenadier from the Faroes shelf and Celtic Seas, red seabream in the Gulf of Cadix and in the Azores, exploratory age-based assessments (model of the fish population demography) were carried out but the results were highly uncertain or considered unreliable. For orange roughy in the southern Celtic Seas (ICES division VII), an acoustic survey provided biomass estimates that were also very uncertain. Stock status (and ICES advice) for other stocks relied upon trends in landings and Catch Per Unit Effort (CPUE) and abundance indices from scientific surveys.

Chapter 3.3.1 Ling, Tusk and Blue ling

Depending on the area, stocks of ling and tusk are either stable at a low level compared to historical levels or declining. In some areas, catches were reduced in previous years and the current catch levels (regulated by TAC or effort management) are believed to allow stock rebuilding.

For blue ling, in all areas there is evidence of strong reduction of stock biomass as current CPUEs and catches are much lower than historical levels. For this species, most of the historical catches were fished on spawning aggregations. Fishing on spawning aggregation is not per se inappropriate as it allows limiting the exploitation to adult fish (immature juveniles are usually not on spawning grounds). However, as the fish are aggregated there is a strong risk of depletion of the biomass to levels well below those producing the Maximum Sustainable Yield (MSY) and safe biological limits (Bpa, see section 3.1).

For the Faroes shelf and Celtic Seas stock of blue ling, since 1984, trends in CPUE have been seriously decreasing, reflecting a strong reduction of the spawning biomass (Lorance et Dupouy 2001). Assessments carried out since 2000 were never sufficiently reliable to provide an update. However, strong temporal trends in CPUEs consistently indicated that in recent years the stock has been below 20% of the virgin stock, corresponding to the limit biomass under which fisheries should be reduced to a minimum to allow stock rebuilding. The Icelandic stock of blue ling seems to have been reduced to comparable levels. The further evolution of the stock may be difficult to observed as for both these stocks, the fisheries have changed from mainly directed catches of spawning aggregations to by-catch in fisheries for mixed deep-sea species.

Chapter 3.3.2. Roundnose grenadier

The catches of roundnose grenadier since the 1980s are believed to have significantly reduced their biomass in all areas. Several assessment methods have been tried on the stock to the west of the British Isles and all have shown a declining trend in stock biomass. Clearly the assessments carried out were not fully robust and were only indicative. Further work is required to ensure that abundance indices based on CPUE indices from commercial vessels are adjusted to take full account of changes in the spatial, seasonal and depth distributions of fishing. Currently the fishery is not spatially stabilized, for example some statistical rectangles were not fished by French trawlers before the 2000s making the observed CPUE trends a combination of variations of abundance and changing fishing grounds (ICES 2006c). However, taking an overview across the entire range of studies carried out suggests that current biomass is less then 50% of virgin biomass and probably as little as 20%.

In the Skagerrak, the catches taken in the period 2004-05 were not sustainable and led to the depletion of the accumulated biomass, because the size of the virgin stock required to sustain such catches would be more than 200,000 t, which cannot occur in such a small area. However, catching more than the sustainable yield for a few years is not per se a problem, but in the absence of quantitative assessments it is not known to which extend the stock has actually been depleted. The sustainable level of the catch is unknown as well but might not be more than a few thousand tons. In accordance with a precautionary approach, the TACs for 2007 and 2008 were set respectively at 1,060 t and 1,000 t.

Chapter 3.3.3. Black scabbard fish

Based on trends in landings and CPUE the situation of black scabbardfish seems less critical. CPUEs decreased in the fishery west off the British Isles and have been stable in the fishery to the west of Portugal.

