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Report of the Working Group on the Biology and Assessment of Deep Sea Fisheries Resources (WGDEEP)

9–16 March 2009

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Contents

1 Executive summary

The Working Group on the Biology and Assessment of Deep Sea Fisheries Resources (WGDEEP) met in Copenhagen from 9 to 16 March 2009. In order to facilitate cooperative working, the meeting was run concurrently with the Working Group on Deep Water Ecosystems (WGDEC). A number of Terms of Reference were addressed jointly between these two groups.

ICES provides advice on deep-sea stocks biennially and no new advice was required in 2009. The Working Group in 2009 updated information on fisheries and stocks in the ICES Area but, for the majority of stocks, did not carry out any new assessments.

Exploratory assessments were carried out for roundnose grenadier in Subareas VI and VII and Division Vb using separable VPA, greater silver smelt in Division Vb using XSA and Tusk in Division Va using Gadget. The outputs of these assessments have not been used as a basis for new advice in 2009. The Working Group considered possibilities for further developing and standardising methodologies through a benchmark workshop. A recommendation was made to hold such a workshop in 2009.

WGDEEP, in conjunction with WGDEC reviewed and considered recent research into unaccounted mortality in commercial fisheries. Four sources of UFM were identified as having particular relevance to the management of the stocks for which WGDEEP provides advice: Illegal, Unreported and Unregulated (IUU) fishing; discards; escape mortality and ghost fishing. The Working Group reviewed available information and summarised ongoing work to quantify UFM in deep-water fisheries in the ICES area.

Also in conjunction with WGDEC, WGDEEP considered the impact of deep-water fisheries in areas for which information has not been analysed to date by using VMS and historical data. Three data sources were used: historical landings by statistical rectangle for a number of countries (Spain, France, Ireland, and UK Scotland, and UK England and Wales) from 2001 to 2008; VMS data from international fisheries in the NEAFC regulatory area and VMS from all vessels in Scottish waters. Maps were produced showing distribution of historic landings and VMS positions associated with landings of deep-water species.

WGDEEP, in conjunction with WGDEC, reviewed the biological parameters collected on the Northeast Atlantic Continental Slope survey coordinated under PGNEACS. It is considered that the spatial distribution of the main stocks for which the survey aims to provide abundance indicators should be reviewed and the design of the survey adjusted to ensure adequate stock coverage. Considering that the highest level of concentration for some of the main stock assessment units considered by PGNEACS is Vb, VI, VII and XIIb, a geographically wider survey may be appropriate. The inclusion of the Nordic Surveys into PGNEACS would be beneficial, as a joint approach would provide survey coverage of widely dispersed stocks such as ling and greater silver smelt. Additionally, an international coordination of the existing Nordic surveys (from Norway, Faroe Islands, Iceland and Greenland) would be highly beneficial for assessment in the Nordic areas.

WGDEEP, in conjunction with WGDEC, considered two requests from NEAFC;

1) to evaluate the use and quality of VMS data and records of catch and effort to be received from NEAFC in order to provide information on the spatial and temporal extent of current deep-water fisheries in the NE Atlantic

ICES provided a response to this request in 2008 based on preliminary analysis by WGDEEP and WGDEC of the NEAFC catch and VMS data for the years 2002 to 2005. No new data have been received since 2008 and this response is based on further analysis of the same dataset. Continued analysis during the 2009 meeting of WGDEEP revealed further concerns concerning the quality of these data. The Working Group made suggestions on how the data could be improved.

2) Develop suitable criteria for differentiating fisheries into possible management types (e.g. directed deep-water fisheries, bycatch fisheries, etc.) and to apply these criteria to categorize individual fisheries in order to allow NEAFC to develop fishery-based management initiatives.

The Working Group considered that the quality of the data is not yet sufficient to provide information on the spatial and temporal extent of current deep-water fisheries in the NE Atlantic and made a number of suggestions as to how the data could be improved. It was concluded that no further progress can be made towards differentiating fisheries through cluster analysis until these apparent problems with the data can be explained and accounted for.

2 Introduction

2.1 Participants

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2.2 Background

The first ICES Study Group on the Biology and Assessment of Deep-Sea Fisheries Resources was held in 1994 (ICES C.M. 1995/Assess:4). It provided the background information on what was known about deep-water fisheries within the ICES area and compiled landings data from both official statistics, where available, and from individual members of the Study Group. The report also summarized the current status of knowledge of the biology of these deep-water species. At this time ling, blue ling and tusk were the responsibility of the Northern Shelf Working Group.

The Study Group met by correspondence in 1995 (ICES C.M.1995/Assess:21) but had little to report. The next meeting of the Study Group was in February 1996 (ICES C.M.1996/Assess:8). Its terms of reference were to: (a) compile and analyse available data on a number of deep-water species (namely argentines, orange roughy, roundnose grenadier, black scabbard fish, golden eye perch (*Beryx splendens*) and red (blackspot) sea bream (*Pagellus bogaraveo*)) in the ICES area and, if possible, provide assessments of the state of the stocks and the level of exploitation, and (b) provide information on the stocks and state of exploitation of the stocks of blue ling, ling, and tusk in Sub-areas IIa, IVa, V, VI, VII and XIV and identify outstanding data requirements. The Study Group met by correspondence in 1997 (ICES C.M.1997/Assess:17) and, in addition to updating descriptions of fisheries, the available information on length/age at maturity, growth and fecundity of deep-water species, including blue ling, ling and tusk, was presented in tabular form. The available information on discards was also compiled.

The terms of reference for the 1998 meeting of the Study Group included the additional request to consider the possibility of carrying out assessments of fisheries for deep-sea resources and developing advice consistent with the precautionary approach. The layout of the report (ICES CM 1998/ACFM:12) was modified to conform to the format of an assessment working group report and the existing data were reformatted to allow for year on year updating. The possibilities for carrying out age-structured assessments were very limited, but several provisional assessments were carried out using DeLury constant recruitment and Schaefer production models. The catch and effort assessment methods used by the Group suggested that time-series of effort and cpue may be particularly valuable for the assessment of deep-water species. The Study Group therefore recommended that member states maintain and refine long-term dataseries and where possible collate historical data. The Study Group recommended that the members be encouraged to provide discard and fish community data.

The Study Group worked by correspondence in 1999 and updated landings statistics and data on biological characteristics. The next (and final) meeting as a study group was held in 2000 (ICES CM 2000/ACFM:8), and in addition to carrying out the tasks requested in the previous years, more attempts were made to carry out assessments using catch and effort methods. This was successful for some of the species in some areas, and the results were used for evaluations consistent with the precautionary response. The report was structured so that species-specific sections were provided for those species for which sufficient information was available to provide evaluations of stock status was possible, at least in some areas. As in previous years, it was recognized that the input data remain generally unsatisfactory and that the assessment results should be interpreted with caution. However, it was also concluded that available information demonstrated that many stocks were very probably being exploited at too high levels and some were depleted. An evaluation of the state of the deep-sea stocks was provided by ACFM later that year (ICES 2000, ICES Coop. Res. Rep. 242 (2)).

In 2001 the Study Group was re-established as the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (WGDEEP), and again worked by correspondence to update landings, fishery descriptions, discard and biological data, but assessments were not updated. The Working Group was requested to provide a document on the applicability of fishery-independent surveys for assessment purposes. This document was an integral part of the report (ICES CM 2001/ACFM:23). The report should also address issues raised in special requests to ICES from NEAFC, the Government of Norway, and the EU. These requests were considered by ACFM in the May and October sessions (ICES 2001, ICES Coop. Res.rep. 246(3), p. 625–641).

The Terms of Reference for the 2002 meeting of WGDEEP included the evaluation of stock status, and it was therefore a central aim to carry out or update assessments for as many stocks as possible. Data constraints limited the assessment efforts at the meeting held in Horta in the Azores, but the general status descriptions were updated based on whatever data were provided (ICES CM 2002/ACFM:16).

In 2003 the Group worked by correspondence and updated landings and other datasets, and furthermore considered special requests from NEAFC regarding baseline levels of effort underlying advice in 2002, new reporting areas, and geographical distribution of aggregation areas for selected species. Prior to the 2004 meeting a stronger effort was made to stimulate intersessional efforts on data collection and compilation, and the running of preliminary assessments.

In 2004, WGDEEP updated fishery descriptions, biological parameters and time-series of abundance indices. Assessments were attempted for some stocks and preliminary results were demonstrated (ICES CM 2004/ACFM:15, Ref :G).

In 2005, WGDEEP was initially due to meet by correspondence with the main aim of updating landings statistics and the scientific basis underlying the population dynamics of deep-water species. However, because of requests from the NEAFC and the EC, a plenary meeting was organized in the end of the year. No assessments were carried out (ICES CM 2005/ACFM:07, Ref:D,G).

In 2006, WGDEEP has provided assessments and management recommendations for deep-sea stocks and fisheries, and it has also addressed specific issues related to area closures, mixed fisheries and the identification of survey needs (ICES CM 2006/ACFM:28). The methods applied were very much dependent on data availability. These included XSA (red sea bream in X), separable VPA (red sea bream in IX, roundnose grenadier in Vb, VI and VII), CSA (blue ling in Vb, VI and VII), and also plain examination of trends in survey abundance indices, cpue, length and depth distributions. The format of the report was modified, so assessments and recommendations were as much as possible structured by ecoregion and stock, and not by species. RGDEEP, the group which reviewed the WGDEEP report, generally supported this approach, but it also noted the lack of scientific evidence underlying the identification of deep-sea stocks.

In 2007, in addition to updating fishery information, WGDEEP had a TOR to hold a three day workshop on stock discrimination. The group evaluated techniques that could be use for stock discrimination in deep-water species and examined the available information to identify stock units in the ICES area. Information for most species was not sufficient to discriminate stocks and the WG recommended that there was no reason to change from the current practice in ICES. However, for tusk there was genetic evidence available that allowed five separate stock units to be identified. WGDEEP recommended that these be adopted for future assessments.

The group also addressed a request from NEAFC to consider coordination of deep-water surveys. Surveys be coordinated in three group; arctic fishery, the North East Atlantic Continental Slope and the Mid-Atlantic Ridge and offshore seamounts.

In 2008, WGDEEP provided assessments and management advice for deep-sea stocks and fisheries and addressed NEAFC requests relating to blue ling spawning aggregations, analysis of VMS data and discrimination of fisheries into management types (ICES CM 2008/ACOM:14). The methods applied included XSA (red sea bream in X), and separable VPA (red sea bream in IX, roundnose grenadier in Vb, VI and VII), however, deterioration in the quality of time-series used in earlier assessments meant that some assessments could not be updated. ICES advice on deep-water stocks in 2008 relied heavily on commercial and survey abundance indices, landings trends and biological characteristic of the stocks.

2.3 Terms of reference and special requests

The terms of reference of the Working Group were as follows:

a) address generic ToRs for Fish Stock Assessment Working Groups;

b) further develop assessment methodologies for deep-water species through exploratory assessments;

c) review and consider recent research into unaccounted mortality in commercial fisheries (in conjunction with WGDEC);

d) Review ongoing work for reducing unintended effects on the seabed and associated communities of fishing operations and gears, including ghost fishing (in conjunction with WGDEC);

e) Consider request from OSPAR on the status of biodiversity of deep-water ecosystems and how it could be measured, for example by using diversity indices (in conjunction with WGDEC);

f) Consider the impact of deep-water fisheries in areas for which information has not been analysed to date, for example the orange roughy fishery on the shelf slope of the Porcupine bank and the roundnose grenadier fishery to the north of Hatton bank by using VMS and historical data. (In conjunction with WGDEC);

g) Review the development of fine scale VMS analysis in relation to habitats and assess vulnerability of deep-water banks, shelf slope and seamounts (in conjunction with WGDEC);

h) Review the biological parameters that should be collected on the NEACS survey by stock in addition to those specified by PGNEACS.

In addition to these terms of reference, two NEAFC requests were referred to WGDEEP and WGDEC for joint consideration:

- NEAFC request to develop suitable criteria for differentiating fisheries into possible management types (e.g. directed deep-water fisheries, bycatch fisheries, etc.) and to apply these criteria to categorize individual fisheries in order to enable NEAFC to develop fishery-based management initiatives;
- NEAFC request to evaluate the use and quality of VMS data and records of catch and effort to be received from NEAFC in order to provide information on the spatial and temporal extent of current deep-water fisheries in the NE Atlantic.

2.4 General approach to addressing Terms of Reference

ToR a) address generic ToRs for Fish Stock Assessment Working Groups

All the stocks assessed by WGDEEP were scheduled for “no advice” in 2009 and so only generic ToR b, c and f of the generic ToR for assessment Working Groups applied;

b) Update, quality check and report relevant data for the working group:

  i) Load fisheries data on effort and catches (landings, discards, bycatch, including estimates of misreporting when appropriate) in the INTERCATCH database by fisheries/fleets;

  ii) Abundance survey results;

  iii) Environmental drivers;

  iv) Propose specific actions to be taken to improve the quality of the data (including improvements in data collection).

c) Produce an overview of the sampling activities on a national basis based on the INTERCATCH database);

f) Produce a brief report of the work carried out by the Working Group. This report should summarize for the stocks and fisheries where the item is relevant:

  i) Input data (including information from the fishing industry and NGO that is pertinent to the assessments and projections);

ii) Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information;

iii) Stock status and 2010 catch options;

iv) Historical performance of the assessment and brief description of quality issues with the assessment;

v) Mixed fisheries overview and considerations;

vi) Species interaction effects and ecosystem drivers;

vii) Ecosystem effects of fisheries;

viii) Effects of regulatory changes on the assessment or projections;

ToR b) further develop assessment methodologies for deep-water species through exploratory assessments

Exploratory assessments were carried out in 2009 for roundnose grenadier in Subareas VI and VII, greater silver smelt in division Vb and tusk in division Va. Descriptions of these assessments are included in the relevant stock sections.

ToR c) to g)

These ToR were jointly addressed by WGDEEP and WGDEC. To avoid unnecessary duplication, a single report section was prepared for each of the joint ToR and these are included in either the WGDEEP or WGDEC report as was considered to be more appropriate. Accordingly, the joint WGDEEP and WGDEC response to ToR c and f are addressed in Sections 16 and 17 of this report while ToR d, e and g are included in the report of WGDEC.

ToR h) Review the biological parameters that should be collected on the NEACS survey by stock in addition to those specified by PGNEACS

The Working Group considered the current core biological sampling plan proposed by PGNEACS and made further recommendations relating to the area to be covered by the surveys. This covered in Section 18 of this report and in the Working Group's recommendations (Section 21).

NEAFC requests

The WGDEEP/WGDEC joint responses to the two NEAFC requests are included in Sections 19 and 20 of this report.

3 Overview

3.1 Data availability

3.1.1 Landings

Most landings data for 2008 were provided by working group members because official statistics available to ICES were incomplete. Because of the early date of the meeting in 2008 relative to earlier years, landings data from some countries were unavailable at the time of the meeting. Official landing statistics were incomplete in 2008 for some major species investigated by the WG, such as roundnose grenadier, orange roughy, black scabbardfish, and also non-target species for which landings may be relatively small and scattered. Working group estimates of landings reported in the stock sections are therefore provisional for 2008.

In particular, data were missing from Spanish fisheries on Hatton Bank. No data has been available from this fishery, which makes a very significant contribution to the landings from some stocks, since 2006.

Several countries (France, Ireland, Spain, UK England and Wales, UK Scotland, and Iceland) now provide landings data to the Working Group disaggregated at the level of ICES statistical rectangles. It is essential that other countries provide data at the same geographical resolution to allow changes in exploitation patterns to be evaluated.

3.1.2 Discards

Several EU countries have initiated observer programmes as in accordance with their obligations under EC regulations 2347/2002 (regulating deep-water fisheries) and 1639/2000 (minimum and extended sampling programmes). Only France, Spain and Portugal supplied discard data to the Working Group in 2009 (see Section 3.4 for details). Discarding is known to be high in some deep-water fisheries and it is imperative that such data are collected and made available to the Working Group.

3.1.3 Fishing effort

Log-book data

Fishing effort time-series were reported for:

- Icelandic trawlers and longliners harvesting blue ling, ling, tusk and greater argentine in Division Va;
- Faroese longliners and pairtrawlers harvesting ling in Division Vb;
- Norwegian longliners from a reference fleet harvesting ling and tusk, mainly in Sub-areas I and II;
- Portuguese (mainland) longliners harvesting black scabbardfish in Sub-areas VIII and IX;
- Azorean longliners harvesting red (blackspot) sea bream and alfonsinos in Division Xa.

VMS data

WGDEEP has in the past emphasized the need of getting access to VMS data, in relation to some terms of references (e.g. stock assessment) and specific NEAFC requests (e.g. evaluation of the impact of area closures). In 2006, NEAFC provided ICES with a full extraction of its VMS database over the period 2001–2006. This comprised the geo-localization of fishing vessels' positions in the international waters within the NEAFC regulatory area. In 2007, NEAFC sent to ICES an update of this database, also including catch data which potentially could be linked with VMS records. However, these data were submitted close before the start of WGDEEP07, and there was not sufficient time for the group to make use of them in relation to the 2007 NEAFC requests (see Sections 14–17).

During the 2008 meeting, WGDEEP, in collaboration with WGDEC, commenced exploratory analysis of these data and some shortcomings in data quality were encountered. Continued analysis in 2009 revealed further concerns over data quality, but allowed preliminary analysis of spatial distribution of fishing effort in the NEAFC regulatory area. This analysis, which is presented in Section 17, could be taken further if a more complete dataset were available and certain issues regarding the data quality can be resolved. A fuller analysis of the quality and use of the data is presented in Section 19.

In national waters, access to VMS data continues to be problematic. Full VMS data for vessels operating in Scottish waters and landings data for Scottish vessels and vessels landing in Scotland were made available to the Working Group in 2009. Analysis of these data is presented in Section 17 illustrating the degree of spatial resolution that could be achieved if all countries supplied VMS data.

3.1.4 Research surveys

In 2007, WGDEEP reviewed the deep-water surveys currently conducted in the ICES area and made recommendations for coordination of surveys. The ICES Planning Group for the North East Atlantic Continental Slope Survey (PGNEACS) met for the first time in 2008 and made considerable progress in coordinating the Scottish and Irish surveys. Recommendations were made for the coordination of Portuguese French and Norwegian surveys under this group.

In 2009, WGDEEP reviewed the progress made by PGNEACS and made recommendations on the biological sampling that should be included in coordinated surveys, Additionally, WGDEEP considered the spatial coverage of the surveys in relation to stocks assessed by WGDEEP and made recommendations for revised survey design to give more complete stock coverage.

The text below summarizes the national surveys, which were made available to WGDEEP09.

Faroe Islands

The Faroese groundfish surveys for cod, haddock and saithe is a fixed station trawl survey conducted annually on the Faroe Plateau. The spring surveys (conducted in February–March) began in 1994 and cover 100 stations whereas the autumn survey (conducted in August) began in 1996 covering 200 stations. The surveys also yield useful information on many other species. It needs to be kept in mind that the spring surveys are restricted to depths shallower than 500 m, so it only covers a part of the distribution area of deep-water species. The autumn survey was expanded in 2000 to cover depths to 1200 m.

Greenland

Greenland has conducted stratified random bottom-trawl surveys in ICES XIVb since 1998 (except 2001) covering depths between 400 and 1500 m. The survey is aimed at

Greenland halibut but estimates of biomass and abundance and length frequencies on roundnose and roughhead grenadier are also available. Information on sex, length and weight on the very few tusk, ling, smoothheads, argentines and different species of elasmobranchs have also been recorded. The utility of this survey for assessment purposes cannot yet be evaluated.

Iceland

The Icelandic groundfish survey, which has been conducted annually since 1985, yields information on the variation in time of the fishable biomass of many exploited stocks in Division Va, and also useful information on many other species. More than 500 stations are fished annually, but the survey depth is restricted to the shelf and slope shallower than 500 m. Therefore the survey area only covers part of the distribution area of ling and blue ling as their distribution extends into greater depths. Another annual deep-water groundfish survey has been carried out all around Iceland since 1996. Although the main target species in this survey are Greenland halibut (*Reinhardtius hippoglossoides*) and deep-water redfish (*Sebastes mentella*), data for all species are collected. These data include length distributions and number of all species caught as well as weight, sex and maturity stages of selected ones.

Ireland

The Marine Institute ran 10 deep-water surveys along the northeastern shelf edge between 1992 and 1999, five each by trawl and longline. This survey programme was an important source of information on the distribution and abundance of deep-water fish during the early development of the commercial fishery, and provided samples of deep-water fish for biological analysis. The surveys have also produced catch per unit of effort (cpue) and discarding information.

In 2006 the Marine Institute recommenced its deep-water survey programme with a slope survey covering the continental slope in Area VIa and the northern Porcupine Bank in Area VIIc. Overall, 27 hauls were carried out at four depths, 500 m, 750 m, 1000 m and 1500 meters. The survey attempted to standardize gear, sampling strategy and protocols with the Scottish survey as much as possible. As part of this standardization and intercomparison, RV Celtic Explorer carried out eight comparative tows with the Scottish research vessel, RV Scotia. The objective of the survey was to collect abundance data and biological information on the main deep-water fish species, including weight, length and maturity, and also to collect benthic invertebrates and bottom sediment samples. CTD transects, grab sampling, and cetacean studies were also carried out. It is envisaged that this survey will provide a time-series for cpue for the main deep-water species in the survey area in future.

Portugal (Azores)

Since 1995, a longline survey has been conducted annually by the Department of Oceanography and Fisheries at the University of the Azores (DOP), during spring, covering the main areas of distribution of demersal species (the coast of the islands, and the main fishing banks and seamounts), with the primary objective of estimating fish abundance for stock assessment (Pinho, 2003).

The survey has supplied information needed to estimate the relative abundance of commercially important deep-water species, from ICES Area X, based on the common assumption that catch rate (cpue) is proportional to species abundance, cpue=q.N, where q is catchability, which is assumed constant, and N is the abundance.

Bottom longline was adopted as a sampling survey technology in the Azores because the seabed is very rough, which does not permit use of other gears (e.g. trawl), and also as a consequence of a combination of behavioural and physiological factors of the demersal species (e.g. deep-water species are difficult to detect acoustically, particularly those living near the seabed, and mark recapture studies are ineffective for some of the species because they die when brought to surface).

Spain

From 2001 a new bottom-trawl survey started in the Porcupine bank to estimate abundance indices of commercial species and the distribution patterns of the demersal and benthic species in the area. Porcupine 2005 survey was organized by the IEO and counted with the collaboration on board the cruise of scientists from the Marine Institute of Ireland and from AZTI. The area covered in Porcupine 2005 survey is the Porcupine bank extending from longitude 12° W to 15° W and from latitude 51° N to 54° N, covering depths between 150 and 800 m. The cruise was carried out between September and October on board R/V "Vizconde de Eza. Trawling time was set to 30 minutes between the end of wire shutting and starting to pull it back and towing speed was set to 3.5 kn.

UK (Scotland)

A deep-water trawl survey of the continental slope to the west of Scotland has been carried out biennially in September by FRS, The Marine Laboratory since 1998. In 2005, it was combined with the Rockall Haddock survey, upgrading both to annual status. A TV sled survey for deep water *Nephrops* burrows is carried out at night at selected sites on Rockall and the slope, and TV drop frame deployments are also carried out as part of collaboration with JNCC (Joint Nature Conservation Committee) to map habitat in these areas. The survey contains stations extending from the Wyville-Thomson Ridge in the north to south of the Hebridean Terrace, although coverage has varied from year to year. Fishing is stratified by depth and currently ranges from 400–1900 m.

3.1.5 Abundance indices

Because of the sparsity of survey data currently available, the WGDEEP has relied heavily on cpue to reflect changes in stock abundance. Although new deep-water surveys are expected to provide abundance indicators in the long term, the WG will still have to rely on commercial cpue trends in the coming years.

WG members have adopted different strategies to standardize fishing effort and cpue. Sumarised below:

Cpue from logline fisheries in the Azores

GLM was used as the standardization method to adjust the cpue trends of several species from the Azores bottom longline fishery, namely of blackspot sea bream, alfonsino, golden eye perch, bluemouth rockfish and greater forkbeard. Factors for year, month, boat class and target species effects were used to adjust the nominal catch per unit of effort. Once the effects of the month, boat class and target species are removed, the remaining year effect was assumed to be proportional to abundance. Trips with zero catches were not included in the calculations. The analysis were conducted for cpue in biomass (kg of fish per 1000 hooks) and for cpue in number (number of fish per 1000 hooks).

GLMs are convenient as they make use of accepted methods to select variables in models, and also because the coefficients derived from these analyses can be directly used to standardize fishing effort and catch rates. However, GLMs are subject to a number of limitations. First, fisheries data are generally unbalanced (e.g. not all vessels are present over all time-series). Second, the underlying functional form is linear, by construction. However, the linkage between cpue and stock abundance could be of a more complex nature, e.g. including non-linear effects. Hinton and Maunder, 2004 reviewed non-linear modelling alternatives which have been or could be used in relation to cpue analyses. These include non-linear models such as General Additive Models (Bigelow *et al.*, 1999), neural networks (Warner and Misra, 1996), regression trees (Watters and Deriso, 2000), and also habitat-based models (Bigelow *et al.*, 2002; Maunder *et al.*, 2002).

Tally books and cpue from the French trawl fishery to the West of the British Isles

Several problems have been seen previously in the French time-series of cpues based upon logbook data.

In the 1990s, i.e. the first decade of the mixed fishery targeting roundnose grenadier, black scabbardfish and sikis sharks, cpues were demonstrated to vary of over 3 different French sub-fleets. Only the cpue for a sub-fleet of large high-sea trawlers prosecuting a pure deep-water activity was considered as a reliable indicator of stocks abundance (Lorance and Dupouy, 2001). The last vessels in this reference fleet used by Lorance and Dupouy, 2001 ceased fishing in 2008.