Chapter 3.3.4. Orange roughy

There are two areas for which it is very clear that the biomass of orange roughy were quickly depleted by fishing. These are located to the west of Scotland, where after the start of the fishery the biomass was fished down in about two years (Lorance and Dupouy 2001, Basson et al 2002, ICES 2006c) and to the west of Ireland, where French and Irish fisheries produced landings varying from 1,000 t to 5,000 t per year from 1991 to 2002. The catch then reduced with the introduction of a TAC (193 t in 2007, 130 t in 2008). A biomass estimate of 19,000 t was derived from an acoustic survey carried out in 2005 (ICES 2006c). Although estimates were uncertain, this survey confirmed the perception that orange roughy populations in the NE Atlantic are small and sustainable catches can only be very small. The current TAC level can be considered reasonable and in the range of sustainable catches.

Chapter 4. Deep-sea habitats and fisheries impacts

Towed deep-sea fishing gears are heavy and designed to roll over rough bottom. Trawl doors may weigh 1 t or more and ground ropes include steel bobbins of 60 cm in diameter. Effects of trawling includes long lasting trawling scrapes and ploughs (Figure 4.1), rolling of large boulders, resuspension of sediments and damage of epibenthic species (Davies et al. 2007). So far this has not been considered to be of importance for sedimentary bottoms but it is a major subject of concern for coral communities.

Figure 4.1. Trawl marks on a sedimentary seabed of the continental slope of the Bay of Biscay at 1300 m

Source: ©Ifremer, VITAL cruise, 2002.

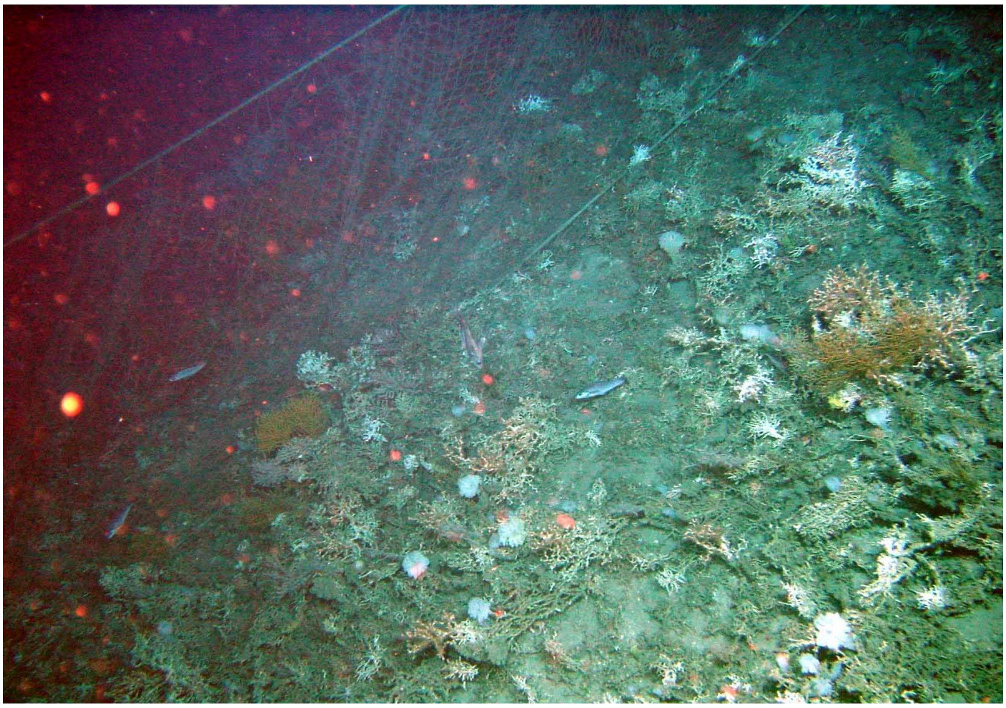
Deep-sea habitats are diverse comprising e.g. sedimentary flats, canyons, rocky bottom and cliff. The deep-sea benthic fauna is diverse, on flat sedimentary bottom it consist mainly of scattered fixed and mobile individual but is some location colonial animals cover 100% of the substratum and form reefs that can generate biogenic mounds several tens of meters high.

About seven species of scleractinian corals (hard coral) occur in the NE Atlantic and two are reef forming: *Lophelia pertusa*, the most abundant, and *Madrepora oculata*. Corals such as Lophelia are preferably termed cold water corals rather than deep-sea corals, because they occur over a large range of depths at a global scale. In colder areas, they tend to occur in shallower waters and high water temperature may be the factor controlling their upper depth limit (Mortensen and Buhl Mortensen 2004). For example, on the mid Norwegian continental shelf they are particularly abundant at depths of 200-400 meters (Fossa 2002). In addition to scleractinian corals, gorgonians and sponge form dense communities in some areas.

Occurrence of cold water corals have been known for a long time in the NE Atlantic, and were considered as damaging to fishing trawlers (Joubin 1922). The development of deep-sea fishing in the 1990s generated concern about its ecosystemic effects and renewed interest for cold water corals. Reviews of the distribution of cold water corals showed that they occur at discrete locations throughout the European continental slope (Friewald 1998, Rogers 1999, Mortensen et al. 2001). Along the Norwegian coast, fishing was shown to have seriously impacted corals, with 30 to 50% being impacted or damaged (Fossa et al. 2002). In Icelandic waters, it is likely that many coral-areas have been destroyed by fishing (Steingrimsson et al. 2006). Although there exists no other large scale survey of the proportion of impacted cold water corals in the NE Atlantic, there is no doubt that fishing gears impact these corals and that in the past some fishing has occurred on corals. However, the impact in terms of the proportion of impacted reefs or ecosystemic effects at the scale of the NE Atlantic or European EEZ is currently unknown.

Similar impacts of fishing on cold water corals have been noted worldwide. Off Tasmania, where a large fishery for orange roughy developed in the 1990s, photographic transects indicated that 95% of the bottom was bare rock on a heavily fished seamount compared with about 10% on the most comparable unfished seamount (Koslow et al 2000). Orange roughy fisheries generated similar concerns in New Zeland and elsewhere (Clark 1999, Branch 2001).
Not only towed gears, but passive gears such as longlines (which can be up to 70 km long) and nets are suspected to get entangled in corals and other vulnerable biogenic structures and generate damages. Lost fishing nets have been observed entangled in coral reefs to the west of Ireland (Olu-Le Roy 2004, Figure 4.2) the ghost fishing (the fishing gear is lost but continues to catch fish, those are eaten by scavengers then cleaning the net) effect of such nets may be high (Davies et al. 2007). Concerning longlines, while effects of a single one is minor compared to a trawl haul, the longterm impact of passive gears can be significant. Lastly, at least in some areas, fisheries impacts on cold water corals have started a long time ago for the shallowest coral habitats (Joubin 1922).

Figure 4.2. Lost gillnet of a coral mound to the South West of Ireland



Source: © ifremer, Caracole Cruise, 2001.

Chapter 5. Biodiversity conservation

In addition to fisheries, other human activities impacting deep-sea biodiversity and habitats include oil and gas extraction and the increase of the PH of the global ocean due to rising carbon dioxide levels in the atmosphere as well as, potentially, the proposal to use the deep-sea as an environment where carbon dioxide could be stored and to carry out deep-sea mining for mineral resources (Davies et al. 2007).

Biodiversity is the natural variation in the genetics and life forms of populations, species, communities and ecosystems (MARBEF, MARine Biodiversity and Ecosystem Functioning, network of Excellence, http://www.marbef.org, Hiddink et al. accepted). There are few, if any, ecosystems worldwide for which knowledge on biodiversity according to this definition would be available. What is often known with some accuracy is species richness and the diversity of some taxonomic groups (e.g. fish), genetic variation in a few species or the distribution of habitats and communities within an ecosystem. Global deep-sea diversity is unknown but expected to be high. At regional and local scales, deep-sea fish are diverse in terms of morphology, feeding strategy and behaviour (Lorance and Trenkel 2006, Mauchline and Gordon 1985, Merrett and Haedrich 1997). Deep-sea benthic communities are also diverse. Cold water corals, gorgonians and sponges generate 3-dimensional structures on the seabed and are therefore considered to create diversity hotspots. Their biodiversity is not quantified but 'they form physical structures, even reefs that rival in size and complexity those in warmer, shallower waters' (foreword of Friewald et al. 2004). Case studies indicate that they are associated with a high diversity of other species, e.g. macrobenthos (Henry and Roberts, 2007) and sponges (Van Soest et al. 2007) to the west of Ireland. Fish species composition and density also differs inside and outside cold water coral reefs (Roos and Quattrini 2007, Costello et al. 2005). Corals may have some particular role for some fish species, e.g. protection either for gravid female redfish or their offsprings (Husebo 2002).