In 2006, a working document demonstrated that several factors affected the French cpues. In particular the fishery have been exploiting new fishing grounds in the 2000s and the cpues in these new grounds were higher than in grounds fished since the early 1990s, driving an increase in global cpues. The cpue per small areas demonstrated different trends (Biseau, 2006WD).

In recent years, a database of tally book (from skipper own logbooks) was provided by the French industry (PROMA/PMA a producers organization and EURONOR a ship owner). A comparison between the catch reported tally books and EU logbooks revealed they were fairly consistent, the advantage of the tally book was the haul by haul resolution and availability of the fishing depth (Pawlowski *et al.*, 2009 WD1). Blue ling, roundnose grenadier and black scabbard fish Landings per Unit of Effort (lpues) were estimated for areas to the British Isles as defined by Biseau, 2006WD (Figure 3.1.1) and are provided in the relevant sections. The most extensive study was made for blue ling and presented as a working document (Lorance *et al.*, 2009 WD18).

3.1.6 Stock structure

This report presents the status and advice of deep-sea species by individual stock component. The identification of stock structure has been based upon the best available knowledge to date (see the species-specific chapters for more details). However, it has to be emphasized that overall, the scientific basis underlying the identity of deep-sea stocks is currently weak. In most of the cases, the identification of stock is based on either theoretical consideration on the mixing of populations in relation to the hydrological and geological characteristics of fishing grounds, or comparison of trends in catch rates, or consistency with management units. Therefore, the WG considers that the stock definitions proposed in this report are only preliminary. There are currently genetic studies ongoing to improve the knowledge of the stock structure of a number of species. The WG recommends that increased research effort be devoted to clarify the stock identity of the different deep-sea species investigated by ICES.

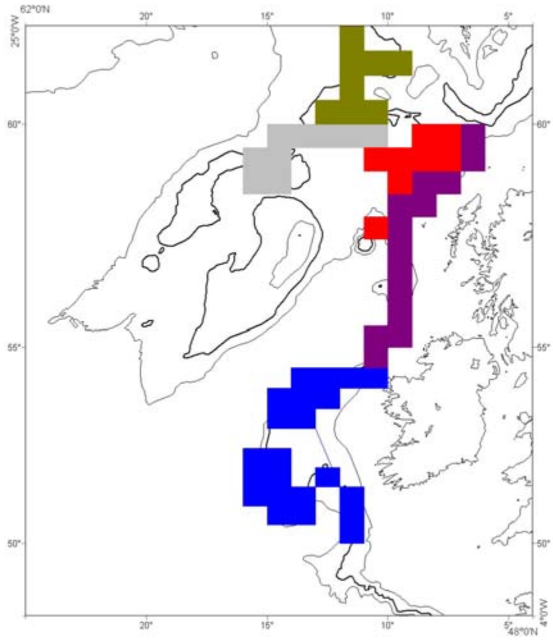


Figure 3.1.1. Areas used to calculate French lpues for blue ling: brown: new grounds in Vb (new5); grey: new grounds in VI (new6); red: others in VI (other6); purple: edge in VI (edge6); blue: all grounds in VII (ref7). Depth contours are 200, 1000 and 2000 m.

3.2 Methods and software

This section summarizes the methods and software used by the Working Group historically and any new methods and software used in 2009.

Historically

3.2.1 Methods

3.2.1.1 Catch curve analysis

The Group were aware of the assumption of constant recruitment implied when constructing catch curves within years. Lack of historical data frequently required this course of action rather than the preferred option of analysing individual year classes by cohort.

3.2.1.2 Depletion models

A catch and effort data analysis package (CEDA) was used to apply modified Delury constant recruitment models when sufficient data were available. The Working Group recognized that depletion models in general assume that data are from a single-stock (i.e. there is no immigration or emigration) and that this approach should not be applied to components of stocks or fisheries. Notwithstanding these assumptions, and the lack of knowledge regarding the stock structure of deep-water species, the Group still felt these methods were worth trying as an investigative tool. The general procedure adopted was to use sensitivity analysis to evaluate the effect on results (residual plots, goodness-of-fit, parameter estimates, principally carrying capacity, catchability and current population size) of a range of assumptions for stock size in the first year as a proportion of carrying capacity and error models. Indexed recruitment depletion models could not be attempted because of a lack of recruit data.

3.2.1.3 Production models

ASPIC and CEDA was also used to fit dynamic (i.e. non-equilibrium) production models. Again sensitivity analysis of outputs was used to evaluate the effect of error models and ratio of initial to virgin biomass and time-lag. For some of the stocks assessed, available time-series data of cpue comprise a gradual decline across the period studied. The Working Group was aware that the results from production models in these circumstances (the so called 'one way trip') can be unreliable.

Attempts have been made to apply a Bayesian approach to a Schaefer model using WINBUGS free software. There are uncertainties about the key population parameters for deep-water fish species and a Bayesian approach is a natural way to portray those uncertainties and to express the risks that are associated with alternative management measures. It is becoming commonly accepted that Bayesian methods can produce less biased estimates when compared with frequentist approaches based on maximum likelihood estimators (Nielsen and Lewi, 2002).

3.2.1.4 VPA analysis

The Lowesoft VPA package has been used to carry out Shepherd/Laurec analyses to detect trends in catchability, and separable VPA and extended survivors analysis (XSA) to produce estimates of stock, where possible.

3.2.1.5 Stock reduction models

Stock reduction analysis is a developed form of a delay-difference model (Quinn and Deriso, 1999). The method uses biologically meaningful parameters and information for time delays as a result of growth and recruitment to predict the basic biomass dynamics of the populations without requiring information on age structure. Thus it can be considered to be a conceptual hybrid between dynamic surplus production and full age based models (Hilborn and Walters, 1992). A full description of the general approach can be found in Kimura and Tagart, 1982, Kimura *et al.*, 1984 and Kimura, 1985, 1988.

The stock reduction model used is part of programme suite (PMOD) developed by Francis, 1992, 1993 and Francis *et al.*, 1995. Simple deterministic and enhanced stochastic models are included, but given the paucity of the available data it was decided to use the former. The method requires time-series data of annual catches, one or more abundance index and a range of biological parameters. A Beverton and Holt stock and recruitment relationship with a steepness of 0.75 was used throughout (Francis, 1993).

The method provides an estimate of virgin biomass (B0) and current biomass from which a depletion ratio can be calculated. The stock reduction model developed by Francis also provides an estimate of the annual mean catch that can be taken, consistent with a 10% probability of spawning-stock biomass falling below 20% of virgin SSB. In New Zealand and Australian fishery this catch is termed the maximum constant yield (MCY). Given that age of recruitment and age of maturity are reasonably similar for some species e.g. blue ling, 20% of virgin SSB can be considered to be broadly equivalent to 20% of virgin exploitable biomass. It should be possible, therefore, to estimate a sustainable constant catch broadly consistent with a high probability of maintaining exploitable biomass above the limit reference level for deep-water stocks in the ICES area.

3.2.1.6 Catch Survey Analysis (CSA)

CSA (Mesnil, 2003) is an assessment method that aims to estimate absolute stock abundance given a time-series of catches and relative abundance indices, typically from research surveys. This is done by filtering measurement error in the latter through a simple two-stage population dynamics model known as the Collie-Sissenwine, 1983 model. The population dynamics are described by the following model:

$$N_{y+1} = (N_y + R_y)e^{-M} - C_y e^{-M(1-\tau)} \quad [1]$$

where:

y : time-step, typically annual. Years may be defined either on a calendar basis or as the interval between regular surveys. The year range is [1, Y].

Ny : population size, in number, of fully recruited animals at start of year y;

Ry : population size, in number, of recruits at start of year y;

Cy : catch in number during year y (known);

M : instantaneous rate of natural mortality (equal for both stages, assumed);

τ : fraction of the year when the catch is taken, e.g. 0 if the fishing season is early in the year, or 0.5 if the catch is taken midway through the year or, by resemblance with Pope's (1972) cohort approximation, evenly over the year.

Estimating the time-series of Ny and Ry given the catches is the basic task of any assessment but, as with other methods, this requires additional information in the form of relative indices ny and ry of abundance for each stage, typically from surveys, which are assumed to be proportional to absolute population sizes Ny and Ry. The indices are deemed to be measured with some (lognormal) observation error:

$$n_y = q_n N_y \exp(\eta_y); y = 1, Y \quad [2]$$

$$r_y = q_r R_y \exp(\delta_y); y = 1, Y-1 \quad [3]$$

where:

qn and qr : catchability coefficients of fully recruited and recruits, respectively, in the survey, supposed to be constant with time;

η and δ : normally distributed random variables.

A constraint must be imposed whereby the survey catchability of the recruits is some fraction s of that of the fully recruited:

$$s = q_r / q_n \quad [4]$$

3.2.1.6.1 *Ad hoc* methods

Where Ad hoc methods have been used these are described in the relevant species assessment sections.

3.2.2 Software

Assessment software used at recent Working Groups includes CEDA (Catch Effort data analysis, produced by MRAG Ltd, 27 Campden Street, London W8 7EP, UK.)

ASPIC, PMOD (stock reduction programme), the Lowestoft VPA package, Winbugs (version 1.4 http://www.mrc-bsu.cam.ac.uk/bugs/winbugs) and CSA.

3.2.3 New methods used in 2009

3.2.3.1 Methods

Gadget is a shorthand for {G}lobally applicable {A}rea {D}isaggregated {G}eneral {E}cosystem {T}oolbox which is a statistical model of marine ecosystems. Gadget is a simulation model designed as a multispecies-multiarea model but can also be used as a single species model. The model operates as an age and length based cohort model, where all the selection curves depend on the length of the fish and information on age is not a prerequisite but can be utilized if available.

3.2.3.2 Software

The software and a detailed description of the model can be found at www.hafro.is/gadget.

3.3 Biological Reference Points and Harvest Control Rules

3.3.1 Biological Reference Points

In 2005, WGDEEP reviewed the biological reference points (BRPs) used in the WG since 1998. These were proposed for data poor situation by ICES SGPA and NAFO in 1997 and are as follows:

$U_{lim} = 0.2 * U_{max}$ (may be a smoothed abundance index)

$U_{pa} = 0.5 * U_{max}$

Where U is the index of exploitable biomass.

$\mathbf{F}_{lim} = F_{35\ \%SPR}$

$\mathbf{F}_{pa} = M$

Historically, WGDEEP has applied these BRPs to all stocks, but the F reference points have not been used because reliable estimates of F have not been available. In 2005, the WG proposed that that the F reference points should remain unchanged but the biomass reference points should be adjusted to take into account differences in life-history characteristics between species (e.g growth rate, age-of-maturity, etc.). Table 3.3.1 provides some background to group species according to these biological characteristics. The WG grouped the different species into 2 categories, one including slow-growing late-maturing species (category 1: orange roughy, roundnose grenadier, deep-water squalids), and another one including relatively quick-growing early-maturing species (category 2: all other species).

It was suggested that the current 50% and 20% thresholds might be reasonable to define the PA BRPs of category 2 species. As for category 1 species, the WG was of the opinion that thresholds should reflect the specific vulnerability of these species to exploitation and their capacity to recover. To quantify these thresholds, two different options were suggested in 2005:

1) The thresholds should be higher than those suggested for category 2 species (respectively 50% and 20% of the virgin biomass for U_{pa} and U_{lim}), and their values should be decided by managers;

2) The thresholds should be set provisionally at 75% and 50% of the virgin biomass for U_{pa} and U_{lim} respectively, to accommodate the PA approach in a data poor context;

The WG could not agree on which option to choose and to date no guidance from managers or ICES (from ISGMAS, for example) was available.

At the 2006 WG, the WG again could not agree a way forward and decided to request advice from ACFM on this issue. The WG recognized that it is desirable that BRPs based on SSB and F levels, instead of cpue levels, should be introduced as more reliable stock assessments become available.

In recent years ACFM in their advice has not specified biological reference points for deep-water species because of concerns that U_{max} (usually the initial value of an abundance index) may not represent virgin biomass when fishing has taken place previously.

The WG consider that this is a valid comment for some species, however for others, where abundance indices commence at the start of the fishery, orange roughy for example; the reference points used previously by WGDEEP remain useable.

Biological indicators such as trends in mean length, ratio of mature/immature continue to provide a valuable insight of the state of stocks.

In the longer term, the WG considers, in line with other ICES assessment WGs, that ICES should develop an MSY-based positive target strategy, rather than current risk avoidance strategies. Experience from around the world suggests that strategies building in positive targets can control fishing mortality more effectively. However, it is recognized that the current level of information available on deep-water species does not allow the calculation of MSY-based BRPs in the short term. When data become available in the longer term, MSY-based BRPs should be calculated and used as benchmarks in substitution to the current U_{pa} and U_{lim}.

The EU Project DEEPFISHMAN, which will develop a monitoring, assessment and management framework for deep-water stocks in the NE Atlantic, has a dedicated workpackage to develop suitable BRPs for deep-water species. The project commences in April 2009 and completes in March 2012.

3.3.2 Harvest Control Rules

In the short term, for both category 1 and 2 species (as defined in Section 3.3.1), ICES advice could in principle be provided in a similar way to that given for other stocks for which stock assessments are routinely carried out. For example:

- If $U < U_{lim}$, fishery should cease
- If $U_{lim} < U < U_{pa}$, exploitation should be reduced until $U > U_{pa}$,
- If $U > U_{pa}$, exploitation should be set so that U remains above U_{pa}

The main difference in advice between species belonging to categories 1 and 2 would be the recovery time. For category 2 species, multi-annual HCR may be contemplated, so the recovery time of stocks should be allowed to exceed 1 year. For category 1 species, multi-annual plans for stock recovery should not be contemplated.

The above HCRs can also be applied to mixed-species fishery. From a biological point of view, and more precisely for the sake of biodiversity preservation, the WG suggests that the poorest or the most vulnerable stock should be a reasonable candidate to set the HCR. However, the WG was of the opinion that the decision weight allocated to each stock should be left to managers. In the longer term, HCR should be elaborated on the newly calculated BRPs, as described above. In addition, HCR should accommodate pertinent environmental issues in a quantitative way.

The EU Project DEEPFISHMAN has a dedicated work-package to develop suitable HCRs for deep-water species.

Table 3.3.1. Deep-water species in the ICES area ranked according to (1) longevity and (2) growth rate (summarized from WGDEEP 2001). Species have been clustered into 2 groups according to their biological characteristics. The numbers given are only indicative as age-reading is poor for most of these species (cf WGDEEP 2001).

Species	Longevity (years)	Growth rate (k (y^{-1}))	Cluster
Orange roughy	125	0.06–0.07	1
Roundnose grenadier	>60	0.06–0.13	1
Deep-water squalid sharks:			1
Centroscymnus coelolepis	Not known	Not known	
Centrophorus squamosus	60-70	Not known	
Blue ling	30	Not known	2
Argentine	35	0.17–0.20	2
Ling	20	Not known	2
Tusk	20?	Not known	2
Black scabbardfish	8–12 from whole otoliths 25 from sections	0.25	2
Red (blackspot) sea bream	16	0.10–0.17	2
Greater forkbeard	15?	Not known	2
Alfonsino:			2
Beryx decadactylus	13	0.11–0.17	
Beryx splendens	11	0.13–0.14	

3.4 Community and discard data

3.4.1 Community data

The list of references to community studies was provided in the 2001 WGDEEP report (ICES CM 2001/ACFM:23) and later in the 2008 WGDEEP report (ICES CM 2008/ACOM:14). This list should not be considered a complete bibliography, but it may serve as a starting point for explorations of the full literature on this topic.

Data on available community data from deep-water fisheries presented to WGDEEP in 1993–2009 are given in Table 3.4.1. It demonstrated that studies on community structure for deep-water fisheries remain scarce and cover several selected areas only.

Table 3.4.1. Summary of available community data from deep-sea fisheries presented to WGDEEP in 2000–2009.

Period	Country	Fishery	Area	Summary source
1993, 1996, 1997	Norway	Experimental longline and trawl fishery	Mid-Atlantic and Reykjanes Ridges	ICES CM 2000/ACFM:8
1999	Norway	Experimental longline fisery	Hatton Bank	ICES CM 2000/ACFM:8
2000	Spain	Experimental trawl fishery	Hatton Bank, Mid-Atlantic and Reykjanes Ridges	ICES CM 2001/ACFM:23
1993–2002	Spain	Bottom trawl fishery for red sea bream (“voracera” fleet)	Strait of Gibraltar	ICES CM 2003/ACFM:25
1996–2002	Spain	“Baka” trawl and longline fishery	VI, VI, VIIIabd	ICES CM 2004/ACFM:15
1993–2003	Spain	Bottom trawl fishery for red sea bream (“voracera” fleet)	Strait of Gibraltar	ICES CM 2004/ACFM:15
2005–2007	Portugal	Black scabbardfish longline fishery	IXa	ICES CM 2008/ACOM:14
2007	Faroes	Otterboard trawl, midwater and bottom-trawl and longline fishery	Vb	ICES CM 2008/ACOM:14
1996–2007	Spain	“Baka” trawl and longline fishery	VI, VI, VIIIabd	ICES CM 2008/ACOM:14
1993–2006	Spain	Bottom trawl fishery for red sea bream (“voracera” fleet)	Strait of Gibraltar	ICES CM 2008/ACOM:14
2005–2008	Portugal	Black scabbardfish longline fishery	IXa	ICES CM 2009/ACOM:?
2007–2008	Portugal	Artisanal longline and line deep-water fishery	Xa2	ICES CM 2009/ACOM:?
2008	Portugal	Trawl, pure seine and artisanal fishery	IXa	ICES CM 2009/ACOM:?

A few new community data were presented to WGDEEP 2009 from Portuguese longline fishery, targeting black scabbardfish, trawl, pure seine and artisanal fishery off mainland Portugal (IXa) and from artisanal longline and line deep-water fishery off the Azores (Xa2).

Portugal (mainland)

The 2005–2008 data on catch composition from longline fishery targeting black scabbardfish in the Sub-area IXa were presented (WD 6). At least 37 species of fish and invertebrates were recorded in these catches (Table 3.4.2). Deepwater sharks *Deania calcea, Etmopterus pusillus* and *Centrophorus squamosus* were most frequently co-occurring species. Other common bycatch species were *Centroscymnus coelolepis*, *C. crepidapter*, *Phycis blennoides*, and *Scymnodon ringens*. It should be noted that 2008 catch composition did not differ notably from that of 2005–2007.

Table 3.4.2. Species composition (mean percentage by weight) of landings and discards in Portuguese longline fishery for black scabbardfish, 2005–2008.

	Landings		Discards	
Species	2005–2007	2008	2005–2007	2008
Longnose lancetish Alepisaurus ferox			0.03	0.03
Baird's smoothhead Alepocephalus bairdii			0.7	0.3
Black scabbardfish Aphanopus carbo	79.4	82.4		
Black scabbardfish Aphanopus carbo damaged	8.4	8.7		
Elongate frostfish Benthodesmus elongatus				
Hollowsnout grenadier Caelorinchus caelorhincus			0.01	0.1
Gulper shark Centrophorus granulosus				
Lowfin gulper shark Centrophorus lusitanicus	0.01	0.03		
Leafscale gulper shark Centrophorus squamosus	1.5	2.0		
Portuguese dogfish Centroscymnus coelolepis	0.7	0.17	0.02	
Longnose velvet dogfish Centroscymnus crepidater	0.3	0.3	0.1	0.03
Shortnose velvet dogfish Centroscymnus cryptacanthus			0.01	0.03
Common dolphinfish Coryphaena hippurus			0.01	
Roundnose grenadier Coryphaenoides rupestris			0.01	
Kitefin shark Dalatias licha			0.01	
Birdbeak dogfish Deania calcea	1.7	1.5		
Arrowhead dogfish Deania profundorum	0.01	0.03		
Black cardinalfish Epigonus telescopus				
Smooth lantern shark Etmopterus pusillus			3.3	2.5
Velvetbelly lantern shark Etmopterus spinax			0.5	
Threadfin grenadier Gadomus longifilis			0.03	0.03
Blackmouth catshark Galeus melastomus	0.01	0.03	0.2	0.8
Bluntnose sixgill shark Hexanchus griseus				
Shortfin mako Isurus oxyrinchus			0.01	
Lepidion guentheri			0.04	
Lepidion spp.			0.02	
Squids of fam. Loliginidae and Ommastrephidae	0.01	0.03		
Black gemfish Nesiarchus nasutus			0.07	0.03
Greater forkbeard Phycis blennoides	0.3	0.8	0.06	0.1
Blue shark Prionace glauca	0.05	0.03	0.03	0.03
Skates Raja spp.			0.01	
Knifetooth dogfish Scymnodon ringens	0.8	0.03	0.1	
Greenland shark Somniosus microcephalus				

	LANDINGS		DISCARDS	
SPECIES	2005–2007	2008	2005–2007	2008
Kaup's arrowtooth eel Synaphobranchus kaupii			0.5	0.03
Albacore Thunnus alalunga				
Roughnose grenadier Trachyrinchus scabrus			0.06	0.07
Swordfish Xiphias gladius	0.01	0.03		

Species compositions of landings of deep-water species from trawl, pure seine, and artisanal fishery off mainland Portugal were presents in WD10 and given in Table 3.4.3. These data demonstrated that landings from trawl fishery composed of at least 37 species of fish and invertebrates. The most important targets are *Pagellus acarne*, *Scyliorhinus stellaris*, *Aristeopsis edwarsiana*, *Lepidorhombus whiffiagonis*, and *Scyliorhinus spp*. The landings of deep-water species from pure seine fishery are minor and comprised mostly *Pagellus acarne* and *Oxynotus centrina*. Landings of other species are insignificant. Artisanal fishery provides the major contribution into total landings of deep-water species off mainland Portugal. The leading position belongs to black scabbard fish followed by European conger, shortfin mako, *Pagellus acarne*, wreckfish, *Phycis phycis*, *Scyliorhinus stellaris*, bluemouth, and *Centrophorus squamosus*. Other species landed in considerably lesser amounts.

Table 3.4.3. Species composition of landings (t) of deep-water species caught in various fisheries off mainland Portugal (Sub-area IX).

SPECIES	TRAWL	P. SEINE	ARTISANAL	TOTAL
Aphanopus carbo	2.7		3598.9	3601.5
Argentina spp.	0.4		1.0	1.3
Aristeopsis edwarsiana	59.7		21.6	81.3
Aristeus antennatus	5.7		0.6	6.3
Beryx decadactylus	0.1	0.4	13.2	13.7
Beryx splendens	0.2	0.3	23.4	23.8
Beryx spp	0.2		4.4	4.7
Centrophorus granulosus	0.2		89.5	89.6
Centrophorus squamosus	0.2	0.1	122.4	122.7
Centroscymnus coelolepis		0.1	34.4	34.5
Centroscymnus crepidater	0.1		35.6	35.7
Conger conger	5.3	1.0	1125.0	1131.3
Dalatias licha		0.1	1.8	1.9
Deania calcea	0.4	0.7	6.5	7.5
Echinorhinus brucus			0.2	0.2
Epigonus telescopus	0.5		3.7	4.3
Galeus melastomus	1.7	0.1	13.5	15.3
Helicolenus dactylopterus	27.5	0.3	137.8	165.6
Hexanchus griseus			1.8	1.8
Hoplostethus atlanticus	0.7		0.1	0.8
Hoplostethus mediterraneus			0.7	0.7
Isurus oxyrhinchus	0.1		481.8	481.9
Lamna nasus			0.3	0.3
Lepidopus caudatus			0.2	0.2
Lepidopus caudatus	1.2		1.6	2.7
Lepidorhombus boscii	36.2	0.6	2.6	39.4
Lepidorhombus whiffiagonis	51.4	0.6	12.4	64.3
Molva macrophtalmus			0.5	0.5
Molva molva			0.2	0.2
Osteichthyes	6.2		5.2	11.4
Oxynotus centrina	0.8	12.7	49.4	62.9
Pagellus acarne	316.6	56.4	398.9	771.9
Pagellus bogaraveo	41.2	0.4	116.3	157.8
Phycis blennoides	0.1	0.7	12.4	13.2
Phycis phycis	4.7	1.0	236.7	242.3
Phycis spp.	0.1		26.3	26.5
Polyprion americanus	0.4	0.1	299.2	299.8
Pontinus kuhlii	0.2		0.3	0.5
Scorpaena scrofa	0.8		1.0	1.8
Scorpaena spp.	2.0	0.3	34.7	36.9
Scorpaenidae	1.4		1.6	3.0
Scyliorhinus spp.	43.5	0.2	76.6	120.3
Scyliorhinus stellaris	275.3	0.4	153.3	429.0
Sebastes marinus			0.2	0.2
Sebastes spp.	2.5		1.8	4.3
Somniosus microcephalus	0.4			0.4
Squalus acanthias	1.6		2.9	4.4
Trichiurus lepturus			0.2	0.2

Portugal (The Azores)

Compositions of landings from artisanal longline and line fishery off the Azores in 2007 and 2008 were presented (WD13). About 15 major deep-water species are targeted by these fisheries (Table 3.4.4). The most frequently caught were red sea bream, wreckfish, European conger, bluemouth and splendid alfonsino. Other species were landed in lesser amounts. Compositions of landings between years almost did not differ. There are no data on non-commercial species caught as bycatch in above-mentioned fisheries.

Table 3.4.4. Composition of landings (t) in artisanal longline and line deep-water fishery off the Azores (ICES Area Xa2).

SPECIES	2007	2008
Red sea bream Pagellus bogaraveo	1071	1089
Wreckfish Polyprion americanus	664	513
European conger Conger conger	341	349
Bluemouth Helicolenus dactylopterus	275	281
Splendid alfonsino Beryx splendens	165	187
Common mora Mora moro	86	53
Skates Raja spp.	71	72
Silver scabbardfish Lepidopus caudatus	55	63
Offshore rockfish Pontinus kuhlii	55	57
Alfonsino Beryx decadactylus	46	63
Blue shark Prionace glauca	46	21
Tope shark Galeorhinnus galeus	43	47
Greater forkbeard Phycis blennoides	17	18
Spanish ling Molva macrophthalma	15	22
Black cardinalfish Epigonus telescopus	7	7
Kitefin shark Dalatias licha	7	10
Leafscale gulper shark Centrophorus squamosus	3	3
Bluntnose sixgill shark Hexanchus griseus	1	0
Dogfish Deania sp.	0	6

3.4.2 Discards

An urgent need remains for more quantitative information on levels of discards from deep-water fishery. A considerable number of discard studies have been undertaken during recent years, however many of these studies have been short-lived, often as a result of being driven by funding from EU projects. Moreover, as a consequence of the heterogeneous nature of many fisheries in relation to depths fished and the limited coverage that can be achieved within the budget of most studies, it has rarely been possible to achieve the level of sampling coverage that would be necessary to provide reliable estimates of discards at the level of fisheries. Consequently, most of the information that currently exists can best be regarded as qualitative or indicative of levels of discards rather than providing reliable estimates of absolute levels of discards.

Available data on discards in deep-water fishery during the period of 1993–2001 were presented in the 2002 WGDEEP report (ICES CM 2002/ACFM:16).

Recently, several EU countries have initiated observer programmes as in accordance with their obligations under EC regulations 2347/2002 (regulating deep-water fisheries) and 1639/2000 (minimum and extended sampling programmes). The preliminary results of these investigations have been presented to WGDEEP 2006, and these were summarized in ICES CM 2006/ACFM:28.

The analysis of existing data on discards (Table 3.4.5) demonstrated that the volume of research on discards in deep-water fisheries decreases from year to year and only single ongoing project, studying discards in Portuguese longline fishery for black scabbard fish, still exists (WD6). Results of the analysis of effect of roundnose grenadier discards in French trawl fisheries on species' stock assessment were presented in WD15. The data on discards in Basque country bottom-trawl fisheries (Spain) west off British Isles and in Bay of Biscay (VI, VII, VIIIabd) were also provided (Guzmán Diez, pers. comm.) The main outputs of these studies are summarized below.

Table 3.4.5. Summary of the data on discards in deep-sea fisheries presented to WGDEEP in 2000–2009.

Period	Country	Survey/Fishery/Gear	Area	Summary source
1993–1997	Norway	Ling and tusk longline fishery	IVa, VIa, Norwegian Deep	ICES CM 2000/ACFM:8
1998	Norway	Experimental trawl fishery	Hatton Bank	ICES CM 2000/ACFM:8
1999	Norway	Exploratory longline fishery	Hatton Bank	ICES CM 2000/ACFM:8
1997	Ireland	Commercial deep-water rock-hopper trawl	Rockall Trough	ICES CM 2000/ACFM:8
1998–1999	Ireland	Trawl multispecies fishery	Faroe-Shetland Channel	ICES CM 2000/ACFM:8
1997, 1999	Ireland	Longline survey	Porcupine Bank	ICES CM 2000/ACFM:8
2000	Spain	Commercial bottom-trawl fishery	Hatton Bank, Reykjanes Ridge	ICES CM 2001/ACFM:23
2000	Russia	Bottom trawl and longline fishery	I, II	ICES CM 2001/ACFM:23
2000	Ireland	Longline survey	Hatton, Rockall, Porcupine Banks	ICES CM 2001/ACFM:23
2001	France	Deepwater bottom-trawl fishery	VI, VII	ICES CM 2002/ACFM:16
2001	Spain	Bottom trawl commercial fishery	Hatton Bank	ICES CM 2002/ACFM:16
1999, 2000	Spain	Bottom otter trawl, pair trawl and high vertical trawl fishery	VI, VII, VIII, IXa	ICES CM 2002/ACFM:16
1996–2001	UK-Scotland	French and Scottish deep-water trawl fishery	West off British Isles	ICES CM 2002/ACFM:16
2001–2003	France	Deepwater bottom-trawl fishery	VI, VII	ICES CM 2004/ACFM:15
2002–2003	Spain	Commercial bottom-trawl fishery	Hatton Bank	ICES CM 2004/ACFM:15
2002–2004	Spain	Commercial bottom-trawl fishery	Hatton Bank	ICES CM 2005/ACFM:07
2004	Ireland	Bottom trawl fishery for orange roughy and black scabbardfish	VIIck	ICES CM 2005/ACFM:07
2005	Portugal	Black scabbardfish longline fishery	IXa	ICES CM 2006/ACFM:28
2004–2005	France	Deepwater bottom-trawl fishery	VI, VII	ICES CM 2006/ACFM:28
2002–2006	Spain	Commercial bottom-trawl fishery	Hatton Bank	ICES CM 2006/ACFM:28

PERIOD	COUNTRY	SURVEY/FISHERY/GEAR	AREA	SUMMARY SOURCE
2005–2007	Portugal	Black scabbardfish longline fishery	IXa	ICES CM 2008/ACOM:14
2005–2008	Portugal	Black scabbardfish longline fishery	IXa	ICES CM 2009/ACOM:?
1990–2007	France	Roundnose grenadier discards in French trawl fishery	Vb, VI, VII	ICES CM 2009/ACOM:?

Portugal

The on-board discard sampling for Portuguese set longlines commercial fleet for deep-water species, targeting black scabbardfish, started in mid 2005 and is integrating the Portuguese Discard Sampling programme, included in the EU DCR/NP. This on-board sampling is programmed to be made once a month to get discards and trip information. The methodology of samplings was described in previous WGDEEP report (ICES CM 2008/ACOM:14).

The data available allow analysing and comparing two sets of data: one from 2005–2007, with 12 trips sampled and another one from 2008, with 4 trips sampled. Percentages of total discarded and landed species in weight and number in relation to total catches were calculated for each trip.

Portuguese black scabbardfish longline fishery continues to demonstrate very low percentages of discards. Thus, landed fish constituted 97.7% and 98.6% by weight and 93.2% and 95.7% by number in 2005–2007 and 2008 respectively. The amounts of discards were 2.3% and 1.4% by weight and 6.7% and 4.3% by number in 2005–2007 and 2008 respectively.

The data analysis demonstrated (Table 3.4.2) that the most discarded species were *Etmopterus pusillus*, *Alepocephalus bairdii*, *Etmopterus spinax, Centroscymnus crepidater*, and *Synaphobranchus kaupii* and this is as a result of their low or null market value. Overall longline discards seem insignificant in relation to the total catch.

France

Landings data are often used as substitutes of catch data in stock assessments. When a significant proportion of the catch is discarded, this is likely to provide underestimated stock size. Discards of roundnose grenadier *Coryphaenoides rupestris* in the Northeast Atlantic account for about 30% of the catch in weight. Scarce discard data available through observer programmes for the period 1996 to 2005, exhibit relatively stable length distributions and discard rates. In contrast, landings data available since 1990 demonstrate that the average pre-anal length has decreased from 20.7 cm in 1990 to 15.7 cm in 2007 resulting in a 50% reduction of the mean individual weight (980 g in 2007) and an increasing occurrence of overlapping class sizes between landings and discards in recent years. A series of separable virtual population analysis stock assessments were carried out using catch datasets reconstructed from information on landings, discards, fishing effort and bathymetric distribution of the stock. Several hypotheses were explored in order to estimate missing catch data. The results indicated that the assumption of stable length distributions of discards was acceptable in recent years, but for the early 1990s, the resulting length distributions of the total catch were bimodal which was not realistic considering the slow growth and longevity of roundnose grenadier. Therefore, the length distribution of discards must have been different in the early years of the fishery (1990 to 1997) with larger individuals being discarded. This could indicate pickier behaviour of fishers when larger fish were more abundant. With decreasing individual sizes in the catches, some size classes that may have been discarded at the start of the fishery might have been landed in recent years. Alternatively, the changes could result from changes in fishing depths which also occurred over time. Both hypotheses were explored through a second series of assessments. Integrating discards into the assessment of roundnose grenadier leads to higher estimates of the stock biomass. Two different methods based on independent data suggest discarded individuals were larger at the beginning of the fishery in the early 1990s. Until recently, stock assessment has mostly been carried out based upon landing data worldwide. Catch data, i.e. including landings and discards are becoming available in several fisheries thanks to the implementation of on-board observation programmes. Fishing mortalities derived from catches are expected to be more reliable than those based on landings. This could be a serious problem for a species such as the roundnose grenadier where numerous age groups are exploited and a wide range of length classes are subject to both landings and discards. Nevertheless, the stock biomass trends estimated are consistent over all methods, suggesting that they are all capable to track the strong declining trend in the stock. The declining trends appear slightly lesser when accounting for discards.

Spain

The Basque Country's trawler fleet operates in ICES Subdivisions VI, VII, and VIIIabd targeting mainly hake (*Merluccius merluccius*), monkfish (*Lophius budegassa* and *L. piscatorius*) and megrims (*Lepidorhombus boscii* and *L. whiffiagonis*). Deepwater species are occasionally caught during these fisheries as well. In most trips, deep-water species are considered as bycatch and discarded as a result of the small size of individuals caught and especially because of the their lower commercial value at local fish markets in Basque Country as compared with the target species. The data on discards during these fisheries were obtained in the period 2003–2008. The estimations of discards in each ICES Subdivision were made aboard based on subsamples of total discard amounts for each haul. The weight of discarded species in the subsample was then extrapolated to the whole discards taken during particular trip and subsequently to the total catch caught by entire fleet in each year.

The analysis of available data (Table 3.4.6) demonstrated that maximum landings of deep-water species (2.7 thou. t) were registered in 2003 then gradually decreased reaching minimum value (1.2 thou. t) in 2008. The leading position in landings of deep-water species belongs to dogfish sharks followed by European conger. These species have likely highest demand at fish markets because there were no discards of dogfish sharks in Sub-division VIII and of European conger in Sub-division VII occurred, whereas discards of the latter species in Sub-division VIII were minor.

Considerable interannual variations of discard values were observed. Despite significant decreasing of total landings of deep-water species from 2003 to 2008, maximum discards/landings ratio (71.4%) was registered in 2008, whereas minimum one (7.9%) in 2004. At species level, maximum discards were characteristic of greater silver smelt in Sub-divisions VI and VIII over the entire period of observations.

Some geographic variations of discard quantities were found. In all the three areas under study maximum and minimum landings were registered in 2003 and 2008 respectively. In Sub-division VI maximum discards (in terms of absolute value) were observed in 2008 and minimum ones in 2005. In Sub-division VI discards, conversely, were minimum (zero value) in 2008, whereas maximum quantities were observed in 2006 (discards/landings ratio 13.1%). In Sub-division VIII maximum discards were observed in 2003 (in terms of absolute value) and in 2005 (in terms of discards/landings ratio), whereas minimum ones were registered in 2004.

Table 3.4.6. Discards of deep-water species (t) in Basque country bottom-trawl fishery (Spain) by ICES Subdivisions, 2003-2008 (1: weight landed, 2: weight discarded, 3: percentage of discards, NC: no catch, percentage of trips samples per year is given in parentheses).

Species	ICES Sub-division	2003 (1.4–1.5)			2004 (0.9–1.8)			2005 (2.1–2.2)			2006 (1.9–2.6)			2007 (2.7–2.9)			2008 (2.9–3.6)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Tusk	VI	13.3	37.5	283.1	17.2		0.0	15.9	2.8	17.7	14.9		0.0	0.5		0.0		169.3	NC
Brosme brosme	VII				0.4		0.0	0.3		0.0									
	VIIIabd				0.0		0.0												
Bluemouth	VI	106.4	26.2	24.6	78.8	1.6	2.1	41.5	18.5	44.7	46.9	61.1	130.2	44.0	64.7	147.0	54.9	49.3	89.7
Helicolenus dactylopterus	VII	1.7	8.5	496.2	3.7	0.7	20.1	10.9		0.0	6.3	37.2	591.7	5.8	8.6	149.1			
	VIIIabd	4.1	0.1	3.2							6.7	3.5	51.5	1.9	2.8	145.4	5.2	0.7	13.8
European conger	VI	12.2		0.0	26.3		0.0	16.5		0.0	17.0		0.0	13.8		0.0	19.5		0.0
Conger conger	VII	565.6		0.0	421.0		0.0	315.3		0.0	296.0		0.0	318.8		0.0	302.8		0.0
	VIIIabd	410.8	0.8	0.2	486.9		0.0	392.0	2.7	0.7	339.2		0.0	312.4	7.8	2.5	389.9	17.9	4.6
Roundnose grenadier	VI		25.6	NC		17.5	NC	0.5	11.2	2293.6		5.0	NC		16.9	NC		94.4	NC
Coryphaenoides rupestris	VII		6.9	NC					3.4	NC		5.2	NC						
	VIIIabd	1.2		0.0	3.2		0.0				0.6		0.0	0.0	1.8	5398.6			
Dogfish sharks	VI																		
Squalidae gen. sp.	VII																		
	VIIIabd	718.7		0.0	562.9		0.0	358.6		0.0	78.3		0.0	302.7		0.0			
Greater forkbeard	VI	129.3	0.0	0.0	53.6		0.0	51.1		0.0	37.1	7.0	19.0	36.7		0.0	27.0	371.5	1373.7
Phycis blennoides	VII	37.0	0.4	1.1	31.3		0.0	29.4		0.0	93.7		0.0	136.0		0.0	0.1		0.0
	VIIIabd	40.7		0.0	30.1		0.0	76.7		0.0	38.8		0.0	9.9	0.1	1.1	32.8	0.3	1.1
Blue ling	VI	191.5		0.0	19.7		0.0	135.1		0.0	26.6	1.6	6.2	48.9		0.0			
Molva dypterygia	VII	0.3		0.0	0.0	2.1	75247.3	0.7		0.0	0.8	0.6	71.8	8.6		0.0	4.7		0.0
	VIIIabd	0.2		0.0	0.7		0.0	0.7		0.0	0.8		0.0	0.5		0.0	0.7		0.0

Ling	VI	74.9		0.0	40.8		0.0	60.9		0.0	60.6		0.0	1.3		0.0	9.8		0.0
Molva molva	VII	152.3		0.0	124.5		0.0	84.7		0.0	66.9	7.7	11.5	60.6		0.0	52.5		0.0
	VIIIabd	79.7		0.0	58.3		0.0	48.1		0.0	43.6		0.0	26.8		0.0	39.0		0.0
Alfonsino	VI	1.8		0.0	0.1		0.0	0.1		0.0				0.0		0.0	0.1		0.0
Beryx decadactylus	VII	0.5		0.0	0.0		0.0				0.7	0.1	11.7	0.3		0.0			
	VIIIabd	5.3		0.0	14.8		0.0	2.3	15.5	677.2	11.3		0.0	2.7		0.0	4.5		0.0
Argentine Argentina sphiraena	VIIIabd	98.4	15.3	15.5	141.4	22.8	16.1	186.2	4.4	2.3	234.1	37.7	16.1	169.0	41.1	24.3	232.3	36.4	15.7
Chimaeras	VI		76.1	NC		21.9	NC		9.9	NC		32.3	NC		97.9	NC		32.8	NC
Chimaeridae gen. sp.	VII											0.9	NC						
	VIIIabd					4.1	NC		14.1	NC									
Scorpionfish	VI	1.9		0.0	1.1		0.0	0.7		0.0									
Scorpaena spp.	VII	2.8		0.0	0.0		0.0	0.1		0.0				0.3		0.0			
	VIIIabd	13.9		0.0	11.0		0.0	15.0		0.0	10.4		0.0	1.9		0.0	1.0	0.2	21.2
Baird's smoothhead	VI		2.7	NC															
Alepocephalus bairdii	VII																		
	VIIIabd																		
Greater silver smelt	VI		298.0	NC		88.5	NC		30.6	NC		57.4	NC		193.9	NC		67.5	NC
Argentina silus	VII		16.2	NC		0.9	NC		16.9	NC		9.2	NC		12.8	NC			
	VIIIabd	0.1	281.9	241164.5		7.4	NC		241.8	NC		36.2	NC		2.7	NC			

3.5 Summary of working documents

There were 18 working documents presented to WGDEEP 2009. The data on authors, titles, countries, ICES divisions and subareas and topics are summarized in Table 3.5.1. Five working documents were presented by Portugal. France and Norway provided by three working documents. Spain, Russia and Faroes presented by two working documents, Iceland provided single working document.

Working documents presented to WGDEEP 2009 contained information on 39 deep-sea fish species (Table 3.5.2). The most working documents presented fishery and biological data on black scabbardfish and blue ling (by 3 working documents). Roundnose grenadier, greater silver smelt and tusk were main study objects considered in two working documents. Data on greater forkbeard, ling, blue mouth, red sea bream, and Spanish ling were presented in single working document. Other working documents dealt with a variety of deep-water species.

WD1

This document presents the database and its validation using national fishery statistics on blue ling. As deep-sea stocks lack analytical information, their states are generally assessed from time-series of lpue trend analysis, lpue being considered as a proxy of abundance. The use of lpue can be misleading as this index is combination of stock abundance and efficiency of fishing gears and strategies. The variation of abundance of a stock may be masked by a change in fishing strategy (high lpue in new grounds, switch of fishery). Gears and practices can also change with time. Therefore, it is necessary to discriminate from raw lpues the impact of those different factors in order to reflect accurately the variation of stock abundance. A partnership between IFREMER and two organizations involved in the deep-sea fishery, EURONOR and PROMA/PMA has led to a more detailed view of the activity of the fleets through a haul by haul database referred as IDSF (Industry DeepSea Fishery).

The comparison between some of the IDSF data and official statistics has revealed some sound consistencies between records. The IDSF dataset has more details than the regular official statistics and the aggregation of its information provides the same values than those officially recorded, which is a strong point in terms of validation.

As the information present in the IDSF database has been demonstrated to be representative of the French deep-sea fishery, the content of this database can be fully used to describe this fishery. To estimate stock abundance, it is however necessary to explore the multivariate nature of the available datasets in order to discriminate the various factors affecting the catches such as the fishing gear, strategies and the true abundance of the stocks. This approach is currently uncertain using official statistics as a result of the aggregated nature of the information in this database. Therefore, the quality of information within the French deep-sea data collection is important to improve the assessments of the deep-water species. Such level of details is necessary and highlights the benefits of building partnerships between fishery science and industry.

WD2

This paper presents time-series of effort and cpue from these two data sources and compares the 2000–2007 data with previously submitted data for the period 1972–1994. It also gives estimates of the mean length of ling, tusk and blue ling during the two periods.

Ling, tusk and blue ling have been fished by Norway for centuries and the amounts landed have been recorded since 1896 (Figure 1). The major fisheries for these species are taken by longlines, and the catches are to a large degree bycatches. The fishery for these three species is mainly influenced by the size of various quotas for other species, especially the quota for Arcto Norwegian cod. Therefore the total catch may not be a good indicator of the state of these stocks. Scientific surveys do not cover the main habitats of these species. Consequently, to estimate the relative abundance of these stocks, indicators such as cpue series need to be generated. In order to construct cpue series, the Institute of Marine Research (IMR), in cooperation with the Norwegian Directorate of Fisheries (NDF), began in 2003 to record in an electronic database the logbooks of longliners larger than 21 m.

Given that other sources of information are lacking, the cpue estimates may constitute the only source of information on temporal trends in abundance. It is a notable result that although the catch-per-vessel increased during the period 2004–2008, the abundance as indicated by cpue in the most important fishing area, Subarea IIa, may be constant or even declining. For the remaining areas the results were more positive. Even though there is a time gap of six to seven years between the old and the new time-series, the recent cpue estimates seem to correspond and reflect the trends in the fishery quite well. The main pattern is that cpue remains at a low level compared with the 1970s and 1980s.

Legislation to regulate the cod fishery has since 2000 resulted in a continuous reduction in the number of longliners participating in the fishery. Even though the number of vessels has decreased, the total effort does not seem to have been reduced. The number of days each vessel is in the fishery has increased and the total number of weeks the fleet is in the fishery has been nearly constant since 2000. The number of hooks used per vessel per day has increased every year. This together with the increased time in the fishery has compensated for the reduction of vessels in the fleet and hence there is little or no reduction in the total effort.

During the period 1998 through 2003 the total catch declined from 32 675 to 19 000 tons although the catch per vessel was relatively stable. The data from 2004–2006 demonstrated that the total catch has been relatively stable with a sharp increase in total catches during 2007 and 2008. The average catch-per-vessel has increased considerably every year since 2004. Current landings are higher than levels recommended by ICES in 2008. It is unlikely that measures implemented in the last 4–5 years has reduced fishing effort to the 1998-level as recommended by ICES in 2004.

It is recognized that caution must be exerted when using cpue from longliners to study variation in abundance. The data presented here demonstrate clearly that the selection of the effort measure is critical. Comparatively crude measures such as "number of fishing days" would not reflect effort in this fishery correctly, and are inferior to "hooks-per-day" series, which appears to be a much preferred measure of effort. "Hooks per day" is in essence a rather readily available measure based on compulsory logbook information. Not accounted for in the 2000–2007 data were changes in efficiency, e.g. by technological advances such as hook design, bait characteristics, effects of fishing practice, e.g. soak times etc., but in the recent period, technological changes appear to have been minor.

WD3

This paper uses research survey data collected through a period of 25 years to analyse temporal variation in abundance and biomass, size distributions, occurrence of juveniles, and spatial distribution of a roundnose grenadier population in the Skagerrak

(ICES Division IIIa). The data for the study come from deep-water annual Norwegian *Pandalus borealis* surveys conducted since 1984. This fisheries-independent dataseries is perhaps the only one of its kind providing information for a quarter of a century on what appears to be a self-contained commercially exploited population of a macrourid fish population.

A substantial interannual variation in both numerical abundance and biomass was observed during the 1984–2009 time-series. Even when years with bathymetrically limited sampling were excluded, the variation is greater than expected for a long-lived species like roundnose grenadier for which rapid variation in at least biomass would seem unlikely. The grenadier is, however, a bentho-pelagic species that tends to occur in aggregations, thus some of the variation may reflect patchiness in distribution combined with variation in sampling effort between years. The abundance in 2004 was exceptionally high and this was the first of only two years when the survey was run in May rather than in autumn and winter. Seasonal abundance or catchability variation has not been observed for this species in this area, but a seasonal pattern cannot be excluded as a source of error.

However, despite substantial interannual variation a long-term trend in abundance and biomass is suggested. From the late 1980s through the 1990s until 2004–2005 the abundance appeared to increase. After that there is some uncertainty as a consequence of the unfortunate weak sampling in the two subsequent years. However, the more reliable estimates from 2008 and 2009 suggest a decline to the level observed in the late 1980s.

The commercial landings did not change substantially until 2003 when a rapid rise in the Danish landings occurred. This expansion appears to have happened in years when the abundance (or catchability) was higher than previously, perhaps as a result of enhanced production. The increase in abundance in the 1990s may also have been influenced by changes in exploitation practices in the shrimp fishery (e.g. the introduction of sorting grids). In 2006 the targeted grenadier fishery was restricted by a quota agreed between the EU and Norway and by 2007 the fishery virtually ceased. Whether the recent decline in abundance and biomass is a result of the 2003–2005 pulse in exploitation remains unclear. The survey results suggest a recent decline in abundance, but not a collapse below previously observed low levels.

The abundance of (predominantly) juveniles of PAL<5 cm was highly variable across the time-series. Pulses in recruitment appear to be followed by many years with almost no recruitment. The pulse in the early 1990s was particularly prominent. There are no age data from this period, so it is not possible to determine, if this pulse is produced by a single or several year classes. The progression of the mode in the size distributions from 1991 onwards, however, suggest that only a single year class 'rejuvenated' the population in this period. What appears as an elevated production of juveniles in the early 1990s probably explains the higher abundance of the population about ten years later, i.e. in 2003–2005.

In 2008 and 2009, the size distributions are dominated by much smaller fish than in the 1980s when the abundance was similar. Fish of PAL>15 cm that were dominant in the 1980s were almost absent in recent years. This change may partly have resulted from the pulse in exploitation in 2003–2006.

The geo-referenced survey catches do not suggest substantial temporal variation in spatial distribution. In the last couple of years, when the abundance declined to levels seen in the 1980s, the largest catches were observed in the easternmost deep areas.

This contrasts somewhat with the pattern in the 1980s when a more even distribution was recorded.

WD4

This paper presents the results of a Generalized Linear Model analysis of black scabbardfish lpue data from the longline fleet operating in Sub-area IXa, 1995–2008. The main purpose of this WD is to obtain standardized effort estimates of the fleet which can be further used in Assessment Models.

WD5

This working document provides main outputs from the APHACARBO project jointly conducted by five Portuguese research institutions between 2005 and 2008 and aimed to improve the knowledge of black scabbardfish biology.

Studies on reproduction demonstrated that sex ratio is clearly unbalanced, with females prevailing in larger lengths and being the smaller individuals predominantly males. Mature individuals only occurred in Madeira and, more recently, in Canary Islands and the northwest coast of Africa, whereas mainland specimens only achieve the developing stage. The length at first maturity was estimated at 1078 mm for females and 1062 mm for males. It is probable that individuals from Canary Islands mature at larger sizes than those in Madeira, influenced by the fact that in the former archipelago they are distributed deeper and that they are subjected to different exploitation levels and regional oceanographic conditions. There is a significant difference in the mean oocyte size between developing females from mainland Portugal and Madeira. In females from Madeira, the occurrence of oocytes in cortical alveoli stage and the gonadosomatic index are higher. Mainland females' oocytes go through a generalized atresia from July on, whereas, in Madeira waters, the reproductive cycle continues until maturation and ovulation. Nonetheless, in some individuals from Madeira, gametogenesis is also halted and all vitellogenic oocytes are reabsorbed via follicular atresia. Total fecundity estimates ranged from to 73 to 373 oocytes g^{-1} female.