Due to the long life span of many deep-sea organisms, damage to deep-sea communities and ecosystems are expected to be persistent and recovery to be slow. Therefore, the intensity and frequency of human disturbance that can be sustained by these systems is low.

Actions have already been taken in the NE Atlantic to reduce the impact of fishing on the deep-sea. After temporary measures, bottom trawls were definitively banned on the Darwin mounds (Figure 5.1) by regulation (EC) N° 602/2004 of the council of 22 march 2004. Two protected areas where bottom trawls and net fishing gears are banned below 200 m are defined in regulation (EC) N° 1568/2005 of the council of 20 September 2005 (Figure 5.1). Since 2004, the deep-sea fish TAC regulation (EC N° 2270/2004 and EC N° 2015/2006) includes large areas to the west of Ireland and Scotland where orange roughy fishing is prohibited (Figure 5.1). In addition to being a fishery management tool, these closures provide protection of deep-sea habitats and communities. Orange roughy has been the main target species in the two most southern boxes and the closure might reduce the deep-sea fishing effort in these areas to low levels, because other deep-sea species have not been caught there is large quantities. In the international waters of the NE Atlantic, five seamounts on the Mid-Atlantic Ridge are currently closed to bottom fishing to protect vulnerable deep-sea habitats as well as four areas on the Hatton and Rockall banks. The use of deep-sea bottom fixed nets is also banned in some areas and at some depths (chapter 1.4). The question of how much of the deep-sea seabed requires protection remains unanswered by science. However, a network of MPA should be designed by 2012 according to international commitments following s the World Submit for Sustainable Development (WSSD 2002). The existing Marine Protected Areas designed to protect deep-sea habitat and area closures designed for fisheries management in the deep NE Atlantic are a step towards this goal.