Sectioned otoliths were demonstrated to be more appropriate to age assignment because growth increments are more evident and ageing of larger specimens is easier than in whole otoliths. Significant differences were obtained in the comparison of the length distributions at age between the Madeira Archipelago, mainland Portugal and the Azores Archipelago.

The variability of otolith contour shape of black scabbardfish from Portuguese waters (Madeira Archipelago, mainland Portugal and Azores Archipelago) was analysed for stock discrimination purposes. Significant differences were found in otolith contour shape between the Madeira and mainland Portugal and between sexes. Otolith contour shape was demonstrated to be a possible tool for differentiating between black scabbardfish stocks in the NE Atlantic.

A first attempt to join the information available from the two longline fisheries (Madeira Archipelago and mainland Portugal) targeting black scabbardfish in Portuguese waters in one single analysis was performed. Nevertheless, considering the hypothesis of occurring a unique stock of black scabbardfish in the NE Atlantic as well as the existence of horizontal migrations, it can be assumed that the differences in the stochastic processes between the two regions are as a consequence of a temporal gap of the species life cycle. In fact, it is expected that higher yields occur first in Madeira region, where a spawning area is confirmed and only occur after in the mainland after a three month period. A time-series of fifteen years seems reasonable because it is quite close to the expected longevity of the species, considering that the latest scientific evidence indicates a maximum age of 15 years in specimens of Madeira.

The effect of geographic region, size, sex and maturity stage on total mercury, cadmium and lead concentrations was investigated in muscle, liver and gonad tissues of black scabbardfish. Specimens were caught at three locations in the southern North East Atlantic: mainland Portugal, Madeira and Azores archipelagos. Total mercury concentrations in specimens from Madeira are significantly different from both Azores and Mainland. Cadmium levels in specimens from Mainland were significantly different from those from Madeira and Azores archipelagos. For Lead levels there were only significant differences between Madeira and the Azores. These dissimilarities might be as a consequence of differences either on trace metal content in the water or to the physiology and diet of the fish inhabiting the three Portuguese regions. These results support a possible occurrence of different black scabbardfish populations among the studied Portuguese regions.

WD6

This paper describes discards of deep-water species in longline fisheries targeting black scabbardfish off mainland Portugal. The on-board discard sampling for Portuguese set longlines commercial fleet for deep-water species, targeting black scabbardfish, started in mid 2005 and is integrating the Portuguese Discard Sampling programme, included in the EU DCR/NP. This on-board sampling is programmed to be made once a month to get discards and trip information. The methodology of samplings was described in previous WGDEEP report (ICES CM 2008/ACOM:14).

The data available allow analysing and comparing two sets of data: one from 2005–2007, with 12 trips sampled and another one from 2008, with 4 trips sampled. Percentages of total discarded and landed species in weight and number in relation to total catches were calculated for each trip.

Portuguese black scabbardfish longline fishery continues to demonstrate very low percentages of discards. The most discarded species were *Etmopterus pusillus*, *Alepocephalus bairdii*, *Etmopterus spinax*, *Centroscymnus crepidater*, and *Synaphobranchus kaupii* and this is as a result of their low or null market value.

WD7

This paper presents the results of the Porcupine Spanish survey carried in 2008. Data on total biomass, length frequencies and geographical distributions of argentines *Argentina* spp. (mostly *A. silus*), bluemouth *Helicolenus dactylopterus*, greater forkbeard *Phycis blennoides* and Spanish ling *Molva macrophthalma* are provided.

Decrease in abundance was observed for all the four species considered, which continues with the decreasing trend detected in these species in the last three or four years, nevertheless the decreases in abundance in argentine and bluemouth are within the ranges of last year's estimates considering both parametric SE and bootstrap confidence intervals. On the other hand decreases in the abundance of greater forkbeard and Spanish ling are larger and more remarkable.

Length distributions of argentine, bluemouth and Spanish ling are very similar to those from last years with low abundances of small individuals (recruits or juveniles) for the three of them. These results are within the ranges of those found for these species in this series, except for Spanish ling that exhibited a marked recruitment peak in 2004. In case of greater forkbeard, individuals smaller than 20 cm were not found at all, though very small recruitment peaks were observed in 2006 and 2007, and a large peak was only found in 2002 and could be tracked in subsequent years.

Geographical distributions of the species have the same patterns as in previous years. The only remarkable difference from lasts years is the low abundance of greater forkbeard in the southeastern part of the study area, where in previous years its abundance was comparable with the rest of the area.

WD8

This paper presents the available information of the red sea bream fishery in the Strait of Gibraltar and provides the data on data landings, lpue, length frequencies and biological information useful for species' stock assessment.

Fishery data demonstrate a continuous increase of the landings with a maximum in 1994. Since 1994 landings have gone decreasing (except for 1996 and 1997) reaching the lowest value in 2002. Since 2003 upward trend in landings was observed with highest value in 2008. Efforts demonstrated similar tendency.

The fishery resource suffers a decrease of the landed mean length mainly from 1995 to 1998. The mean length in the landings progressively increased from 1999 to 2003 with subsequent decreasing. During last three years upward trend of mean length occurs again.

Von Bertalanffy growth parameters estimates for red sea bream are: L_∞= 62 cm (fixed from the largest observed sample), k= 0.162 and t_0= -0.337 (r^2=0.94). The relationship between the length of the individuals and its respective weight is: Total Weight (g) = 0,014*[Total Length (cm)]^{3,014}.

The spawning season seems to take place during the first quarter of the year. The smallest specimens are mainly males maturing at a L_{50}=30.1 cm. Females are maturing at L_{50}=35.1 cm. All individuals older than 5 years could be considered as mature ones.

WD9

This document provides data on catches of deep-water species by Russian vessels by species and new ICES statistical areas. In 2008 the Russian deep sea directed fisheries in the North-East Atlantic were mainly carried out in the Faroese Fishing Zone and in the Rockall area as well as occasionally on the Lousy Bank and Mid-Atlantic Ridge. In other areas deep-water fish were taken as bycatch. Total Russian catch of deep-water fish in 2008 amounted 1345 t.

WD10

This paper provides the information on 2008 landings of deep-water species caught off mainland Portugal (Sub-area IX) by type of fisheries and also by landing ports. Landings from trawl fishery composed of at least 37 species of fish and invertebrates. The most important targets are axillary sea bream *Pagellus acarne*, nursehound *Scyliorhinus stellaris*, deep-water shrimp *Aristeopsis edwarsiana*, megrim *Lepidorhombus whiffiagonis*, and *Scyliorhinus* spp. The landings of deep-water species from pure seine fishery were minor and comprised mostly axillary sea bream and angular roughshark *Oxynotus centrina*. Landings of other species are insignificant. Artisanal fishery provides the major contribution to total landings of deep-water species off mainland Portugal. The leading position belongs to black scabbard fish followed by European conger, shortfin mako, axillary sea bream, wreckfish, forkbeard *Phycis phycis*, nursehound, bluemouth, and leafscale gulpershark *Centrophorus squamosus*. Other species were landed in considerably lesser amounts.

WD11

This working document describes the results of 2008 acoustic survey and 2003–2008 bottom-trawl surveys conducted on Norwegian continental slope in regard to obtain data on distribution, biomass and length composition of greater silver smelt.

As the goal in the 2008 survey was to find dense registrations for the acoustical studies the length distributions are closer to represent typical fisheries operation rather than being representative for the population in the area. For the sampling a short duration of trawling with limited catches is to be preferred. There was however a concern about relatively long face of pelagic fishing affecting species composition in the greater argentine trawl, which in essence is a pelagic trawl. After experimentation on short duration of trawling, a strategy of longer 2–4 hours trawling at bottom was applied. The length distributions from the bottom-trawl surveys demonstrated in general substantially more of larger fish than found in most trawl hauls of the 2008 April survey, and greater argentine less than 30 cm in length was scarce in these surveys. A marked seasonal difference in length distribution cannot be spotted from the length distributions in the bottom-trawl surveys. The specialized greater argentine trawl is not recommended in preference to bottom trawls for ordinary surveys aimed for estimation on distribution and biomass. The data from the bottom-trawl surveys do not indicate that larger greater argentine are getting less present in later years.

WD12

This working document presents cpue from the groundfish surveys for cod, haddock and saithe for blue ling, ling and tusk; cpue from logbooks for blue ling, ling, tusk, roundnose grenadier and black scabbard fish; length distributions from landings for blue ling, ling and tusk; age distribution from landings for ling.

Both datasets from groundfish surveys and cpue from otterboard trawlers demonstrate gradual decreasing of blue ling relative abundance since 2006. Survey indices and cpue from longliners testify increasing of ling relative abundance during several recent years. 2008 cpue from pairtrawlers conversely was lower as compared with that in 2007. Tusk cpue in 2008 summer survey was higher than in previous year, whereas summer survey revealed converse results. Cpue from longliners in 2008 was also lower than in 2007. Roundnose grenadier cpue series from otterboard trawlers demonstrate gradual increasing from 2000 till 2006. 2008 value was considerably lower than in previous year. Black scabbardfish cpue series demonstrated rather stable situation during 3 recent years with slight upward trend since 2005.

WD13

This document resumes the available information, by species, from the Azores deep-water fishery for the 2007 and 2008.

The bulk of landings of deep-water species off the Azores during recent year was represented by red sea bream followed by wreckfish, European conger, bluemouth, alfonsinos, and common mora. The total landings of deep-water species in this area comprised about 3 thousand t. Analysis demonstrated that 2008 landings were slightly lower than those in previous year and still less than those in 1992–1999.

Data available allow the analysis of multy-annual landings dynamics for 9 deep-sea species since 1980. Present values of annual landings are significantly lower than those in the 1990s for alfonsinos, bluemouth, silver scabbardfish and Spanish ling. At the same time, there is well-pronounced positive trend during recent years of red sea bream, alfonsininos and wreckfish landings. Landings of offshore rockfish do not demonstrate any certain pattern and its recent landings are similar to those in the late 1980s or late 1990s.

The analysis of relative abundance indices demonstrated that during recent years positive trends observed in relation to red sea bream, alfonsino, bluemouth, offshore rockfish, and wreckfish. At the same time, relative abundance of splendid alfonsino and silver scabbardfish considerably decreased recently.

Length compositions of alfonsinos and red sea bream are provided.

WD14

This paper presents fisheries and biological data on greater silver smelt in Faroese waters (Division Vb) and species' stock assessment.

A preliminary assessment calculates the greater silver smelt stock to be about 100 to 200 thousand tonnes. This will give a production of about 11 to 21 thousand tonnes a year. The fishery is biologically sustainable because only the production is fished upon. The average landings (1995–2008) are below 11 thousand tonnes and the landings in 2008 are below 19 thousand tonnes.

The length and age distribution in the landings demonstrated a decrease from 1994 to 1999, since then, the distribution has been about the same. The decrease in distribution is probably a response to fishery. There is continuous recruitment to the stock, because the spawning biomass is at least half of the total biomass. Catch per unit effort from logbooks demonstrates no decrease; it is about 2500 kg/h.

It is very important to follow the stock in future to ensure that the fishing pressure is not too high for a sustainable fishery.

WD15

This working document analyses effect of discards on roundnose grenadier stock assessment in the Northeast Atlantic.

Landings data are often used as substitutes of catch data in stock assessments. When a significant proportion of the catch is discarded, this is likely to provide underestimated stock size. Discards of roundnose grenadier *Coryphaenoides rupestris* in the Northeast Atlantic account for about 30% of the catch in weight. Scarce discard data available through observer programmes for the period 1996 to 2005, exhibit relatively stable length distributions and discard rates. In contrast, landings data available since 1990 demonstrate that the average pre-anal length has decreased from 20.7 cm in 1990 to 15.7 cm in 2007 resulting in a 50% reduction of the mean individual weight (980 g in 2007) and an increasing occurrence of overlapping class sizes between landings and discards in recent years. A series of separable virtual population analysis stock assessments were carried out using catch datasets reconstructed from information on landings, discards, fishing effort and bathymetric distribution of the stock. Several hypotheses were explored in order to estimate missing catch data. The results indicated that the assumption of stable length distributions of discards was acceptable in recent years, but for the early 1990s, the resulting length distributions of the total catch were bimodal which was not realistic considering the slow growth and longevity of roundnose grenadier. Therefore, the length distribution of discards must have been different in the early years of the fishery (1990 to 1997) with larger individuals being discarded. This could indicate pickier behavior of fishers when larger fish were more abundant. With decreasing individual sizes in the catches, some size classes that may have been discarded at the start of the fishery might have been landed in recent years. Alternatively, the changes could result from changes in fishing depths which also occurred over time. Both hypotheses were explored through a second series of assessments. Integrating discards into the assessment of roundnose grenadier leads to higher estimates of the stock biomass. Two different methods based on independent data suggest discarded individuals were larger at the beginning of the fishery in the early 1990s. Until recently, stock assessment has mostly been carried out based upon landing data worldwide. Catch data, i.e. including landings and discards are becoming available in several fisheries thanks to the implementation of on-board observation programmes. Fishing mortalities derived from catches are expected to be more reliable than those based on landings. This could be a serious problem for a species such as the roundnose grenadier where numerous age groups are exploited and a wide range of length classes are subject to both landings and discards. Nevertheless, the stock biomass trends estimated are consistent over all methods, suggesting that they are all capable to track the strong declining trend in the stock. The declining trends appear slightly lesser when accounting for discards.

WD16

This paper reports on results of exploratory stock assessment on tusk in Va using GADGET, shorthand for Globally applicable Area Disaggregated General Ecosystem Toolbox, which is a statistical model of marine ecosystems. GADGET is a simulation model designed as a multispecies-multiarea model but can also be used as a single species model. What distinguishes this model from the most stock assessment models such as XSA is that both age and length are modelled which then requires the fish growth (length and weight) to be modelled.

Gadget can use various types of data that can then be included in the objective function. Length distributions, age length keys, survey indices by length or age, cpue data, mean length and/or weight-at-age and stomach content data. Importantly the model can be used for stocks such as tusk where data are not sampled regularly enough to calculate annual catch in numbers by age, or where age readings are not considered reliable.

It was attempted with the use of GADGET to estimate the number of parameters (totally 45) such as number of fish when simulation starts (8), recruitment each year (30), length at recruitment (2), parameters of the growth function (2), parameter β controlling the spread of the length distributions (1), selection pattern of the commercial catches (2).

The GADGET run presented is strictly preliminary and various model settings and data aggregation setup have to be explored in future.

WD17

This working document presents results of Russian biological studies of deep-water fish based on the data collected in 2008 during 7 cruises of fishing and research vessels. Most data were gathered in experimental fishery for deep-water fish in the area west of the British Isles. In other areas samples were occasionally taken during research cruises for demersal and pelagic species and by observers placed on board fishing vessels.

Selected biological characteristics (length composition, maturity, diet composition) are presented for ling (II, Vb, VIb1), blue ling (Vb, VIb1), tusk (II, Vb), roundnose grenadier (VIb1, VIb2), greater forkbeard (Vb), bluemouth (Vb, VIb1), roughhead grenadier (II, Vb, XIVb2), common mora (Vb), and rabbitfish (Vb).

WD18

This paper presents results of the analysis of haul by haul data for blue ling that can be used for species' stock assessment.

A database of tally book (from skipper own logbooks) was provided by the French industry (PROMA/PMA, a producers organization and EURONOR, a ship owner). For each haul, total catch, catch by species, tow duration, depth and location were reported. The database provides more accurate data than EU logbooks (haul by haul instead of fishing sub-trip combining 3 to 5 hauls) and, most importantly includes depth, which is a major factor for blue ling catches. Based on these data blue ling Landings per Unit of Effort (lpues) were estimated for four areas to the West of Scotland, defined previously based upon logbook data.

Generalised Additive Models were used to estimate the lpue is each area. The explanatory variables were: depth, engine power, statistical rectangle, year and area with an interaction between these two variables (i.e. a different year effect was fitted per area with no general year or area effect). Model were fitted on four different data subsets: the full database, tows carried out during the spawning season, tows outside the spawning season and tows where blue ling was a bycatch of other deep-water fishing.

As a consequence of data availability, estimates could be made for 2000–2007 for all areas and for 1993–2008 for the slope to the West of Scotland. The results indicate that blue ling lpue have been mainly stable over recent years, and possibly back to 1993 for the west of Scotland slope. The data subset for tows where blue ling was caught as a bycatch was believed the most reliable because it included only catches from not aggregated fish (unlike catches on spawning aggregations). The results for this "bycatch" data subset were similar to the result for tows outside spawning season.

Table 3.5.1. Summary of working documents presented at the WGDEEP 2009 (9–16 March 2009).

№ of WD	Author(s)	Title	Country	ICES division and subarea	Topic
WD1	Lionel Pawlowski, Pascal Lorance, Franck Evrat, Antonie Le Garrec, Julien Lamonthe	Collection process and validation of haul by haul data: a partnership between science and industry	France	V, VI	Fishery data analysis
WD2	Kristin Helle, Odd Aksel Bergstad, Michael Pennington	Estimates of effort, cpue, and mean length for the Norwegian commercial catch of ling, blue ling and tusk	Norway	I, IIa, IIb, IIIa, IVa, IVb, Va, Vb, VIa, VIb, VIIc, XII, XIVb	Ling, blue ling and tusk fishery data analysis
WD3	Odd Aksel Bergstad, Hege Øverbø Hansen, Terje Jørgensen	Fisheries-independent information on temporal variation in abundance, size structure, recruitment and distribution of the roundnose grenadier Coryphaenoides rupestris, 1984-2009	Norway	IIIa, IVa	Long-term variations of roundnose grenadier abundance, size structure, recruitment and distribution
WD4	Ivone Figueiredo, Iñes Farias	Fishing effort standardization of black scabbardfish commercial data from ICES division IXa – period 1995-2008	Portugal	IXa	Analysis of multi-annual black scabbardfish LPUE data
WD5	Ivone Figueiredo	APHACARBO project	Portugal	IXa, Xa2	Studies on stock structure, reproduction, age and growth, bioaccumulation and fisheries of black scabbardfish
WD6	Ana Cláudia Fernandes, Dina Silva, Elisabete Henriques, Graça Pestana	Discards on Portuguese set longlines fishery targeting black scabbardfish	Portugal	IXa	Discards on black scabbard longline fishery
WD7	F. Velasco, M. Blanco, F. Baldo, J. Gil	Results on argentine (Argentina spp.), bluemouth (Helicolenus dactylopterus), greater forkbeard (Phycis blennoides) and spanish ling (Molva macrophthalma) from 2008 Porcupine bank (NE Atlantic) survey	Spain	VIIc2, VIIk2	Spatial distributions, relative abundance and length frequencies of argentines, bluemouth, greater forkbeard and blue ling
WD8	Juan Gil, Jesus Canoura, Candelaria Burgos, Carlos Farias	The red sea bream (Pagellus bogaraveo) fishery in the Strait of Gibraltar: Data updated for assessment of the ICES Sub area IX	Spain	IX	Updated fisheries and biological information for red sea bream stock assessment

№ of WD	Author(s)	Title	Country	ICES division and subarea	Topic
WD9	V.I. Vinnichenko, A.S. Mitina	Russian deep-sea fishery in the North-East Atlantic in 2008	Russia	I, IIa, IIb, Vb, VIb1, XIIc, XIVb2	Data on catches of deep-water species
WD10	Ivove Figueiredo, Iñes Farias	Information on deep-water species from mainland Portugal	Portugal	IXa	Data on landings of deep-water species
WD11	Elvar H. Hallfredsson, Ingvald Svellingen	Greater argentine research in Norway 2008	Norway	IIa2, IVa	Results of acoustic and bottom-trawl surveys on greater silver smelt
WD12	Lise H. Ofstad	Data on Faroese deep-sea fishery	Faroes	Vb	Fisheries and biological data on main deep-water species from groundfish surveys and landings
WD13	Mario Rui Pinho	Information of deep-water species from the Azores (Xa2)	Portugal	Xa2	Landings data, relative abundance trends of selected species, length compositions of alfonsinos and red sea bream
WD14	Lise H. Ofstad, Eidna I Homrum	Greater silver smelt (Argentina silus) in Faroese waters (Division Vb)	Faroes	Vb	Landings, distribution, biology and stock assessment of greater silver smelt
WD15	Lionel Pawlowski, Pascal Lorance	Effect of discards on roundnose grenadier stock assessment in the Northeast Atlantic	France	Vb, VI, VII	Analysis of data on landings, discards, fishing efforts and bathymetric distribution of roundnose grenadier stock to reconstruct catch data for stock assessment purpose
WD16	Gudmumdur Thordarson	Exploratory stock assessment on tusk in Va using GADGET	Iceland	Va	Use of GADGET statistical model to assess stocks of tusk in Icelandic waters
WD17	V.I. Vinnichenko, K.Yu. Fomin, A.M. Safronov, B.D. Zhivov, V.N. Mashkov	Russian investigations of deep-water fish in the Northeast Atlantic in 2008	Russia	IIa2, IIb2, Vb, VIb1, XIVb1, XIVb2	Biological data on deep-water species caught by Russian research and commercial vessels
WD18	Pascal Lorance, Lionel Pawlowski, Venera M. Trenkel	Analysis of haul by haul data for blue ling	France	V, VI, VII	Analysis of multi-annual fisheries data on blue ling positive hauls to identify trends of species' abundance

Table 3.6.2. Species information included in working documents presented at the WGDEEP 2009 (9–16 March 2009).

Species Common name Scientific name	WD 1	WD 2	WD 3	WD 4	WD 5	WD 6	WD 7	WD 8	WD 9	WD 10	WD 11	WD 12	WD 13	WD 14	WD 15	WD 16	WD 17	WD 18
Baird's smoothhead Alepocephalus bairdi						■			■									
Blue antimora Antimora rostrata																	■	
Black scabbardfish Aphanopus carbo				■	■	■			■	■		■					■	
Greater silver smelt Argentina silus									■		■			■			■	
Argentines Argentina spp.							■			■								
Elongate frostfish Benthodesmus elongatus						■												
Alfonsino Beryx decadactylus										■			■					
Splendid alfonsino Beryx splendens										■			■					
Alfonsinos Beryx spp.										■			■					
Tusk Brosme brosme		■							■			■				■	■	
Hollowsnout grenadier Caelorinchus caelorinchus						■												
Rabbitfish Chimaera monsrosa									■								■	
European conger Conger conger									■	■			■					
Roundnose grenadier Coryphaenoides rupestris			■			■			■			■			■		■	
Black cardinalfish Epidonus telescopus						■				■			■					
Threadfin grenadier Gadomus longifilis						■												
Bluemouth Helicolenus dactylopterus							■		■	■			■				■	
Orange roughy Hoplostethus atlanticus										■								
Mediterranean slimhead Hoplostethus mediterraneus										■								
Lepidion guentheri						■												
Silver scabbardfish Lepidopus caudatus										■			■					
Roughhead grenadier Macrourus berglax									■								■	
Blue ling Molva dypterygia	■	■							■			■					■	■

Species Common name Scientific name	WD 1	WD 2	WD 3	WD 4	WD 5	WD 6	WD 7	WD 8	WD 9	WD 10	WD 11	WD 12	WD 13	WD 14	WD 15	WD 16	WD 17	WD 18
Spanish ling Molva macrophthalma							■			■			■					
Ling Molva molva		■							■	■		■					■	
Common mora Mora moro													■				■	
Black gemfish Nesiarchus nasutus						■												
Axillary sea bream Pagellus acarne										■								
Red sea bream Pagellus bogaraveo								■		■			■					
Greater forkbeard Phycis blennoides						■	■		■	■			■				■	
Forkbeard Phycis phycis										■								
Forkbeards Phycis spp.										■								
Wreckfish Polyprion americanus										■			■					
Offshore rockfish Pontinus kuhlii										■			■					
Kaup’s arrowtooth eel Synaphobranchus kaupi						■												
Spearnose chimaera Rhinochimaera atlantica																	■	
Roughnose grenadier Trachyrincus scabrus						■											■	
Largehead hairtail Trichiurus lepturus										■								
Deepwater and other sharks						■			■	■								

4 Area overviews

4.1 Stocks and fisheries of Greenland and Iceland Seas

4.1.1 Fisheries overview

There is no directed fishery for any of the species dealt with in this Working Group in ICES XIV. A number of the species are, however, taken as very small bycatches in the fishery for Greenland halibut in XIVb. Roundnose grenadier is the only species for which catches have been reported though the years. There were no catches reported by Greenland in 2006 and other countries (EU, Norway) fishing in the area have reported catches of in total 79 tons of roundnose grenadier in 2006 to the Greenland authorities.

Since the mid-seventies stocks in Division Va have mainly been exploited by Icelandic vessels. However, vessels of other nationalities have also operated in the pelagic fishery on capelin, herring and blue whiting and few trawlers and longliners targeting for deep-sea redfish, tusk and ling have been operating in the region.

Fisheries in Icelandic waters are characterized by the most sophisticated technological equipment available in this field. This applies to navigational techniques and fish-detection instruments as well as the development of more effective fishing gear. The most significant development in recent years is the increasing size of pelagic trawls and with increasing engine power the ability to fish deeper with them. There have also been substantial improvements with respect to technological aspects of other gears such as bottom trawl, longline and handline. Each fishery uses a variety of gears and some vessels frequently shift from one gear to another within each year. The most common demersal fishing gear are otter trawls, longlines, seines, gillnets and jiggers whereas the pelagic fisheries use pelagic trawls and purse-seines. At present there are approximately 1400 Icelandic vessels operating in the fisheries. The definition of types of vessels may be very complicated as some vessels are operating both as large factory fishing for demersal species and as large purse-seiners and pelagic trawlers fishing for pelagic fish during different time of the year.

Demersal fisheries take place all around Iceland including variety of gears and boats of all sizes. The most important fleets targeting them are:

Large and small trawlers using demersal trawl. This fleet is the most important one fishing cod, haddock, saithe, redfish as well as a number of other species. This fleet is operating year around; mostly outside 12 nautical miles from the shore.

- Boats (<300 GRT) using gillnet. These boats are mostly targeting cod but haddock and a number of other species are included. This fleet is mostly operating close to the shore.
- Boats using longlines. These boats are both small boats (<10 GRT) operating in shallow waters as well as much larger vessels operating in deeper waters. Cod and haddock are the main target species of this fleet but a number of deep-sea species are also caught, some of them in directed fisheries.
- Boats using jiggers. These are small boats (<10 GRT). Cod is the most important target species of this fleet with saithe following as the second most important species.

- Boats using Danish seine. (20–300 GRT). The most important species for this fleet are cod and haddock but this fleet is the most important fleet fishing for a variety of flat fish like plaice, dab, lemon sole and witch.

The total catch in Icelandic waters in 2006 amounted to 874 thousand tonnes where pelagic fish amounted to 357 thousand tonnes, and deep-sea species amounted to around 18 000 tonnes (Figure 4.1.1; Table 4.1.1).

Total of 603 vessels reported landed of deep-sea species in 2006, from less than 10 kg to more than 1100 t, as can be seen in the table below:

2006	Ling	Blue ling	Tusk	Gr. silver smelt
No vessels	528	220	535	43
max catch	308	125	450	1143
min catch	< 0.1	< 0.1	< 0.1	< 0.2
Mean	11.9	7.9	9.5	113.5

4.1.2 Trends in fisheries

Tusk, ling and blue ling remains the most important "deep-sea species" in Icelandic waters. In recent years, about 120 vessels were engaged in these fisheries with registered catches from less than 100 kg to nearly 1000 tonnes. In 2007 about 7000 tonnes of deep-water species were caught in bottom trawl, whereof 4100 were greater silver smelt. There has been an increase in the landings of ling, tusk and blue ling in the last five years (Figure 4.1.1), the increase in the two former stocks as a consequence of increase in quota (a TAC is not set for blue ling). In 2008 the longline fishery for blue ling seems to have changed from almost a pure bycatch fishery to a more targeted fishery (Figure 4.1.3). This trend is against ICES advice (ACOM May 2008) which states that *"There should be no directed fisheries for blue ling in Areas Va and XIV and measures should be implemented to minimize bycatches in mixed fisheries. Blue ling is susceptible to sequential depletion of spawning aggregations and therefore closed areas to protect spawning aggregations should be maintained and expanded where appropriate."*

Table 4.1.1 gives the catches of the Icelandic fleet of the most important deep-sea species taken by different gears in 2007 and 2008 and Table 4.1.2 gives the total landings of deep-sea species from Sub-division Va since 1988.

4.1.3 Technical interactions

The ling, blue ling and tusk in Icelandic waters constitute only a minor portion of the total demersal removal from the Icelandic Ecosystem (Figure 4.1.2). These three species are to a large extent bycatch in fisheries targeting other species; both in the longline (Figure 4.1.3) and the bottom-trawl (Figure 4.1.4) fisheries. As stated above, this may be changing in the longline fishery for blue ling. Greater silver smelt on the other hand is targeted in the trawl fishery (Figure 4.1.4)

The geographical distribution of bottom-trawl catches of ling and blue ling overlap to a large extent with those that are the main target species, among other being Greenland halibut, *Sebastes sp*., saithe and cod (Figure 4.1.5).

However some limited targeted longline fishery of ling and in particular tusk takes place. For the latter species, there are indications that the fishery in the southwest of the Icelandic fishing area on the Reykjanes is directed at tusk, with relatively little catch of other species (Figure 4.1.6).

4.1.4 Ecosystem considerations

A number of recent initiatives have attempted to map the presence of cold-water corals in Icelandic waters through questionnaires to fisher and ROV surveys (ICES 2004, 2005 and 2006). *Lophelia pertusa* occurs near the shelf break off the south and west coasts at a depth range of 100–800 m in water temperatures of 5.5–7.3°C. Large coral areas are known on the Reykjanes Ridge, in the Hornafjarðardjúp deep and in the Lónsdjúp deep (SE Iceland). However, there were indications that the coral distribution has been significantly reduced in the last 20–30 years. Since January 1st 2006, 5 areas, covering 80 km^2 have been closed to all fishing except those targeting pelagic fish.

4.1.5 Management measures

The Ministry of Fisheries is responsible for management of the Icelandic fisheries and implementation of the legislation. The Ministry issues regulations for commercial fishing for each fishing year, including an allocation of the TAC for each of the stocks subject to such limitations.

A system of transferable boat quotas was introduced in 1984. The agreed quotas were based on the Marine Research Institute's TAC recommendations, taking some socio-economic effects into account, as a rule to increase the quotas. Until 1990, the quota year corresponded to the calendar year but since then the quota, or fishing year, starts on September 1 and ends on August 31 the following year. This was done to meet the needs of the fishing industry.

In 1990, an individual transferable quota (ITQ) system was established for the fisheries and they were subject to vessel catch quotas. The quotas represent shares in the national total allowable catch (TAC) for each species, and most of the Icelandic fleets operate under this system.

With the extension of the fisheries jurisdiction to 200 miles in 1975, Iceland introduced new measures to protect juvenile fish. The mesh size in trawls was increased from 120 mm to 155 mm in 1977. Mesh size of 135 mm was only allowed in the fisheries for redfish in certain areas. Since 1998 a mesh size of 135 is allowed in the codend in all trawl fisheries not using "Polish cover". A quick closure system has been in force since 1976 with the objective to protect juvenile fish. Fishing is prohibited for at least two weeks in areas where the number of small fish in the catches has been observed by inspectors to exceed certain percentage. If, in a given area, there are several consecutive quick closures the Minister of Fisheries can with regulations close the area for longer time forcing the fleet to operate in other areas. Such permanent closure took place at several places along the south–southeast area for tusk in 2003 (Figure 4.1.5). Inspectors from the Directorate of Fisheries supervise these closures in collaboration with the Marine Research Institute. In 2005, 85 such closures took place.

In addition to allocating quotas on each species, there are other measures in place to protect fish stocks. Based on knowledge of the biology of various stocks, many areas have been closed temporarily or permanently aiming at protect juveniles. Figure 4.1.7 shows map of such legislation that was in force in 2004. Some of them are temporarily, but others have been closed for fishery for decades.

Table 4.1.1. Overview of the Icelandic deep-sea landings (in tonnes) in Icelandic waters (Va) in 2007 and 2008 by gear type.

Species	Fishing Gear	2007	2008
Ling	Bottom trawl	1395	1509
	Danish seine	238	290
	Gillnet	633	476
	Lobster trawl	243	416
	Long-line	4042	5002
	Other gears	49	35
	Total	6600	7736
Blue ling	Bottom trawl	1483	2081
	Danish seine	44	54
	Gillnet	22	28
	Lobster trawl	55	29
	Long-line	375	1454
	Other gears	17	7
	Total	1995	3653
Tusk	Bottom trawl	95	114
	Gillnet	38	43
	Hook	9	5
	Lobster trawl	9	12
	Long-line	4833	6756
	Other gears	2	2
	Total	5986	6932
Greater silver smelt	Bottom trawl	4108	8774
	Pelagic trawl	108	4
	Total	4226	8778

Table 4.1.2. Total landings of deep-sea species in ICES Sub-divison Va.

SPECIES	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ALFONSINOS (Beryx spp.)																				0	0
ARGENTINES (Argentina silus)	206	8	112	247	657	1255	613	492	808	3367	13387	6704	5657	3043	4960	2683	3645	4481	4775	4227	8778
BLUE LING (Molva dypterigia)	2171	2533	3021	1824	2906	2233	1632	1635	1323	1344	1154	1877	1711	941	1377	1158	1204	1539	1836	2162	3788
BLACK SCABBARDFISH (Aphanopus carbo)							1			1		9	18	8	13	0	0	19	23	1	0
BLUEMOUTH (Helicolenus dactylopterus)																				0	0
GREATER FORKBEARD (Phycis blennoides)																		0	0	1	3
LING (Molva molva)	5861	5612	5598	5805	5116	4854	4604	4192	4060	3933	4302	4647	3743	3346	4518	4264	4606	4488	7405	7640	9284
MORIDAE																			0	0	0
ORANGE ROUGHY (Hoplostethus atlanticus)				65	382	717	158	64	40	79	28	14	68	19	10	+		9	2	0	4
RABBITFISH (Chimaerids)				499	106	3	60	106	21	15	29	2	5						1	1	1
ROUGHHEAD GRENADIER (Macrourus berglax)									15	4	1		2	1	4	33	3	5	7	2	0
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	2	4	7	48	210	276	210	398	140	198	120	129	54	40	60	57	181	76	62	16	29
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)																				0	0
SHARKS, VARIOUS		31	54	58	70	39	42	45	65	70	87	45	45	57				54	0	2	43
SILVER SCABBARDFISH (Lepidopus caudatus)																				0	0
SMOOTHHEADS (Alepocephalidae)					10	3	1	1												0	0
TUSK (Brosme brosme)	6855	7061	7291	8732	8009	6075	5824	6225	6102	5394	5171	7264	6391	4823	5578	5596	4836	3842	6599	7552	8637
WRECKFISH (Polyprion americanus)																				0	0

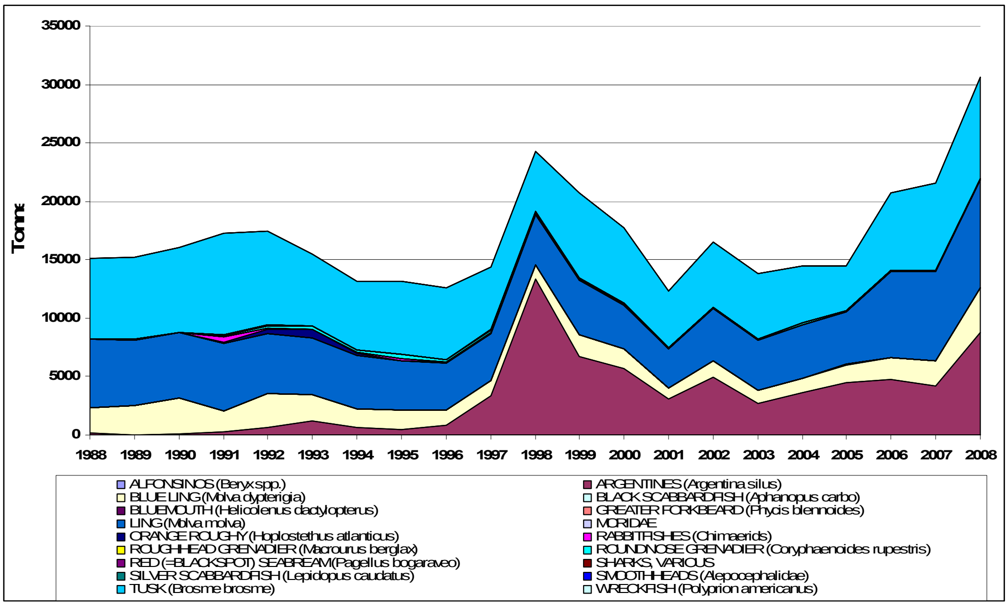


Figure 4.1.1. Fishery of deep-sea species in sub-Division Va 1988–2008, by species.

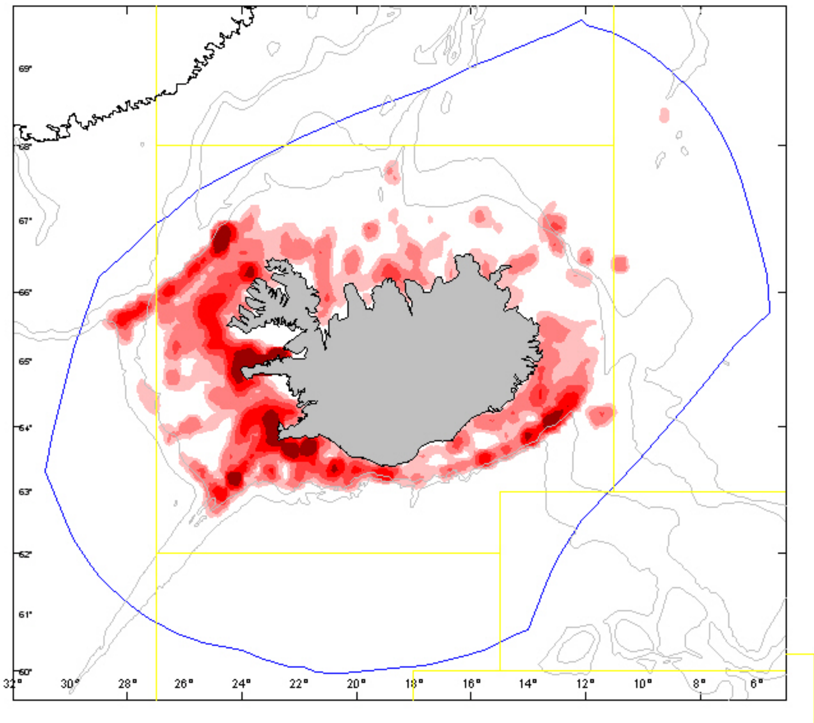


Figure 4.1.2. The spatial distribution of the total removal of all species by the Icelandic demersal fishing fleet in the Icelandic EEZ in 2007. The EEZ is shown as a blue line, regular thin lines show major ICES areas and contour lines indicate 500 and 1000 m depth.

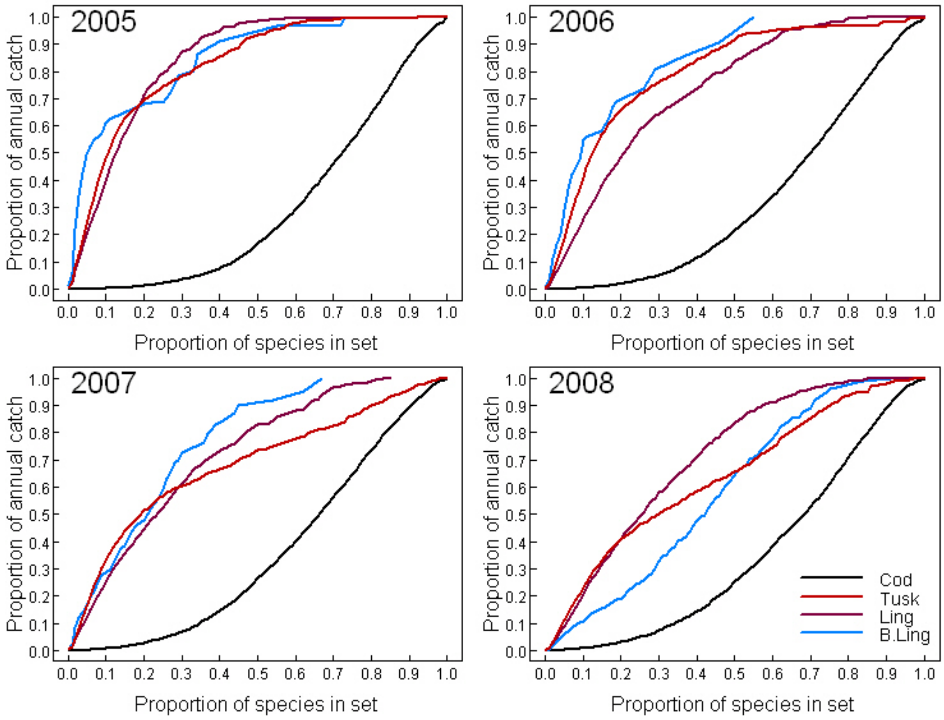


Figure 4.1.3. Cumulative plot for longline in 2005–2008. An example describes this probably best. Looking at the figure for 2005 above it can be seen from the solid line that 50% of the catch of ling comes from sets where tusk is less than 15% of the total catch whereas only unsignificant % of the catch of cod sets where it is less than 15% of the total catch in each set. Over 90% of ling catches are caught where ling is less than about 30% of total catches in given set. For comparison, only around 15% of cod is caught in sets where cod is less than 50 % of the total catch.

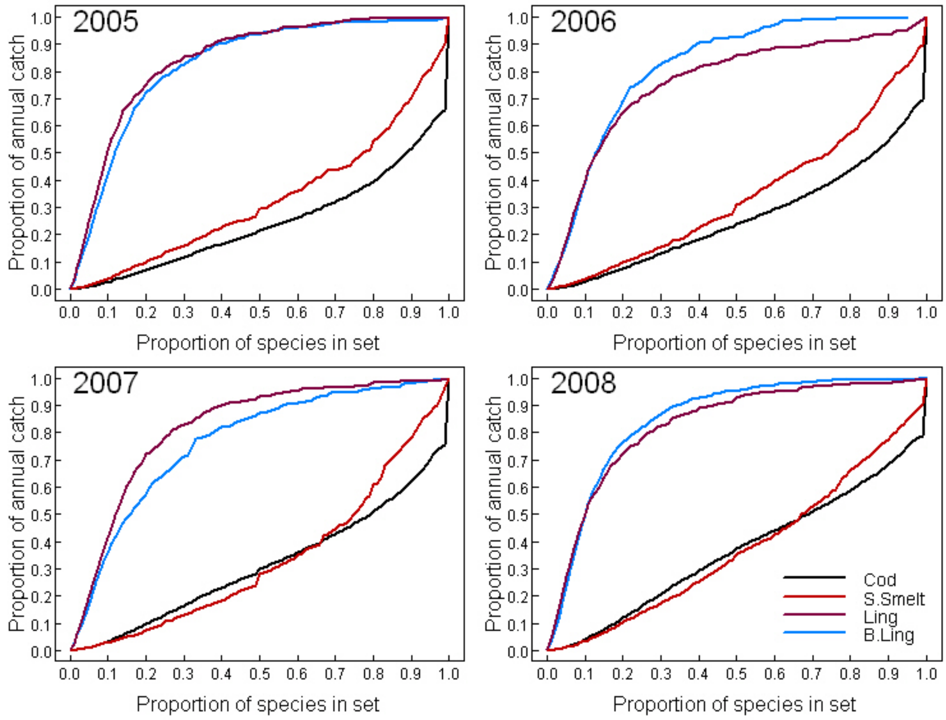


Figure 4.1.4. Cumulative plot for bottom trawl in 2005–2008. See Figure 5.1.2 for details.

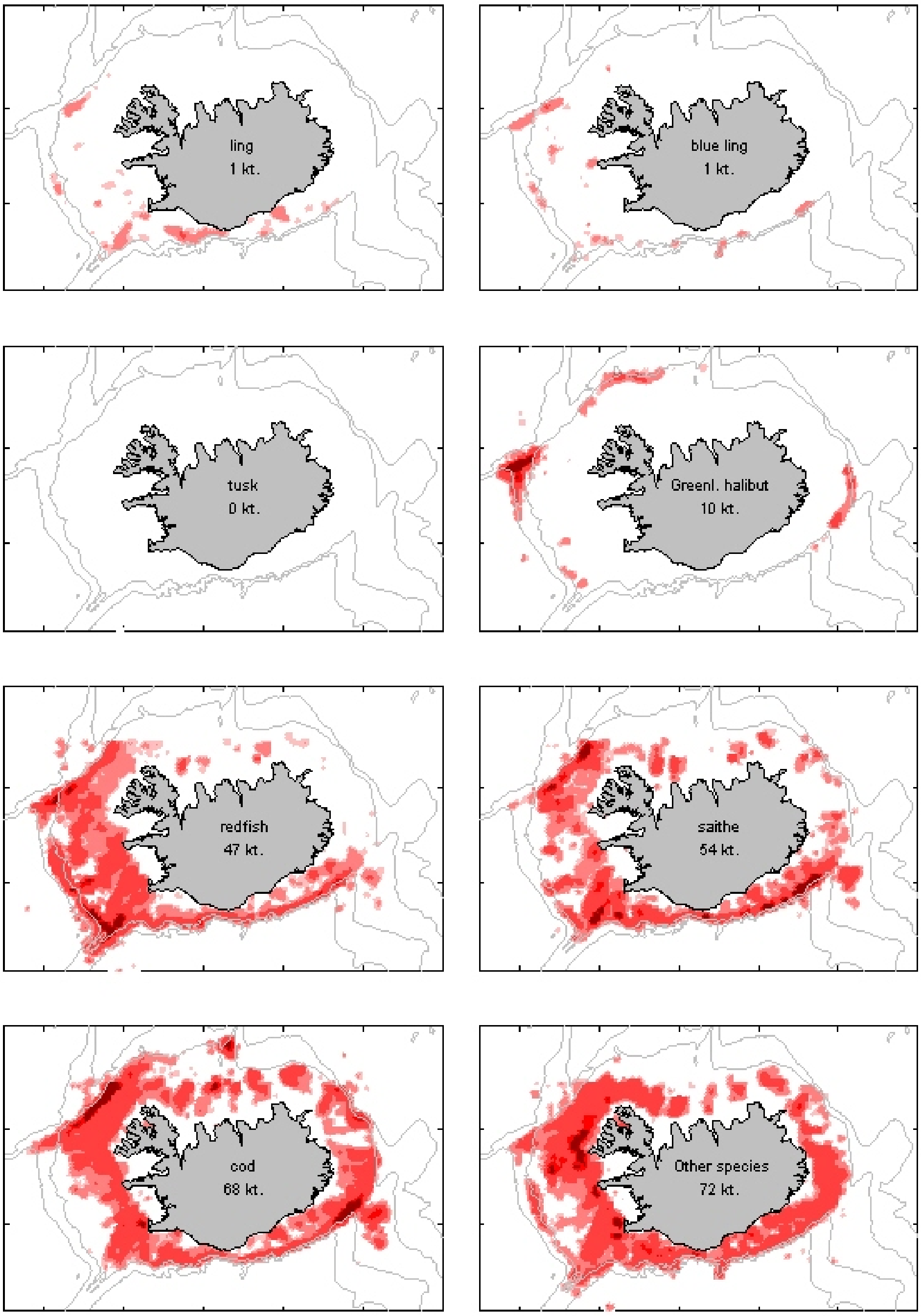


Figure 4.1.5. Spatial distribution of the removal of various species by the bottom trawling in 2007. The densities scale is comparable among the figures. The total catch by species is shown in units of thousand tonnes (kilotonnes). The grey lines correspond to 500 and 1000 meter depth contours.

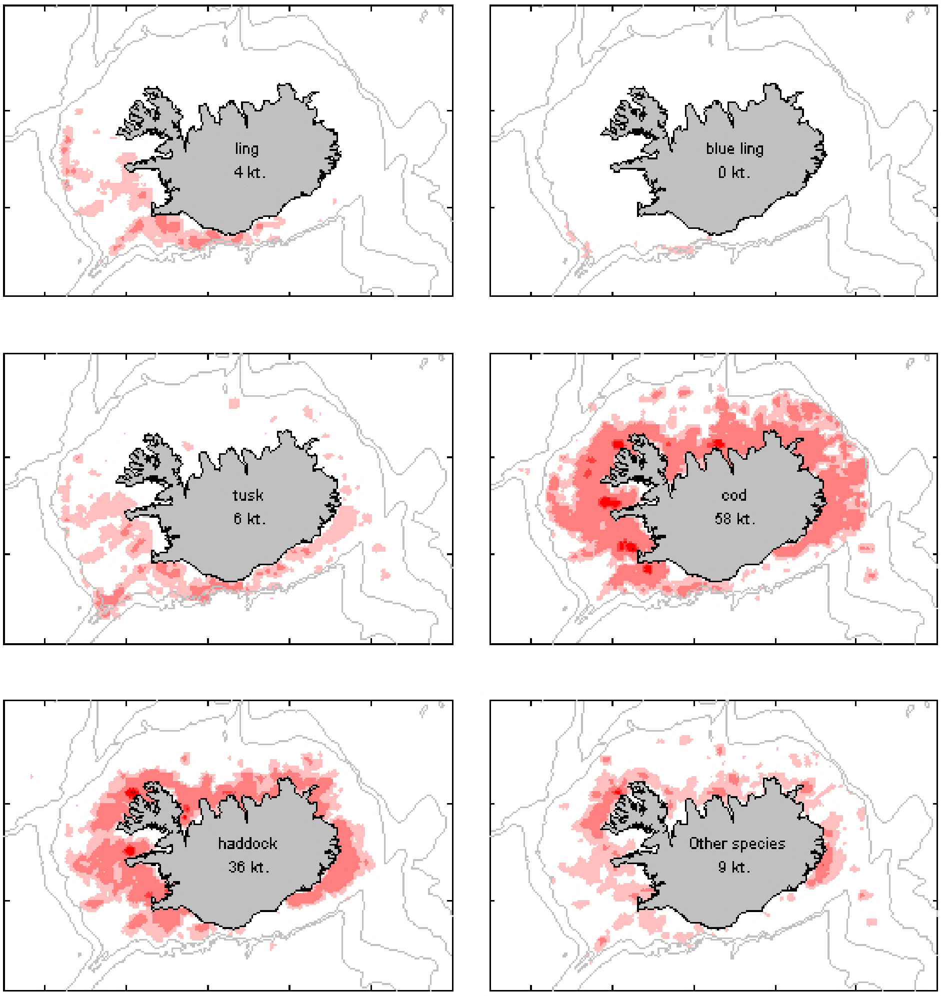


Figure 4.1.6. Spatial distribution of the removal of various species by the long lining in 2007. The densities scale is comparable among the figures. The total catch by species is shown in units of thousand tonnes (kilotonnes). The grey lines correspond to 500 and 1000 meter depth contours.