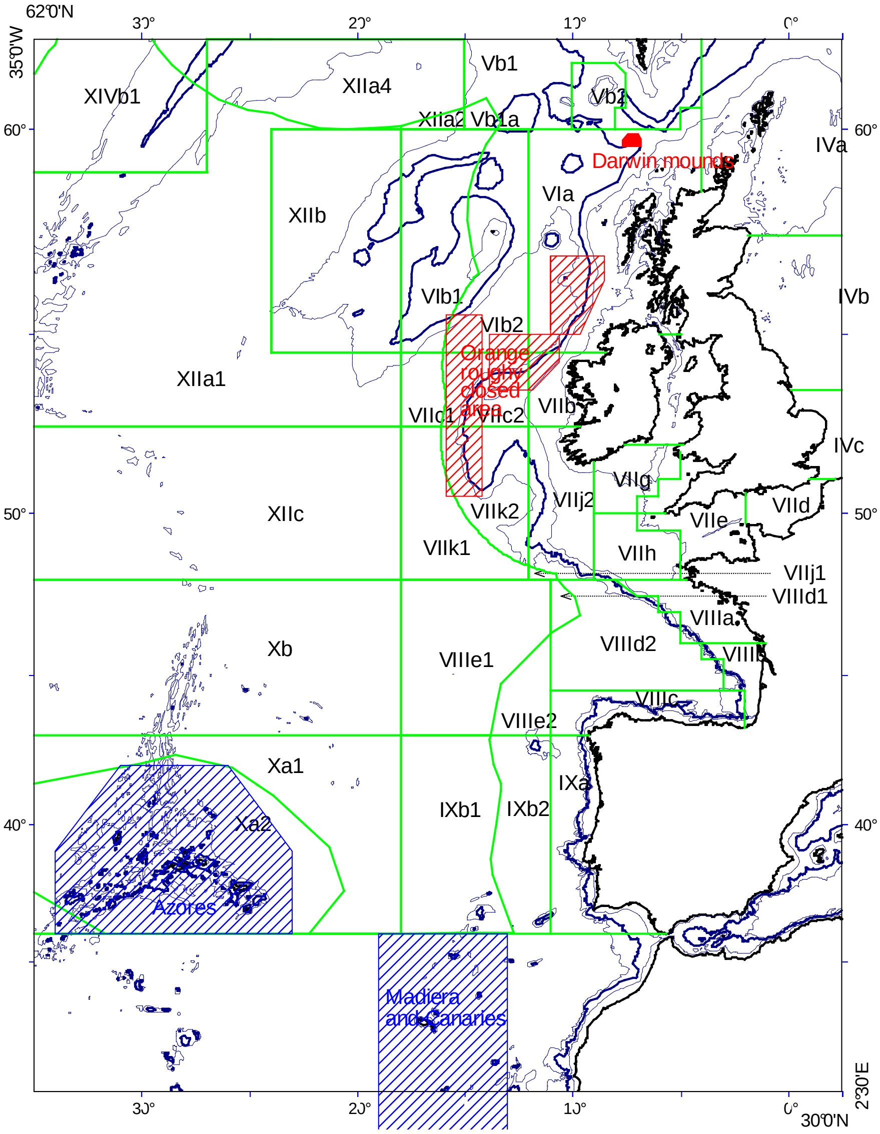


Figure 5.1. Deep-sea Marine Protected Areas (MPAs) in the NE Atlantic: permanent ban of fishing gears in contact with the bottom and other human activities at the seafloor (Azores, Madeira, Canaries: blue), ban of any fishing activity (Darwin mounds: red), Area of ban of orange roughy fishing (west of Ireland, red).

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ANNEXES

Annex 1. Species considered as deep-sea by ICES and/or the EU regulation. - I- Bony fishes

Scientific name	French name	English name	EC reg
Aphanopus carbo	Sabre noir	Black scabbardfish	Annex I
Coryphaenoides rupestris	Grenadier de roche	Roundnose grenadier	Annex I
Argentina silus	Grande argentine	Greater silver smelt	Annex I
Beryx splendens	Béryx long	Alfonsino, golden eye perch	Annex I (
Beryx decadactylus	Béryx commun	Alfonsino, red bream	Annex I (
Hoplostethus atlanticus	Hoplostète orange, empereur	Orange roughy	Annex I
Molva dypterygia	Lingue bleue	Blue ling	Annex I
Molva molva	Lingue	Ling	
Brosme brosme	Brosme	Tusk	
Phycis blennoides	Mostelle de fond	Forkbeards	Annex I
Pagellus bogaraveo	Dorade rose	Red (blackspot) seabream	Annex II
Marcrourus berglax	Grenadier à tête rude, grenadier gris	Roughhead grenadier (Rough rattail)	Annex II
Mora moro	Moro commun	Common mora	Annex II
Antimora rostrata	Antimora bleu	Blue antimora (Blue hake)	Annex II
Epigonus telescopus	Apogon noir, cardinal	Black (Deep-water) cardinal fish	Annex II
Helicolenus dactylopterus	Sébaste chèvre	Bluemouth (Blue mouth redfish)	Annex II
Lepidopus caudatus	Sabre argenté, Coutelas	Silver scabbard fish, Cutlass	Annex II
Alepocephalus bairdii	Alépocéphale, cassigné gulliver	Baird's smoothhead	Annex II
Lycodes esmarkii	Blennie vivipare	Eelpout	Annex II
Raja hyperborea	Raie arctique	Arctic skate	Annex II
Sebastes viviparus	Rascasse du Nord	Small redfish (Norway haddock)	Annex II
Hoplostethus mediterraneus	Hoplostète de Méditerranée	Silver roughy (Pink)	Annex II
Trachyscorpia cristulata	Rascasse de profondeur	Spiny (Deep-sea) scorpionfish	Annex II
Alepocephalus rostratus	Alépocéphale de Risso, cassigné commun	Risso's smoothhead	Annex II
Polyprion americanus	Cernier atlantique	Wreckfish	Annex II
Trachyrincus scabrus	Grenadier-scie commun	Roughsnout grenadier	
Micromesistius poutassou	merlan bleu	Blue whiting	
Reinhardtius hippoglossoides	Flétan noir	Greenland halibut	
Sebastes spp.	Sébastes	Redfishes	
Conger conger	Congre	Conger eel	Annex II
Merluccius merluccius	Merlu	Hake	
Lophius spp.	Lottes, baudroies	Monkfishes, Anglerfishes	
Lepidorhombus spp.	Cardines	Megrims	

(1)as Beryx spp.
(2) as Trachyrhynchus trachyrhynchus
(3) species that should be considered as deep-sea, but are dealt upon by specific working groups in the ICES framework
(4) 'extended distribution' species mainly fished on the continental shelf which distribution extends to deepwaters

Annex 1 (continued). Species considered as deep-sea by ICES and/or the EU regulation. -II- Sharks, rays and chimaeras

Scientific name	French name	English name	EC regulation	ICES
Centrophorus squamosus	Squale chagrin de l'Atlantique, siki	Leafscale gulper shark	Annex I	deep-s
Centroscymnus coelolepis	Requin portugais, siki	Portuguese dogfish	Annex I	deep-s
Centrophorus granulosus	Squale chagrin commun	Gulper shark	Annex I	deep-s
Centroscyllium fabricii	Aiguillat noir	Black dogfish	Annex I	deep-s
Centroscymnus crepidater	Pailona à long nez	Longnose velvet dogfish	Annex I	deep-s
Dalatias licha	Squale liche	Kitefin shark	Annex I	deep-s
Deania calceus	Squale savate	Birdbeak dogfish	Annex I	deep-s
Galeus melastomus	Chien espagnol	Blackmouth dogfish	Annex I	
Galeus murinus	Chien islandais	Mouse catshark	Annex I	
Scymnodon ringens	Requin grogneur commun	Knifetooth dogfish	Annex I	deep-s
Hexanchus griseus	Requin griset	Six-gilled shark	Annex I	
Chlamydoselachus anguineus	Requin lézard	Frilled shark	Annex I	
Oxynotus paradoxus	Humantin	Sailfin roughshark (Sharpback shark)	Annex I	
Somniosus microcephalus	Requin du Groenland	Greenland shark	Annex I	
Apristurus spp.	Holbiches	Iceland catshark	Annex I	
Etmopterus princeps	Sagre rude	Greater lanternshark	Annex I	deep-s
Etmopterus spinax	Sagre commun	Velvet belly	Annex I	deep-s

Raja nidarosiensis	Pocheteau de Norvège	Norwegian skate	Annex II	
Raja fyllae	Raie ronde	Round skate	Annex II	
Hydrolagus mirabilis	Chimère à gros yeux	Large-eyed rabbit fish (Ratfish)	Annex II	
Rhinochimaera atlantica	Rhinochimère à nez droit	Straightnose rabbitfish	Annex II	
Chimaera monstrosa	Chimère commune	Rabbit fish (Rattail)	Annex II	deep-s

Annex 1 (continued). Species considered as deep-sea by ICES and/or the EU regulation. -III- Crustaceans

Scientific name	French name	English name	EC regulation	ICES
Aristeomorpha foliacea		Giant red shrimp		deep-sea
Chaecon (Geryon) *affinis*	Crabe rouge	Deep-water red crab	Annex II	deep-sea