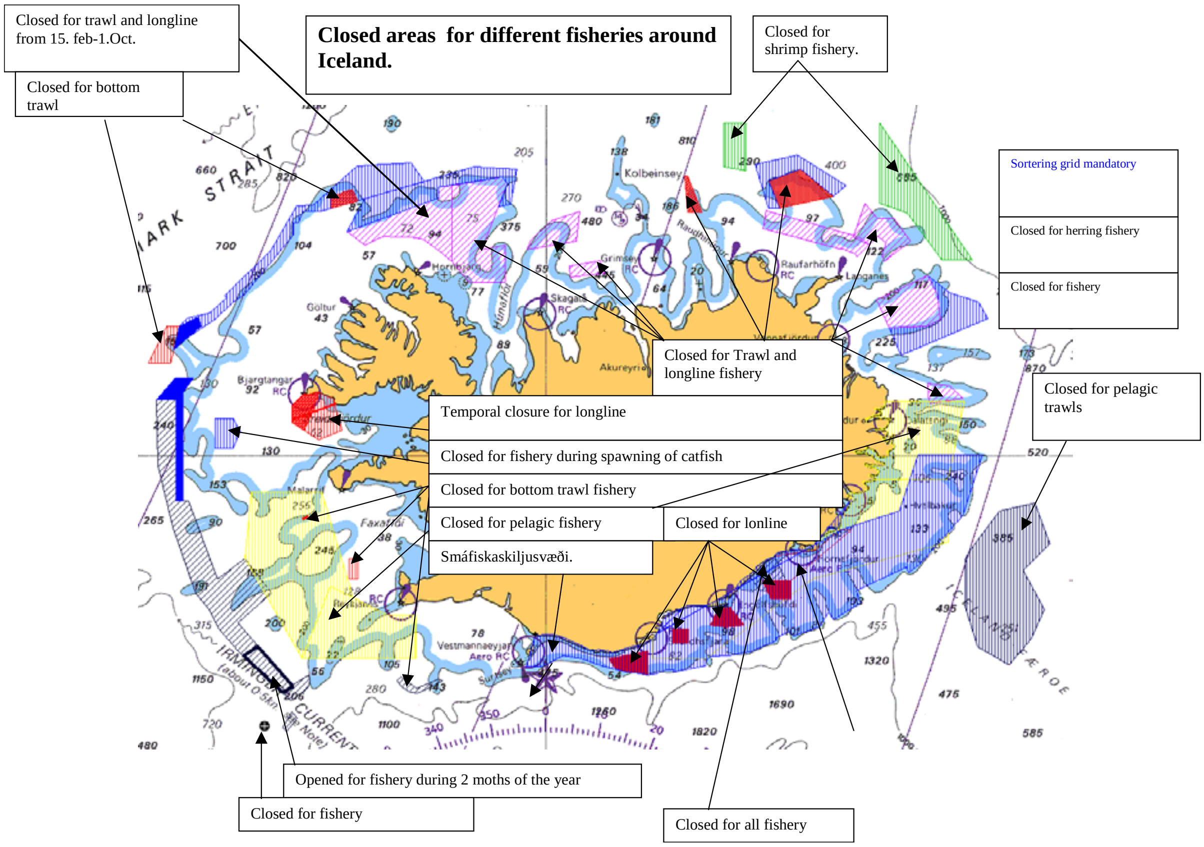


Figure 4.1.7. Overview of closed areas around Iceland. The boxes are of different nature and can be closed for different time period and gear type.

4.2 Stocks and fisheries of the Barents Sea and Norwegian Sea

4.2.1 Fisheries overviews I and II

In Subareas I and II three species, ling (*Molva molva*), tusk (*Brosme brosme*) and Greater silver smelt (*Argentina silus*) make up almost 99 per cent of the landed catches (Table 4.2.1 and Figure 4.2.1). Ling and tusk are mainly caught by longliners and a small proportion is caught in gillnets. Greater silver smelt are caught by bottom and mid-water trawls in almost equal amounts. Minor catches of other species, which are mainly taken as bycatches, include roughhead grenadier (*Macrourus berglax*), greater forkbeard (*Phycis blennoides*), roundnose grenadier (*Coryphaenoides rupestris*), rabbit-fish (Chimaerids) and blue ling (*Molva dypterigia*). Norway lands by far the largest amount of the three species. The Faroes, France, Germany, Russia, Scotland, Ireland and England and Wales report small bycatch landings of ling, blue ling and tusk. Occasional landings of these species in the direct fishery for greater silver smelt were reported by the Netherlands and as bycatches by Germany, Russia, Scotland and the Faroes.

Longline fisheries

The longline fishery for ling (*Molva molva*) and tusk (*Brosme brosme*) has for many years been the most targeted deep-sea fishery in Norway (e.g. Bergstad and Hareide, 1996). The number of fishing vessels over 21 m targeting ling, tusk and blue ling has declined from 72 in 2000 to 36 in 2008 (Table 4.2.2). The number of vessels declined during this period mainly as a consequence of changes in the laws concerning quotas for catching cod.

Trawl fisheries

Argentina silus has been targeted in trawl fisheries off mid-Norway (Division IIa) since the late 1970s. This fishery has continued, as described in ICES C.M. 1996/ Assess:8, but the effort directed at *A. silus* varies and is highly correlated with market demand. In Division IIa landings declined from approximately 10 000–11 000 t in the mid 1980s to about half that level in the early 1990s. During the period 2004–2006 there was a large increase in landings resulting in a 2007 Norwegian TAC set to 12 000 tons. The landings in 2008 have decreased to a level below the TAC.

In the late 1990s there used to be a minor trawl fishery in mid-Norway (IIa) targeting roundnosed grenadier *Coryphaenoides rupestris* and *Argentina silus*. Details on this fishery were given in the report of the EC FAIR project (Gordon, 1999). This fishery is no longer executed.

Gillnet fisheries

There is a targeted gillnet fishery for ling (*Molva molva*) on the upper slope off mid-Norway (Area IIa). This fishery started in 1979 as a targeted fishery for blue ling. The catches of blue ling declined throughout the following decade to the extent that the fishery has since the 1990s become almost entirely focused on ling.

4.2.2 Trends in fisheries

Landing statistics for Sub-areas I and II for the period 1988–2008 are given in Table 4.2.1.

Tusk, ling and blue ling

There was a steady decline in the landings of tusk during the period 1988 through 2005 and the landed catches have declined from almost 20 000 tons at the end of the eighties to about 7000 tons in 2005. During the three last years the reported catches has increased significantly and the preliminary catches for 2008 is almost 12 000 t. The landings of ling have remained stable at between 7000 and 8000 tons, but also ling had an increase in the 2006 landings to almost 9000 tons and in 2008 the landings passed 11 300 tons. Blue ling landings declined markedly from 1988 through 1993, and the catches have been at a low level until 2008 (Figure 4.2.2).

Greater silver smelt

During the period 1988–2000 there was a slight downwards trend in the landed catches. In 2000, 2004 through 2006 there was a doubling in the landed catches to about 22 000 tons. Preliminary data demonstrate that the catches have declined to about 12 000 tons in 2008 (Figure 4.2.2).

4.2.3 Ecosystem considerations

Along the coast of northern Norway and in the Norwegian Sea a large number of coral reefs have recently been discovered. These are Lophelia reefs that represent an important natural resource with a high associated biodiversity and great abundance of fish. To protect the coral reefs from destruction caused by fishing activities the fishers have been urged to be careful when fishing close to the reefs. Five areas have also been closed to fisheries using towed gears, but longliners can fish in these areas.

Cold-water corals are particularly abundant along the Norwegian Continental shelf, between 200–400m depths. Fosså *et al*., 2000 estimated that between 1500–2000 km^2 of the Norwegian EEZ is covered by this habitat. Recent surveys using ROVs and manned submersibles have also found dense populations of gorgonian corals *Paragorgia arborea* and *Primnoa resedaeformis* associated with *Lophelia* pertusa (ICES, 2006). These reefs represent an important natural resource with a high associated biodiversity and a high abundance of fish. However, it was estimated that between 30 and 50% of the Norwegian reef areas have been impacted by trawling (Fosså *et al*., 2000). A number of areas have been closed to towed fishing gears although long lining is still permitted. While such static gear has a smaller impact than trawling, increased intensity of such activity has the potential, over time, to cause significant damage through localized physical destruction of the coral structure from anchors and snagged gear.

A number of seamounts occur in these areas. Two are listed in the WGDEC 2006 report, Eistla and Gjalp, both with summit depths below the daytime depth of the deep-scattering layer, but at depths shallower than 2000 m. Little is known about the fauna of these seamouts or the level of fishing activity, but such habitats are known generally to be areas where there are often higher levels of productivity with associated dense aggregations of fish.

4.2.4 Management measures

There is no regulation of the Norwegian fishery for ling, tusk and blue ling in subareas I and II.

The Norwegian greater silver smelt fishery has since 2007 been regulated by a Norwegian TAC.

The EU sets TACs and quotas applicable to EC vessels fishing in community waters and international waters of Sub-area I and II.

Table 4.2.1. Overview of landings in Sub-Areas I and II.

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ALFONSINOS (Beryx spp.)																					
ARGENTINES (Argentina silus)	11 351	8390	9120	7741	8234	7913	6807	6775	6604	4463	8261	7163	6293	14 369	7407	8917	16 162	17 093	21 685	13 273	11 876
BLUE LING (Molva dypterigia)	3537	2058	1412	1479	1039	1020	422	364	267	292	279	292	252	209	150	148	175	198	202	262	329
BLACK SCABBARDFISH (Aphanopus carbo)																					
BLUEMOUTH (Helicolenus dactylopterus)																					
GREATER FORKBEARD (Phycis blennoides)			23	39	33	1								8	318	155	75	51	49	47	116
LING (Molva molva)	6126	7368	7628	7793	6521	7093	6322	5954	6346	5409	9200	7651	5964	4957	7132	6157	6560	6313	8845	10 338	11 320
MORIDAE																					
ORANGE ROUGHY (Hoplostethus atlanticus)																					
RABBITFISH (Chimaerids)												1	6	5	15	57	21	66	28	63	82
ROUGHHEAD GRENADIER (Macrourus berglax)			589	829	424	136				17	55		48	94	29	77	79	77	78	50	55
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)		22	49	72	52	15	15	7	2	106	100	46		2	12	4	27	13	8	12	10
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)																					
SHARKS, VARIOUS	37	15											1								
SILVER SCABBARDFISH (Lepidopus caudatus)																					
SMOOTHHEADS (Alepocephalidae)																					
TUSK (Brosme brosme)	14 403	19 350	18 628	18 306	15 974	17 585	12 566	11 617	12 795	9426	15 353	17 183	14 008	12 061	12 191	7940	7426	7050	9988	10 744	11 913
WRECKFISH (Polyprion americanus)																					

Table 4.2.2. Number of vessels exceeding 21 m in the Norwegian longliner fleet during the period 1995–2008.

Year	Number of longliners
1995	65
1996	66
1997	65
1998	67
1999	71
2000	72
2001	65
2002	58
2003	52
2004	43
2005	39
2006	35
2007	38
2008	36

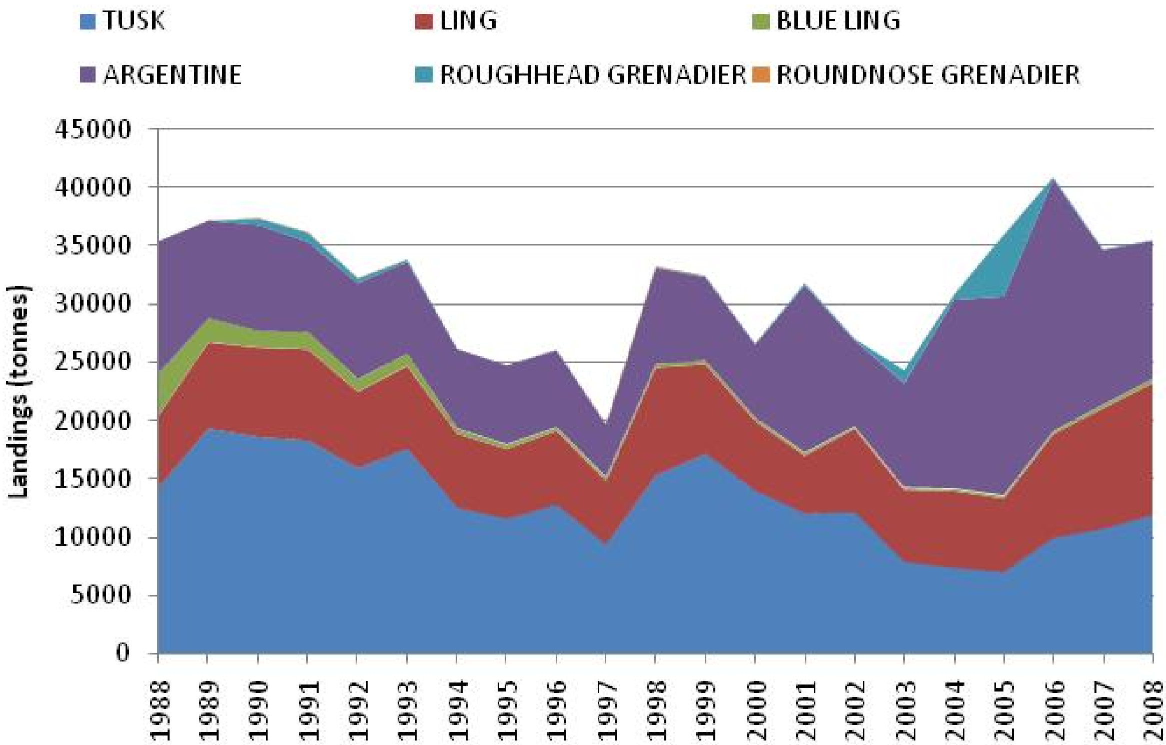


Figure 4.2.1. Trends in the landings in Subareas I and II.

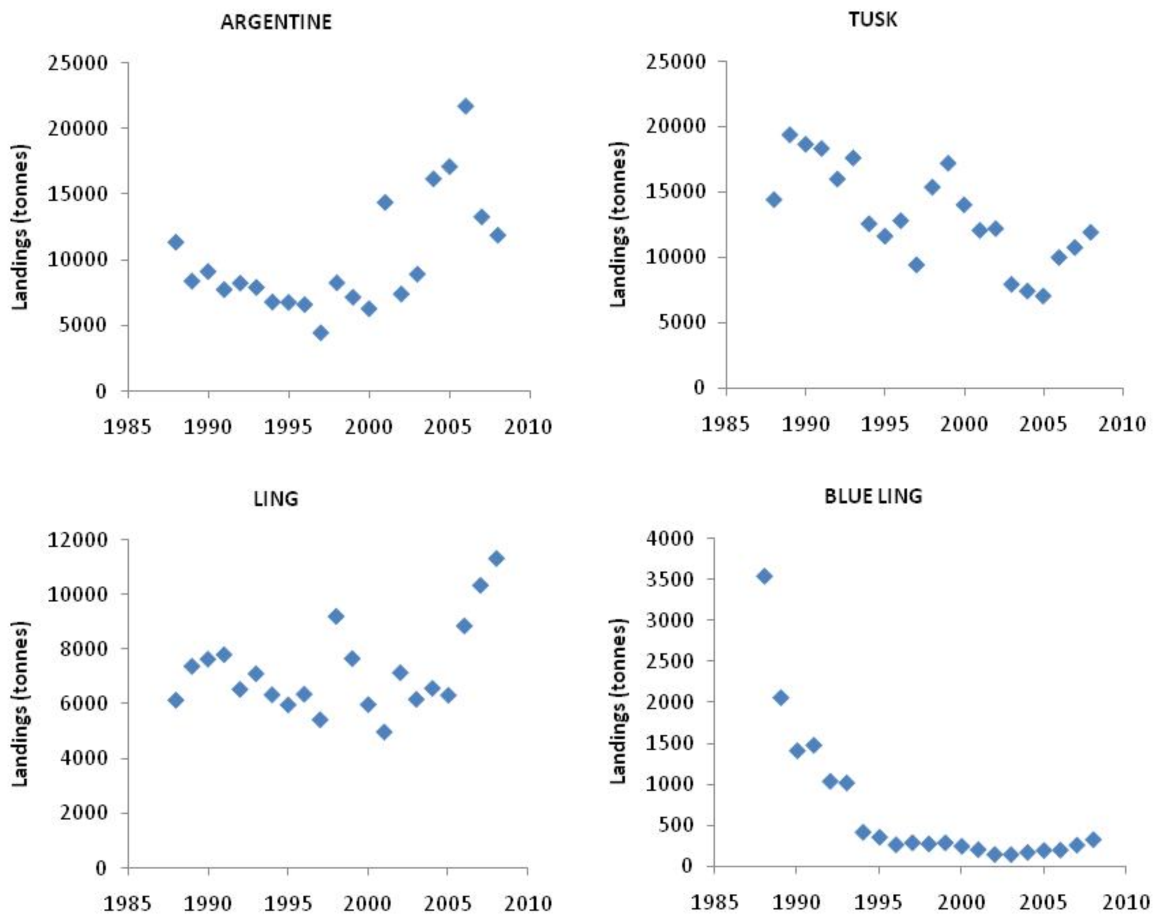


Figure 4.2.2. Trends in the landings of argentines, tusk, ling and blue ling in Subareas I and II.

4.3 Stocks and fisheries of the Faroes

4.3.1 Fisheries overview

4.3.2 Fisheries in Faroese waters (Division Vb)

The fishery around the Faroe Islands has for centuries been an almost free international fishery involving several countries. Up to 1959, all vessels were allowed to fish around the Faroes outside the 3 nm zone. During the 1960s, the fisheries zone was gradually expanded, and in 1977 an EEZ of 200 nm was introduced in the Faroe area. The demersal fishery by foreign nations has since decreased and Faroese vessels now take most of the catches. The main fisheries in Faroese waters are mixed-species, demersal fisheries and single-species, pelagic fisheries. The demersal fisheries are mainly conducted by Faroese vessels, but vessels from other nations are still participating like Norwegian longliners and EU trawlers licensed through bilateral and multilateral agreements. The major part of the pelagic fisheries is conducted by foreign vessels through similar agreements.

4.3.3 Trends in fisheries

Except for the traditional longline fisheries for tusk and ling, which have been well established for decades, the Faroese deep-water fisheries started in the late 1970s following the expansion of the national EEZs to 200 nm and a wish to reallocate fishing effort from traditional shelf fisheries. In the first years all fishing was within the Faroese EEZ. Later, the fishery gradually expanded to more distant areas and to include more and more species/stocks.

The main deep-water fleet consist of about 13 otterboard trawlers with engines larger than 2000 Hp. They have traditionally targeted saithe, redfish *(Sebastes spp.)*, Greenland halibut, blue ling and to a lesser degree black scabbardfish *(Aphanopus carbo)* and roundnose grenadier *(Coryphaenoides rupestris)*. There has been an increased effort in recent years in Faroese waters as the deep-water fleet has reduced its effort in other areas. This has resulted in increased effort on black scabbardfish, roundnose grenadier and blue ling in Vb with a corresponding increase in the landings of these species.

The traditional longline fleet fishing ling, tusk and blue ling consist of 24 longliners larger than 110 GRT; they are mainly targeting cod and haddock and in years where the availability of these species is high and market conditions satisfactory, they spend very little effort in deep water. Recently, a directed longline fishery with one vessel on deep-water sharks (*Centroscymnus coelolepis* and *Centrophorus squamosus*) was initiated; however, there has been no such fishery in 2002 and 2003 and the same applies for 2006 onwards.

In the 1990s, a gillnet fishery directed at monkfish *(Lophius piscatorius)* and Greenland halibut *(Reinhardtius hippoglossoides)* developed in Vb and is now well established; bycatches in this fishery are among others deep-sea redcrab and blue ling. More recently exploratory trap fisheries for deep-sea red crab have been performed.

A trawl fishery for greater silver smelt (*Argentina silus*) has been expanding rapidly in recent years. Three pairtrawlers, which otherwise mainly target saithe (*Pollachius virens*), hold licences to this fishery that mainly takes place in late spring and summer. Small quantities of Greater silver smelt are also taken as bycatch in the blue whiting fishery and in the deep-water fishery for e.g. red fish and blue ling.

Updated total international landings of deep-sea species in Division Vb are given in Table 4.3.1 and Figure 4.3.1.

4.3.4 Technical interaction

As explained above, several fleets are fishing deep-sea species in Vb, either regularly targeting these species or now then participate in such fisheries depending on availability of other targets. Although greater silver smelt is taken only by 3 pairtrawlers with special licenses for this fishery, grenadiers and black scabbard fish are targeted by the larger otter board trawlers (>2000 HP).

The text table below demonstrates the 2007 share by Faroese fleet categories of ling, blue ling and tusk, respectively (no data available for 2008).

2007	Longliners <110GRT	Longliners >110GRT	OB trawlers <1000HP	OB trawlers >1000HP	Pairtrawlers <1000HP	Pairtrawlers >1000HP	Others
Ling	9%	48%	2%	19%	5%	15%	2%
Blue ling	0%	16%	0%	83%	+	+	1%
Tusk	9%	74%	1%	10%	1%	3%	2%

Although the proportions by fleet of these 3 species do vary annually, ling is on average over many years a 60% line fishery and 40% trawl fishery; blue ling is mainly a trawl fishery whereas tusk is mainly taken by longlines. If Norwegian vessels are included, most of the ling is taken by longline.

4.3.5 Ecosystem considerations

The waters around the Faroe Islands are in the upper 500 m dominated by the North Atlantic current, which to the north of the islands meets the East Icelandic current. Clockwise current systems create retention areas on the Faroe Plateau (Faroe shelf) and on the Faroe Bank. In deeper waters to the north and east is deep Norwegian Sea water, and to the south and west is Atlantic water. From the late 1980s the intensity of the North Atlantic current passing the Faroe area decreased, but it has increased again since. The productivity of the Faroese waters was very low in the late 1980s and early 1990s. This applies also to the recruitment of many fish stocks, and the growth of the fish was poor as well. From 1992 onwards the conditions have returned to more normal values, which also is reflected in the fish landings. There has been observed a very clear relationship, from primary production to the higher trophic levels (including fish and seabirds), in the Faroe shelf ecosystem, and all trophic levels seem to respond quickly to variability of primary production in the ecosystem (Gaard *et al.*, 2001).

Existing and former areas of *Lophelia* coral have been mapped around the Faroes through questionnaires to fishers (Frederiksen *et al.*, 1992; Jákupsstova *et al.*, 2002). An estimated 11 000 km² of living coral are found in Faroese waters, although this is estimated to be a significant reduction from earlier times (ICES, 2005). Some of these coral areas have in recent years been closed to fishing and mapping of these areas is ongoing with the purpose of a further expansion of closed areas.

4.3.6 Management measures

Since 1 June 1996, a management system based on a combination of area closures and individual transferable effort quotas in days within fleet categories have been in force. The individual transferable effort quotas apply to 1) the longliners less than 110

GRT, the jiggers, and the single trawlers less than 400 HP, 2) the pairtrawlers and 3) the longliners greater than 110 GRT. One fishing day by longliners less than 100 GRT is considered equivalent to two fishing days for jiggers in the same gear category. Longliners less than 110 GRT could therefore double their allocation by converting to jigging. The allocation of number of fishing days is based on areas shallower than about 200 m. Holders of individual transferable effort quotas who fish in deeper waters can fish for 3 days for each day allocated. The single trawlers greater than 400 HP are not regulated through number of fishing days, but the numbers of fishing licenses have been settled for this fleet as well as for the gillnetters and they are regulated by depth of fishing as well. Trawlers are not allowed to fish within the 12 nautical mile limit and large areas on the shelf are closed to them. Inside the 6 nautical miles limit only longliners less than 110 GRT and jiggers less than 110 GRT are allowed to fish. The Faroe Bank shallower than 200 m is closed to all trawl and gillnet fisheries.

Technical measures such as area closures during the spawning periods, to protect juveniles and young fish and mesh size regulations are a natural part of the fisheries regulations.

As mentioned above, vessels from other nations are licensed to fish in Faroese waters through bilateral and multilateral agreements. Only Norway and EU have permission to fish deep-water species. The TACs for 2008 and 2009 are demonstrated in the text table below. In the agreement with Norway it is stated that the maximum bycatch of roundnose grenadier/black scabbardfish in the blue ling/ling fishery is 25%.

	2008		**2009**	
	Norway	EU	Norway	EU
Blue ling / ling	2525	3065	2525	3065
Tusk	1847		1847	
Roundnose grenadier / Black scabbardfish	631	1080	631	1080

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ALFONSINOS (Beryx spp.)			5		4			1										2		0	0
ARGENTINES (Argentina silus)	287	227	2888	60	1443	1063	960	12286	9498	8433	17570	8214	5204	10081	7471	6552	6451	6973	12559	14125	14595
BLUE LING (Molva dypterigia)	9526	5264	4799	2962	4702	2836	1644	2440	1602	2798	2584	2932	2524	2119	2020	3815	2699	2516	2835	3296	1920
BLACK SCABBARDFISH (Aphanopus carbo)		166	419	152	33	287	160	424	186	68	180	172	311	795	1751	1633	862	553	784	789	971
BLUEMOUTH (Helicolenus dactylopterus)												64	16				3	0		0	1
DEEP WATER CARDINAL FISH (Epigonus telescopus)												8	2	7			1	0		0	0
GREATER FORKBEARD (Phycis blennoides)	2	1	38	53	49	27	4	9	7	7	8	34	32	100	148	73	48	58	41	47	41
LING (Molva molva)	4488	4652	3857	4512	3614	2856	3622	4070	4896	5657	5359	5238	3785	4588	4138	4893	5967	6049	5208	4729	4699
MORIDAE				5								1		100	19	2		1	5	4	8
ORANGE ROUGHY (Hoplostethus atlanticus)			22	48	13	37	170	420	79	18	3	5	155	5	1	5	7	12	0	1	0
RABBITFISHES (Chimaerids)								1				3	54	96	64	61	96	3	10	78	51
ROUGHHEAD GRENADIER (Macrourus berglax)										6	9	58	1	4	3	12	9	0		5	3
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	1	258	1549	2311	3817	1681	668	1223	1078	1112	1667	1996	1791	2016	1025	1532	1579	1395	1802	1700	1012
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)																				0	0
SHARKS, VARIOUS			140	78	164	478	192	262	380	308	433	470	409	543					303	663	509
SILVER SCABBARDFISH (Lepidopus caudatus)																				0	0
SMOOTHHEADS (Alepocephalidae)																	6	1		0	4
TUSK (Brosme brosme)	5665	5122	6181	6266	5391	3439	4316	3978	3310	3319	2710	3964	2700	3993	3003	3292	3643	3621	3877	3810	3825
WRECKFISH (Polyprion americanus)																				0	0

Table 4.3.1. Deep-sea landings in Division Vb.

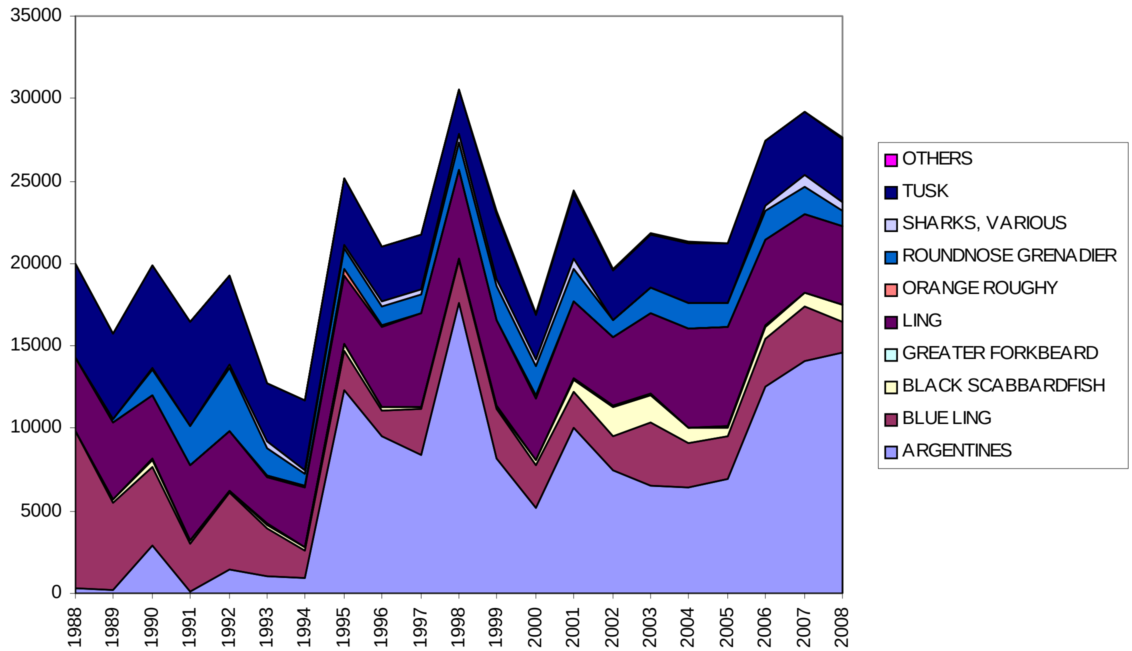


Figure 4.3.1. Deep-sea landings in Division Vb.

4.4 Stocks and fisheries of the Celtic Seas

4.4.1 Fisheries overview

Deepwater Trawl fisheries are conducted in areas VI and VII, principally by French, Irish Spanish and Scottish vessels. French vessels operate a mixed deep-water fishery mainly targeting roundnose grenadier, black scabbardfish and siki sharks on the continental slope and offshore banks of Sub-area VI and VII. In 1998–2002 about 45 vessels from this fleet landed more than 5 tonnes of roundnose grenadier, this number decreased to 19 in 2007 and 11 in 2008.

The Irish deep-water fishery is based on the flat grounds and targets orange roughy, black scabbard, roundnose grenadier and siki sharks. A number of Scottish vessels target monkfish (*Lophius spp)* on the continental slope of Subarea VIa and on the Rockall Bank. This fishery has a bycatch of deep-water species including ling, blue ling and siki sharks and a small number of these vessels occasionally fish in deeper water targeting roundnose grenadier, black scabbardfish and siki sharks. Spanish trawlers targeting Hake in Area VII and VI (on Porcupine, Rockall and Red Sole banks) have a bycatch of deep-water species including ling, blue ling, greater forkbeard and bluemouth.

A fleet of 29 Spanish stern bottom freezer trawlers fish in international waters of the Hatton Bank (ICES XIIb and VIb1). The presence of the majority of the vessels in this area is discontinuous. Vessels conduct fishing trips of variable duration. Fishing operations are conducted in a depth range of 800–1600 m, mainly at depths >1000 m or deeper. Roundnose grenadier and Baird's smoothhead (3000–13 000 t per year in 1997–2005) are the most important species in the catches. Black scabbardfish (1000 t in 2002, then decreasing) and blue ling (600–1000 t/year) are also caught in significant amounts. In 2005, landings of roughhead grenadier comparable with those of roundnose grenadier were reported to the Working Group. Concerns were expressed during the 2007 WGDEEP meeting that, in this area, roughhead grenadier is not known to occur at sufficient density to generate such landings. Catch data for this fleet were not available for 2008 and have never been reported by rectangle in the past.

A fleet UK registered gillnetters have, until recently, operated in areas VI and VII targeting hake, monkfish and deep-water sharks, this fishery was stopped or seriously reduced as a result of regulation of deep-water gillnetting (see below, management measures).

UK registered longliners target hake with a bycatch of ling and blue ling.

There is a UK trap fishery for Deepwater red crab *Chaceon affinis* in *S*ub area VI and VII.

4.4.2 Trends in fisheries

Total landings of deep-water species from Sub-areas VI and VII are given in Table 4.4.1.

4.4.3 Technical interactions

Although a few of the French trawlers working in Subareas VI and VII are dedicated to deep-water fishing, the majority also fish on the continental shelf targeting saithe with a bycatch of other demersal species (megrim, monkfish). The catch of ling is also most likely to come mainly from fishing activity on the shelf or shelf break between 200 and 400 m depth than from fishing targeting deep-water species. Vessels can move rapidly between fisheries and often target both deep-water and shelf species in the course of a single trip. None of the Scottish vessels fishing deep-water stock is dedicated to deep-water trawling and vessels move between traditional fisheries for gadoid species on the shelf and in the North Sea, slope fisheries for monkfish and megrim, and genuine deep-water fisheries according to the availability of fishing opportunities. The Scottish bottom-trawl fishery targeting monkfish and megrim extends to depths of 800 m or more and has a bycatch deep-water species.

Although considered as deep-water species by this WG, the depth range of ling, tusk and greater forkbeard in Subareas VI and VII extends onto the continental shelf and large quantities of these species are caught by a number of fleets and a variety of gears. Juveniles of some of the species considered by this WG are distributed in relatively shallow water and so are caught and discarded by other fisheries. This particularly applies to bluemouth, which is discarded in large quantities by vessels fishing on the continental shelf in are VIa and on the Rockall Bank.

As a consequence of regulations banning deep-water gillnetting below 600 m, interactions of the UK gillnet fishery with deep-water species are small.

The Spanish fleet fishing on the Hatton Bank is not exclusive to this area and also works on a variety of grounds in the North Atlantic (East and West).

4.4.4 Ecosystem considerations

The Rockall Trough lies in Sub-area VI to the west of Scotland and Ireland which is bounded to the North by the by the Wyville Ridge at a depth of about 500 m. This is a major faunal barrier and there is little similarity between the fish assemblages on either side of the ridge (Bergstad *et al.*, 1999; Gordon, 2001). To the west and northwest, the Rockall Trough is separated from the Icelandic basin by the Rockall Plateau and a chain of northern banks including the Rosemary, Bill Bailey and Hatton. To the south there is a gradual increase in depth onto the abyssal plain. To the west of Ireland the slope on the western edge of the Porcupine Bank is steep, while to the south, the Porcupine Seabight, has more gentle slopes. The fish populations have been relatively well described in this region compared with other deep-water areas (e.g. Gordon and Duncan, 1985a and b; Gordon, 1986; Gordon and Bergstad, 1992). At depths between about 400 and 1500 m there may be between 40 and 50 demersal species present depending on gear type. Maximum species diversity occurs between 1000–1500 m before declining markedly with depth. Deep water species, are typically slow growing, long lived, late maturing and have low fecundity. Fishing has a greater effect on species with such life-history traits (Jennings *et al.*, 1998; Jennings *et al.*, 1999), making them particularly vulnerable to over-exploitation. This applies to both the target and non-target species. A large proportion of deep-water trawl catches (upwards of 50%) can consist of unpalatable species and numerous small species, including juveniles of the target species, which are usually discarded (Allain *et al.*, 2003). The main species in the discards of the trawl fishery in by far the Baird's smoothhead (*Alepocephalus bairdii*) however, a large number of other non marketable bentho-pelagic species are discarded. The survival of these discards is unknown, but believed to be virtually zero because of fragility of these species and the effects of pressure changes during retrieval (Gordon, 2001). Therefore such fisheries tend to deplete the whole fish community biomass. Depletion of dominant species can induce major changes to fish communities through removing key predatory or forage species. A study of the impacts of deep-water fishing to the West of Britain using historical survey data found some evidence of changes in size spectra and a decline in species diversity between pre- and post-exploitation data, but the scarce and unbalanced nature of the time-series hampered firm conclusions (Basson *et al*., 2001). A presence/absence analyses indicated a very likely decline in the abundance of the Portuguese dogfish since the 1980s, which was consistent with assessments for this species. Deepwater sharks, which demonstrate a greater diversity on the slope compared with continental shelf, at temperate latitudes, are important predators and their removal through targeted fisheries and bycatch in trawl fisheries for other species such as roundnose grenadiers is likely to have a major impact on the eco-system. Although at worldwide scale there are more shark species in shallow waters than at slope depths, in the north-East Atlantic and the Mediterranean the species richness of demersal sharks is higher along the slope (35 deep-water speciesvs.22 occurring on the shelf). Contrarily, ray species are more numerous on the shelf. Rays are caught is small numbers by deep-waters fisheries, as rather rare species they may be severely impacted by fishing but this is difficult to assess because as rare species they would require high sampling intensity. Lastly chimaeras (5 species) form a third group of Chondrichthyans, which life history and populations' dynamics is poorly known or unknown and which occur only in deep-water. Despite historical studies of stomach contents, a full understanding of the foodweb dynamics of most deep-water ecosystems is still lacking and more studies are required. The general understanding is that slope fish tend to feed mainly on pelagic preys, among the species forming most of the total biomass, only chimaeras are known as epibenthic feeders (Mauchline and Gordon, 1983, 1991).

Discarding of unwanted catch may impact the demersal community by benefit scavenging species over those with other foraging strategies and change the trophic flux. Shallow water studies have documented the active response of scavenging and predatory demersal fish to the increase in food resources left in the wake of a trawl and from discarded catch (Kaiser and Spencer, 1996; Groenewold and Fonds, 2000). The impact of this short term increase in food resources for scavenging and predatory demersal fish in the deep-water environment is unknown, but may potentially alter the species as well as functional diversity of the community.

The effects of fishing on the benthic habitat relates to the physical disturbance by the gear used. This includes the removal of physical features, reduction in complexity of habitat structure and resuspension of sediment. Benthic fauna in deep waters are understood to be diverse but of low productivity. Little information is available on the effects of trawling on deep-sea soft sediment habitats. Cryer *et al*., 2002 used suite of multivariate analyses to infer that trawling probably changes benthic community structure and reduces biodiversity over broad spatial scales on the continental slope in a similar fashion to coastal systems. More attention has been paid to biogenic habitat that occurs along the slope, mainly the cold-water corals, which, in the Northeast Atlantic include the azooxanthellate scleractinarian corals *Lophelia pertusa*, *Madrepora oculata*, *Solenosmilia variabilis*, *Desmophyllum cristagalli,* and *Enallopsammia rostrata*. The main reef building species is *L. pertusa*. The other coral species often occur in association with *Lophelia pertusa* and none has been found forming reefs without *L. pertusa* being present. No exhaustive description of the distribution of *L. pertusa* exists, but it is found on the continental slopes off Norway, Iceland, Faroes, the UK, France, Spain and Portugal as well as the Mid Atlantic Ridge (ICES, 2003, 2004 and 2005; Rogers, 1999). The extent of individual reefs varies. Some biogenic seamounts are reported as up to 200 m high, and several km long

(Rogers, 1999; Freiwald *et al.*, 1999). A dense and diverse range of megafauna are associated to *Lophelia* reefs. This includes fixed (anthipatarians, gorgonians, sponges) and mobile invertebrates (echinoderms, crustaceans). The species richness of macrofauna associated to coral reefs has been found to be up to three times higher than on surrounding sedimentary seabed (Mortensen *et al.*, 1995). Several species of deep-water fish occur associated with corals, some in more abundance than in surrounding non-coral areas, but the functional links between fish and coral are still to be fully elucidated. However, it is accepted that generally, structurally complex habitats, such as corals, offer a greater diversity of food and physical shelter to fish and other macrofauna. Other deep-water biogenic habitats with structures that stand proud of the seabed include sponge and xenophyophore fields, seafans and seapens (octocorals). Any long-lived sessile organisms that stand proud of the seabed will be highly vulnerable to destruction by towed demersal fishing gear. There are a number of documented reports of damage to *Lophelia* reefs in various parts of the Northeast Atlantic by trawl gear where trawl scars and coral rubble have been observed (e.g. Hall- Spencer, *et al.*, 2002). Damage can also be caused on a smaller scale by static gears such as gillnets and longlines (Grehan *et al*., 2003). The degree of this damage depends on fishing effort (ICES, 2007b). The recovery rates for damaged coral are likely to be extremely slow (Risk, 2002). In Divisions VI, VII and XIIb there are a number of known areas of cold-water corals. These include the shelf break to the west and north of Scotland, Rockall Bank, Hatton Bank and the Porcupine Bank. The best known site is the Darwin Mounds, located at 1000m to the south of the Wyville Thompson Ridge. Some of these areas have been heavily impacted by deep-water trawling activities (Hall-Spencer, 2002; Grehan *et al.*, 2003). In 2005, WGDEC recommended a number of areas on Rockall that would be appropriate to closure to protect cold-water corals from trawling activity. The choice of these sites was based on examination of scientific and anecdotal fishers' records of coral occurrence and VMS data indicating where fishing activity occurred.

Seamounts are widely recognized to be areas of high productivity where dense aggregations of fish can occur. The special hydrographic conditions and good availability of hard bottom are favourable for sessile suspension-feeders, which often dominate the community on seamounts (Genin *et al*., 1986). Within ICES area VI there are three documented seamounts; Rosemary, Anton Dohrn and Hebrides Terrace. The first two of these have summits above the daytime depth of the deep scattering layer. These seamounts have been exploited since the 1990s, probably by vessels fishing for the orange roughy.

4.4.5 Management measures

Since 2003, Black scabbardfish (*Aphanopus carbo*), Blue ling (*Molva dypterygia*), Greater silver smelt (*Argentina silus*), Ling (*Molva molva*), Orange roughy (*Hoplostethus atlanticus*), Red sea bream (*Pagellus bogaraveo*), Roundnose grenadier (*Coryphaenoides rupestris*) and Tusk (*Brosme brosme*) have been subject to TACs and quotas in EC waters and for Community vessels fishing elsewhere.

Under Council Regulation (EC) No 2347/2002, Member States must ensure that fishing activities which lead to catches and retention on board of more than 10 tonnes each calendar year of deep-sea species by vessels flying their flag and registered in their territory are subject to a deep-sea fishing permit. Member states are obliged to calculate the aggregate power and the aggregate volume of their vessels, which, in any one of the years 1998, 1999 or 2000, landed more than 10 tonnes of any mixture of the deep-sea species.

The aggregate volume of vessels holding deep-sea fishing permits may not exceed this figure.

Council Regulation (EC) No 27/2005 obliged Member States to ensure that, for 2005, the fishing effort levels, measured in kilowatt days absent from port, by vessels holding deep-sea fishing permits did not exceed 90% of the average annual fishing effort deployed by that Member State's vessels in 2003 on trips when deep-sea fishing permits were held and deep-sea species were caught. For 2006 this limit was further reduced to 80% of 2003 levels.

Council Regulation (EC) No 51/2006 banned the use of gillnets by Community vessels at depths greater than 200 m in ICES Divisions VIa, b and VII b, c, j, k. In 2006 a derogation was introduced allowing the setting of gillnets with mesh sizes between 120 and 150 mm down to depths of 600 m. In 2008, this measure was extended to cover Sub-areas III and IV. This remains a "*transitional measures to allow these fisheries to take place under certain conditions* [...] *until more permanent measures are adopted*" included in the general TAC regulation (Council regulation (EC) N° 40/2008 of the council of 16/01/2008) however it is expected that this will become a permanent provision in a Technical measures Regulation to be adopted later in 2008. NEAFC has also banned deep-water gillnetting in international waters at depth below 200 m, until management measures can be put in place. It was unclear to the WG whether this measure, effective from 01/02/2006 and still appearing on the NEAFC website as a 2008 measure was still valid or have been updated.

Landings of the main deep-water species caught in subareas VI and VII are managed by TACs since 2003 for black scabbardfish, argentine, tusk, blue ling, ling, roundnose grenadier, orange roughy and red (blackspot) sea bream (EC regulation n° 2340/20024 of the council of 16 December 2002). In 2005, TACs were introduced for deep-water sharks and greater forkbeard (EC regulation n° 2270/2004 of the council of 22 December 2004). TACs are revised every second year. They were reduced at each revision (for 2005/2006, 2007/2008 and 2009/2010). No EU-TAC (zero TAC) are set for orange roughy and deep-sea sharks from 2010 and this is expected to be kept in place until sustainable conditions and level of exploitation are defined.

From 2009, EU-TACs for blue ling and greater silver smelt in Sub-areas, II, IV, V, VI and VII are set within the annual TAC regulation because the TAC level depends upon annual negotiation between Norway and EU.

From 2009, in order to protect the spawning aggregations of blue ling in ICES zone Via, some areas have been defined were fishing for blue ling is strongly limited (vessels should not keep more than 6 tonnes of blue ling) from 1st of March to May 31. This regulation is expected to be kept in place until significant rebuilding of the blue ling stock is observed.

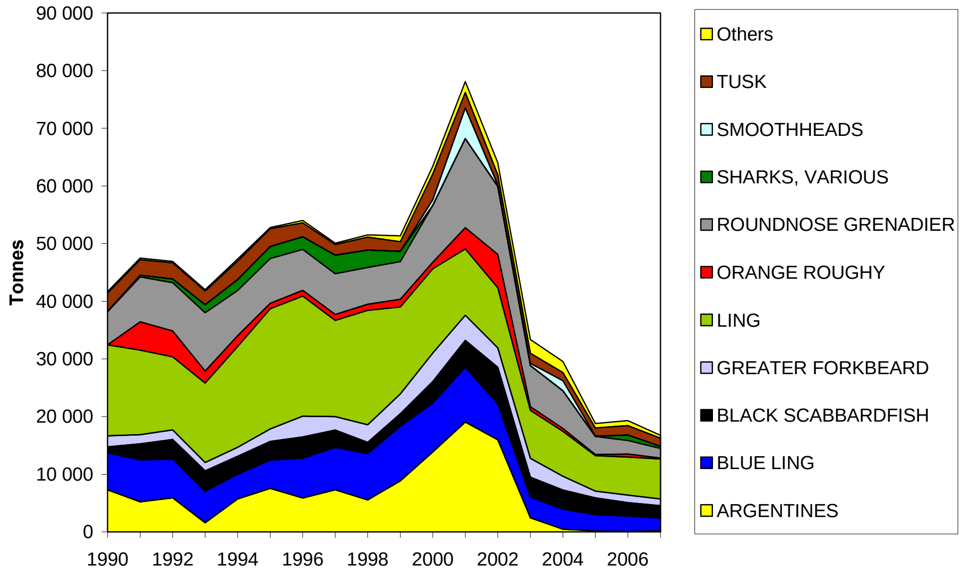


Figure 4.4.1. Landings of deep-water species from Sub-areas VI and VII

Table 4.4.1. Deep-sea landings in Division VI and VII

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ALFONSINOS (Beryx spp.)		12	8		3	1	5	3	178	25	81	75	133	186	94	82	62	15	0	64	22
ARGENTINES	10438	25559	7294	5197	5906	1577	5707	7546	5863	7301	5555	8856	13863	19050	15985	2444	480	178	55	257	4035
BLUE LING	9285	9434	6396	7319	6697	5471	4309	4892	6928	7361	8004	9472	8525	9534	6252	3605	3437	2839	2705	2257	1820
BLACK SCABBARDFISH		154	1060	2759	3436	3529	3101	3278	3689	2995	1967	2166	3712	4623	6327	3458	3355	2880	2320	2353	2397
BLUEMOUTH		127	100	128	159	152	117	71	87	88	145	354	332	279	196	397	433	43	35	338	105
DEEP WATER CARDINAL FISH						30	217	91	45	49	115	258	287	385	974	1075	869	684	330	226	23
GREATER FORKBEARD	1898	1815	1921	1574	1640	1462	1571	2138	3590	2335	3040	3430	4919	4349	3352	3257	2400	1176	1298	1974	1271
LING (Molva molva)	28092	20545	15766	14684	12671	13763	17439	20856	20838	16668	19863	15087	14613	11528	10435	8321	7762	6154	6605	7366	5665
MORIDAE				1	25							20	146	190	158	327	71	0	3	64	481
ORANGE ROUGHY		8	17	4908	4523	2097	1901	947	995	1039	1071	1337	1158	3692	5788	622	490	206	521	185	94
RABBITFISH							2					236	355	722	573	474	433	6	24	391	353
ROUGHHEAD GRENADIER						18	5	4	13	12	10	34	10	44	19	12	13	2	75	39	6
ROUNDNOSE GRENADIER	32	2440	5730	7793	8338	10121	7860	7767	7095	7070	6364	6538	9845	15456	11777	7134	6548	3141	2360	1804	1489
RED (=BLACKSPOT) SEABREAM	252	189	134	123	40	22	10	11	29	56	17	23	20	51	25	38	31	36	54	135	56
SHARKS, VARIOUS	85	40	43	254	639	1392	1864	2099	2176	3240	3023	1791	8		1				956	948	849
SILVER SCABBARDFISH						2						18	15		1				342	67	0
SMOOTHHEADS				31	17								978	5305	260	393	1765	45	3	0	3
TUSK (Brosme brosme)	3002	4086	3216	2719	2817	2378	3233	3085	2417	1832	2240	1647	4504	2688	1794	1719	1411	1386	1601	1398	1594
WRECKFISH	7		2	10	15				83		12	14	14	17	9	2	2			2	3

4.5 Stocks and fisheries of the North Sea

4.5.1 Fisheries overview

A landings overview is shown in Figure 4.5.1. and Table 4.5.1. At present, the main fisheries currently targeting deep-sea species in the IIIa and IV are the following:

Bycatches of ling and tusk are taken in the UK demersal trawl fisheries.

Fisheries for deep-sea shrimp (*Pandalus borealis*) carried out by Denmark, Norway and Sweden in Skagerrak and in the Norwegian Deep in the eastern part of the northern North Sea. The gears (trawls) used in these fisheries are small-meshed (mesh size 35–45 mm). Bycatches of deep-sea fish species, such as Anglerfish, tusk, ling and witch flounder, are also landed. Also bycatches of Roundnose grenadier in this fishery have occasionally been landed for reduction, depending on the quantities. Introduction of sorting grids in recent years has probably reduced the amounts of some of this bycatch. Further information on the shrimp fisheries and their bycatches is found in the reports of NIPAG (NAFO-ICES Pandalus Assessment Group).

Bottom trawl fisheries by Denmark and Norway and UK mainly in the northern and northeastern North Sea directed at mixed demersal species including ling, tusk and anglerfish and *Nephrops*.

Minor fisheries in Skagerrak (IIIa) by Denmark and Sweden targeting witch flounder. These are mainly trawl fisheries, but also Danish seine has been used. Further information is found in ICES WGNEW report.

A Danish trawl fishery directed for roundnose grenadier in the deeper parts of Skagerrak was carried out by very few vessels from the 1980s up to 2006.

A directed midwater trawl fishery for greater silver smelt, conducted mainly by Norway, in IVa.

Table 4.5.2 gives an overview of the landings by country for the area.

4.5.2 Trends in fisheries

The fishery for roundnose grenadier in Skagerrak.

As mentioned above, minor catches of roundnose grenadier are taken as bycatch by shrimp (*Pandalus*) trawlers in IIIa (Skagerrak) and occasionally landed (mainly for reduction). However, since the late1980s a Danish directed fishery for roundnose grenadier has been conducted in the deeper part of Skagerrak at depths of 400–650 meters, the geographical area of exploitation being very small constituting of only few ICES rectangles. This fishery for roundnose grenadier began in 1987 as an exploratory fishery, following exploratory efforts by Denmark and Norway for new fish resources in the 1980s. However, in Norway and Sweden directed fisheries for this species never developed.

During most of the period, up to 2002, the Danish directed fishery has mainly been conducted by the same single vessel accounting for more than 80% of the total landings. The gear (trawl) used is characterized by a mesh size <70 mm in the codend, most often 55 mm has been recorded. Vessel sizes are around 30 m. Because of the prevailing market conditions the majority of the catch is landed for oil and meal. Almost all catches are landed in ports of Hirtshals and Skagen. In 2006 the economic value of the landings was around 225 000 €.

The development of this fishery during the recent decade has been remarkable considering the small area. From a level of around 2000 t up to 2002, taken by a mainly a single vessel, total landings increased to more than 10 000 t in 2005. Landing decreased, however, in 2006 to around 2300 tons as a consequence of catch restrictions following a revised EU Norway agreement. A total of only 2–3 vessels participated significantly in the fishery during the period of peak catches, 2002–2005, see Section 10.3.1. In 2007 and 2008 there was no directed fishery, not because of the catch restrictions introduced in 2006 or signs of stock decline, but because the remaining single fisher retired without any successors.

4.5.3 Technical interactions

The mixed demersal trawl fisheries are directed at roundfish species (cod, saithe, ling and tusk). A considerable part of this fishery is carried out in the Norwegian Deep within the Norwegian EEZ.

The fishery for Pandalus is classified as a small-meshed fishery and the bycatch landings are restricted by the general 10% (weight) regulation. Apart from the bycatch of the deep-sea species mentioned above, bycatches of cod, ling and saithe are common in this fishery.

The directed fishery for roundnose grenadier exploited the aggregations of this species in the deepest part of Skagerrak, and the reported bycatch in this fishery was rather insignificant, consisting of: Greater silversmelt, rabbitfish, blue ling and lantern shark.

4.5.4 Ecosystem considerations

The deep waters of Division IIIa and Sub-area IV are small and geographically isolated from other deep-sea areas. It is likely that the deep-water fauna in this region, such as Roundnose grenadier, constitute separate stocks to those in the North Atlantic (Bergstad 1990; Bergstad and Gordon 1994; Mauchline *et al*., 1994; Bergstad *et al*., 2003), and could therefore be particularly vulnerable to localized population depletion through heavy exploitation, see Section 10.3. There are a number sites in the northeast Skagerrak where the cold-water coral, *Lophelia pertusa* are known from and recent observations have suggested that some have been destroyed or severely damaged by trawling activities in relatively recent times (Lundälv and Jonsson, 2003). This damage was thought likely to be caused by trawling for *Pandalus borealis*.

4.5.5 Management measures

Management of fisheries in IIIa

ICES Subdivision IIIa is shared between the EU and Norway. However, according to the tri-lateral treaty between Denmark, Norway and Sweden (Skagerrak Treaty) fishing vessels from each of the 3 countries may operate freely in each country's waters. Normally, bi-lateral EU-Norway agreements on the shares of TACs for the exploited fish stocks are the bases for further national management of the fisheries in IIIa. The special case of the management of the Danish fishery for roundnose grenadier in IIIa and the development of this fishery in 2006 and 2007 is described in Section 4.5.2.

Management of fisheries in IV

The North Sea is shared between the EU and Norway, and consequently the management in the EU zone are managed according to EU regulation, whereas the fisheries in the Norwegian zone IV are managed according to Norwegian regulations following the EU-Norway negotiations.

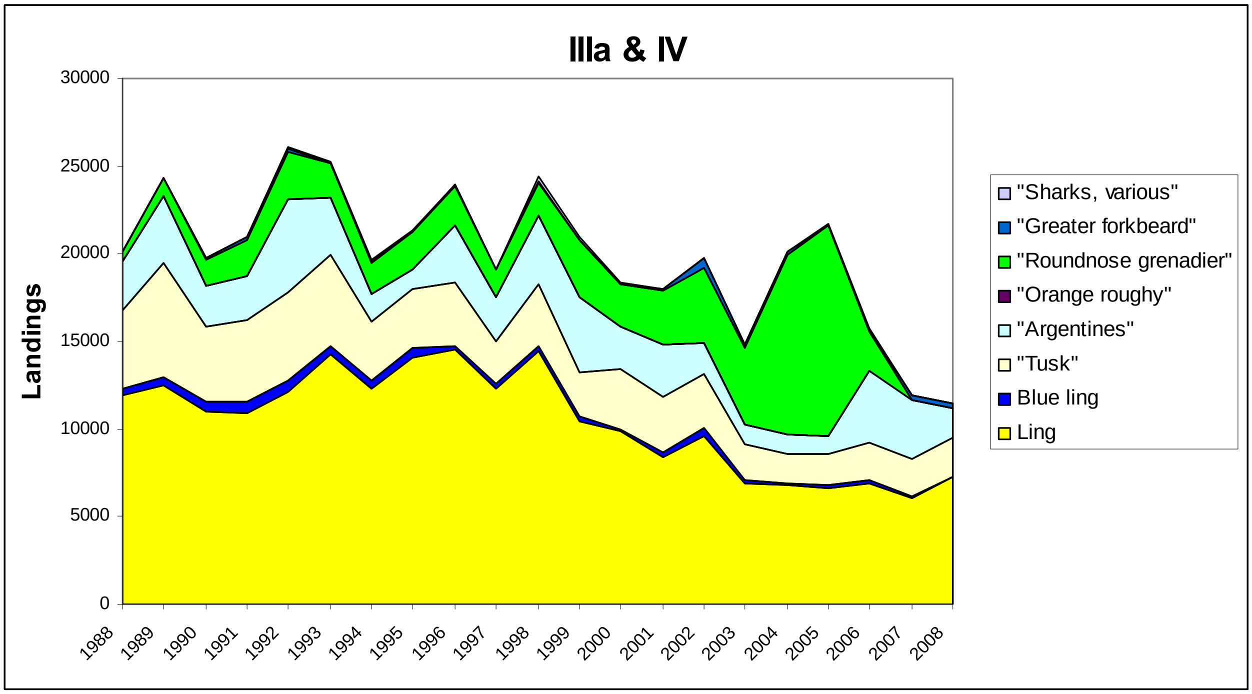


Figure 4.5.1. Overview of deep-sea species landings over 1988–2008 (tonnes).

Table 4.5.1. Landings of Deep-sea species in Division III and IV.

SPECIES	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ALFONSINOS (Beryx spp.)												0	0
ARGENTINES (Argentina silus)	3300	2598	3982	4319	2471	2925	1811	1166	1105	1021	4018	3343	1629
BLUE LING (Molva dypterigia)	202	291	292	271	144	276	386	120	94	115	138	63	77
BLACK SCABBARDFISH (Aphanopus carbo)	4	2	9	7	5	12	24	4	4	2	13	1	0
BLUEMOUTH (Helicolenus dactylopterus)	2	1		8					2	0		0	0
GREATER FORKBEARD (Phycis blennoides)	18	7	12	31	11	26	585	233	142	88	142	239	245
LING (Molva molva)	14 531	12 325	14 472	10 472	9858	8396	9642	6928	6770	6653	6918	6060	7227
MORIDAE											0	0	0
ORANGE ROUGHY (Hoplostethus atlanticus)										0	0	14	0
RABBITFISH (Chimaerids)	14	38	56	45	33	20	24	25	40	168	14	18	20
ROUGHHEAD GRENADIER (Macrourus berglax)	4	5	1		4	10	3	2	1	38		0	0
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	2284	1533	1854	3187	2406	3121	4258	4319	10 267	11 942	2272	26	1
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)										0	0	0	1
SHARKS, VARIOUS	14	32	359	201	36	62				16	22	22	48
SILVER SCABBARDFISH (Lepidopus caudatus)												0	0
SMOOTHHEADS (Alepocephalidae)												0	0
TUSK (Brosme brosme)	3576	2341	3474	2498	3411	3204	3082	2056	1733	1839	2204	2199	2238
WRECKFISH (Polyprion americanus)												0	0

Table 4.5.2. Landings (t) by country, division and species in 2008 for Division IIIa and Subarea IV.

Contry	Division	Greater Silver smelt	Blue Ling	Ling	Roundnose Grenadier	Tusk	Witch Flounder	Lantern sharks	Rabbitfish	Sharks	Greater forkbeard	Others
DK	III a	0	0	59	0	0	476	0	0			
	IV a	10	2	446	0	57	241	0	0			
	IV b	13	0	40	0	0	110	46	10			
	IV c			0				0	0			
UK-e+w												
	IVa			20		3						
	IVb			25						2		0
	IVc											7
UK-scot												
	IVa		0	1549		75			0	1	1	
	IVb			10								
	IVc											
FRO												
	IVa	58		1								
	IVb											
	IVc											
NOR												
	IIIa	0	2	88	0	43			1		4	
	IVa	1548	63	4725	0	1975			7		235	
	IVb	0	1	87		69			0		5	
	IVc											
FRA												
	IVa		9	174	1	15			2		0	1
	IVb		0	2	0				0			
	IVc			0								
		1629	77	7226	1	2238	827	46	20	3	245	8

4.6 Stocks and fisheries of the South European Atlantic Shelf

4.6.1 Fisheries overview

In ICES Subarea VIII there are two main **Spanish fishing fleets** defining the fisheries:

- The trawl fishery targets species such as hake, megrim, anglerfish, and *Nephrops* but also has variable bycatch of deep-water species. These include *Molva spp*., *Phycis phycis*, *Phycis blennoides*, *Conger conger*, *Helicolenus dactylopterus*, *Polyprion americanus*, *Beryx spp* and *Pagellus bogaraveo*.
- Longline fishery mainly targets deep-water species on conger, greater forkbeard, deep-water sharks and ling.

The **French trawler fishery** mainly target demersal and pelagic species on the shelf with a small bycatch of deep-water species such as bluemouth and greater forkbeard. To the north of Sub-area VIII, **a small handline fishery** targeting mainly bass and pollack (*Pollachius pollachius*) has a bycatch of red (blackspot) sea bream. In recent years, some landings of orange roughy caught to the north or Sub-area VIII have occured, from artisanal trawlers targeting this species. This activity was stopped as a consequence of low quota.

In ICES Subarea IX on the contrary there is a main directed **Portuguese longline fishery** for black scabbard fish (*Aphanopus carbo*) with a bycatch of the deep-water sharks, and also and **Spanish longline** (Voracera) fishery for *Pagellus bogaraveo*. There is also a bottom-trawl fishery at the southern part of the Portuguese continental coastal, targeting crustaceans some on deeper grounds such as *Nephrops norvegicus* and *Aristeus antennatus*. Typical bycatches species of this fishery are: bluemouth (*Helicolenus dactylopterus*), greater forkbeard (*Phycis blennoides*), conger eel (*Conger conger*), blackmouth dogfish (*Galeus melastomus*), kitefin shark (*Dalatias licha*), and gulper shark (*Centrophorus squamosus*).

There has been a small expansion of UK (England and Wales) gillnet fisheries into Subareas VIII and IX. In Subarea VIII but landings are on a small scale.

4.6.2 Trends in fisheries

Although since 1988 from six to seventeen deep species are usually landed historically in Areas VIII and IX, the catches of *Aphanopus carbo* (45.9%) *Lepidopus caudatus* (17.5%) *Pagellus bogaraveo* (9.9%), *Molva molva* (6.8%), *Phycis blennoides* (5.9%), *Polyprion americanus* (3.7%) *Beryx spp*. (2.6%) and *Argentina sphiraena* (2.0%) represent on average the 94% of total Subarea VIII and IX landings.

Since 1988 on average 7137 t of these species are landed from these subareas, but in last 10 years this amount has been never reached (Table 4.6.1). In 1995 an important peak of 12 678 t is observed as a consequence of an increase of *L. caudatus* landings in Subarea IX.

Black scabbardfish (*Aphanopus carbo*) *and* silver scabbardfish (*Lepidopus caudatus*)

*Aphanopus carb*o and *Lepidopus caudatus* are the main species landed in both subareas combined, but it is worthy of remark that most of *A. carbo* and *L. caudatus* landings come from Subarea IX. Landings of Black scabbard fish never has been lower than 2400 t/year, and in 1993 reached its higher value (4524 t). Since this year the trend indicates a decrease until 2000, and after this year the average landings have been 2909 t/year.

The trend of Silver scabbard fish landings is very variable along the period 1988–2006. Landings of this species have been always lower than Black scabbardfish ones, except in 1995 in which 5672 t were reached. In 2000 only 16 t are recorded but in 2006 the landings of this species were increased to 845 t in 2008 (Figure 4.6.1).

Red Seabream (Pagellus bogaraveo) and Ling (Molva molva)

Since the collapse of the Bay of Biscay stock in the early 1980s, the main landings of Red sea bream since 1988 come from Subarea IX. In European Atlantic Shelf from 1988 to 1998 the landings rank between 666 and 1175 t (on average 958 t), but, from 1999 to 2008 the total landings have been always below 718 t (on average 615 t).

Almost the 100% of total landings of ling come from Subarea VIII. The series demonstrates a continuous decrease of catches from 1991 to 1994. Since this year a clear increase is observed, and in 1998 the peak of the series (1799 t) is raised. However from 1999 to 2008 landings of this species have been decreased strongly (Figure 4.6.1).

Geater forkbeard (*Phycis blennoides*), Wreckfish (*Polyprion americanus*) and Alfonsinos (*Beryx spp.*)

Since 1998 the 97% of Greater forkbeard landings in Southern European Atlantic shelf belongs to Subarea VIII. The landings in the combined areas demonstrate a clear increase from 1988 to 1998. Since 1998 an important decrease in the historical series was recorded, especially in last two years in which only 166 t and 172 t were reported.

The wreckfish landings do not demonstrate a clear trend. 1994 reveals a peak of 440 tonne but since this year the trend in landings is negative until 2004. Since this year the wreckfish display an important increase in the landings, reaching the peak of the series with 504 tonne in 2007.

The most important landings of Alfonsinos in Subareas VIII and IX ware recorded in since 1995. From 1995 to 2005 an increase of landing trends is observed but landings since this decreased strongly to 58 t in 2008 (Figure 4.6.1).

Deep-Water red crab (*Chaceon spp.*)

For this species landings in 2006 and 2007 were recorded (305 t and 83 t respectively). This fishery apparently disappeared in 2008 because no landings were reported in this year. The main bycatch of this new fishery in 2006 was the deep-water sharks, but on the contrary, in 2007 any catches of these species were reported.

4.6.3 Technical interactions

The new small England and Wales gillnet fisheries fishing deep-water crabs and sharks in Subareas VIII and IX are probably the consequence of the displacement of gillnet effort as result of the 2006 gillnet ban in depths greater than 600 m in ICES Subareas VI and VII. This fishery was active until 2007 but the level of catches is much lower than in 2006.

An update of information of gear interaction of Spanish fleet fishing deep-water species during the period 2005–2008 is demonstrated in Table 4.6.2.

4.6.4 Ecosystem considerations

Chaceon affinis is normally found on seamounts and escarpments at depths over 500 m., and has already been demonstrated to be vulnerable in certain areas of the Atlantic.

Deep water conditions are more conducive to net loss, and there is strong evidence of net dumping and significant levels of ghost fishing in the deep water Northeast Atlantic fishery for monkfish. There is a need to evaluate the scale of this problem in Subareas VIII and IX.

In Subarea VIII there are historical records of impacts on deep-water ecosystems, in particular corals (Joubin, 1922).

4.6.5 Management measures

The 2009 and 2010 TACs for the most of deep-water species are set at lower levels than previous years, and even a TAC 0 has been adopted in 2010 for some species as orange roughy in Sub-areas I, II, III, IV, V, VIII, IX, X, XI, XII and XIV, and deep-water sharks in V, VI, VII, VIII, IX and X).

The ban on deep-water gillnetting in depths greater than 600 m does not apply to Sub-areas VIII and IX. There are no TACs or quotas for Deep-water crab in Sub-areas VIII and IX.

Table 4.6.1. Overview of landings in Sub-Areas VIII and IX.

SPECIES	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ALFONSINOS (Beryx spp.)			1		1		2	82	88	135	269	201	167	229	237	109	280	191	94	71	58
ARGENTINES (Argentina silus)															191	37	23	202		1	1
BLUE LING (Molva dypterigia)										14	33	4	4	6	29	22	22	61	351	36	15
BLACK SCABBARDFISH (Aphanopus carbo)	2602	3473	3274	3979	4398	4524	3434	4272	3689	3555	3152	2752	2404	2767	2725	2664	2502	2770	2726	3480	3644
BLUEMOUTH (Helicolenus dactylopterus)		2	5	12	11	8	4			1	3	29	33	34	18	124	135	206	279	356	213
DEEP WATER CARDINAL FISH (Epigonus telescopus)												3	5	4	8	5	10	9	11	6	6
GREATER FORKBEARD (Phycis blennoides)	81	145	234	130	179	395	320	384	456	361	665	377	411	494	489	422	482	337	316	166	172
LING (Molva molva)	1028	1221	1372	1139	802	510	85	845	1041	1034	1799	451	331	577	439	450	527	487	355	321	302
MORIDAE								83	52	88			26	20	8	12	11	15	9	18	12
ORANGE ROUGHY (Hoplostethus atlanticus)	0	0	0	0	83	68	31	7	22	24	15	40	52	20	20	31	43	27	43	1	9
RABBITFISH (Chimaerids)												2	2	7	6	2	6	5	10	3	3
ROUGHHEAD GRENADIER (Macrourus berglax)																			3	0	
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)			5	1	12	18	5		1		20	16	5	7	3	2	2	7	28	11	5
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)	826	948	906	666	921	1175	1135	939	1001	1036	981	647	691	553	489	560	574	584	656	718	679
SILVER SCABBARDFISH (Lepidopus caudatus)	2666	1385	584	808	1374	2397	1054	5672	1237	1725	966	3069	16	706	1832	1681	854	526	620	654	845
SMOOTHHEADS (Alepocephalidae)										7											
TUSK (Brosme brosme)	1										1								1	0	0
WRECKFISH (Polyprion americanus)	198	284	163	194	270	350	410	394	294	222	238	144	123	167	156	243	141	196	333	504	300
DEEP WATER RED CRAB (Chaceon spp)*																			305	83	
LESSER SILVER SMELT (Argentina sphiraena)**																131	189	223	264	180	237

*** new species included in the WG2007.**

**** new species included in the WG2008.**

Table 4.6.2. Quantitative description of fishing gears and landings (t) interaction of Spanish fleets in Subareas VIII and IX.

		2005		2006		2007		2008*	
Species	Gear	VIII	IX	VIII	IX	VIII	IX	VIII	IX
Molva molva	Hooks and (long)lines	47	0	48	0	32	0	34	0
	Gillnets	16	0	8	0	7	0	1	0
	Bottom trawl	12	0	17	0	8	1	8	0
	Others	66	0	0	0	0	0	0	0
Aphanopus carbo	Hooks and (long)lines	0	0	0	0	0	0	0	0
	Gillnets	0	0	0	0	0	0	0	0
	Bottom trawl	1	0	0	0	1	0	0	0
	Others	0	0	0	0	0	0	0	0
Pagellus bogaraveo	Hooks and (long)lines	44	334	28	369	83	404	20	439
	Gillnets	6	0	7	0	17	2	4	1
	Bottom trawl	16	2	21	4	47	1	15	3
	Others	24	29	1	66	2	0	2	0
Phycis spp	Hooks and (long)lines	148	0	80	1	294	3	20	14
	Gillnets	8	0	21	1	41	4	3	29
	Bottom trawl	97	39	84	28	113	55	56	0
	Others	0	18	0	42	0	0	0	0
Beryx spp	Hooks and (long)lines	21	0	26	3	47	1	4	0
	Gillnets	35	0	13	0	9	1	1	0
	Bottom trawl	19	0	7	2	3	4	5	1
	Others	62	6	1	2	0	0	0	0
Polyprion americanus	Hooks and (long)lines	15	0	2	1	42	6	2	3
	Gillnets	0	0	0	0	2	6	0	0
	Bottom trawl	0	1	0	3	0	5	1	0
	Others	0	5	0	10	0	0	0	0
Lepidopus caudatus	Hooks and (long)lines	0	449	0	563	0	645	0	842
	Gillnets	0	0	0	0	0	0	0	0
	Bottom trawl	0	0	0	0	0	3	0	0
	Others	0	59	0	51	0	0	0	0
Argentina sphyraena	Hooks and (long)lines	0	0	0	0	0	0	0	0
	Gillnets	0	0	0	0	0	0	0	0
	Bottom trawl	32	0	261	3	184	1	237	1
	Others	0	4	0	0	0	0	0	0

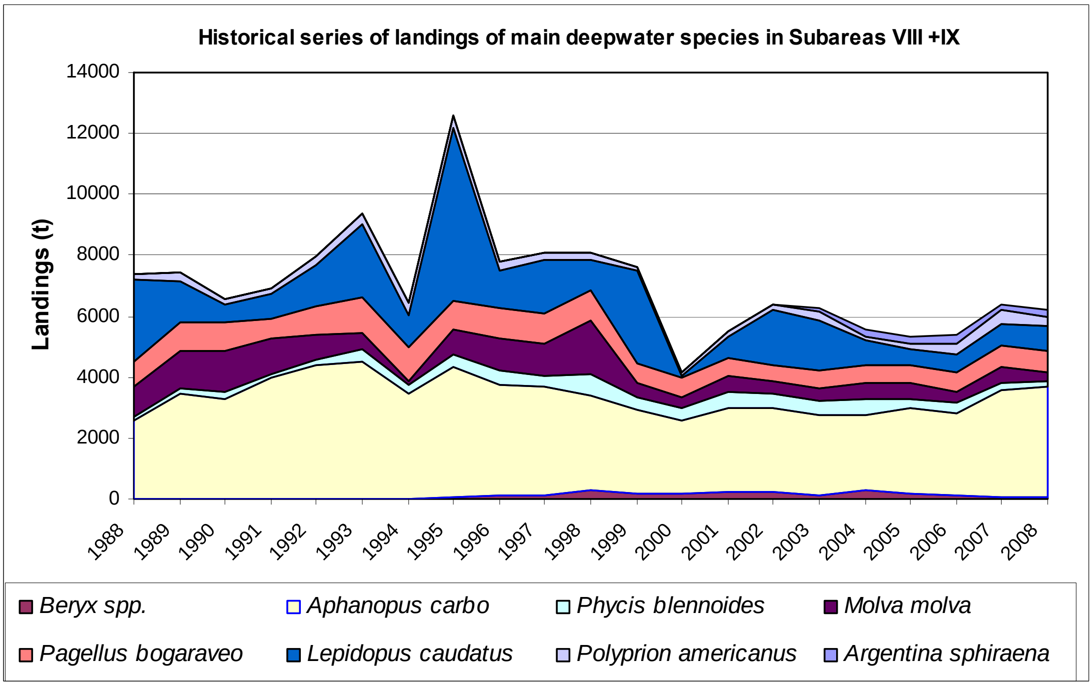


Figure 4.6.1. Historical series of eight main species landed in combined Subareas VIII and+ IX since 1988.

4.7 Stocks and fisheries of the Oceanic Northeast Atlantic

4.7.1 Fisheries overview

The Mid-Atlantic Ridge (MAR) is the spreading zone between the Eurasian and American plate. The ridge is continually being formed as the two plates spread at a rate of about 2 cm/year. In the Ices area it extends over 1500 nautical miles from the Iceland to the Azores crossing the Azores archipelago between the Western and central islands groups. It is characterized by a rough bottom topography comprising underwater mountain chains, a central rift valley, recent volcanic terrain, fracture zones, and seamounts. In these areas two different types of fisheries occur. Industrial oceanic fisheries in the central region and northern parts of the Mid-Atlantic Ridge. There is an artisanal fishery inside the Azorean EZZ and this is targeted at stocks which may extend south of the ICES Area.

This section deals with fisheries on the Mid Atlantic Ridge and the Azores.

Azores EEZ

The Azores deep-water fishery is a multispecies and multigear fishery. The dynamic of the fishery seems to be dominated by the main target species *Pagellus bogaraveo*. However, others commercially important species are also caught and the target species change seasonally according abundance, species vulnerability and market.

The fishery is clearly a typical small-scale one, where the small vessels (<12 m; 90% of the total fleet) predominate, using mainly traditional bottom longline and several types of handlines. The ecosystem is a seamount type with fishing operations occurring in all available areas, from the islands coasts to the seamounts within the Azorean EEZ. The fishery takes place at deeps until 1000 m, catching species from different assemblages, with a mode on the 200–600 m strata, the intermediate strata where the most commercially important species occur.

Mid-Atlantic Ridge

The Northern Mid-Atlantic Ridge (MAR) is a huge area located between Iceland and Azores. There are more than 40 seamounts of commercial importance (Table 4.7.2). The deep-water fishery on the MAR started in 1973, when dense concentrations of roundnose grenadier (*Coryphaenoides rupestris)* were discovered. Later aggregations of alfonsino *(Beryx splendens)*, orange roughy *(Hoplostethus atlanticus)*, cardinal fish *(Epigonus telescopus)*, tusk (*Brosme brosme*), 'giant' redfish (*Sebastes marinus)* and blue ling (*Molva dypterigia)* were found. Trawl and longline fisheries were conducted in Subareas XII, X, XIV and V (Figure 4.7.2) by Russian, Icelandic, Faroese, Polish, Latvian and Spanish vessels.

4.7.2 Trends in fisheries

Azores EEZ

Since mid-nineties the landings of deep-water species demonstrate a decreasing tendency (Figure 4.7.1, Table 4.7.1), reflecting the change in the fleet behaviour, that has since started to target on blackspot sea bream.

Since 2000, the use of bottom longline in the coastal areas has significantly been reduced, as a result of the interdiction by the local authorities of the use of longlines in the coastal areas on a range of 3 miles from the islands coast. As a consequence, the smaller boats that operate in this area have changed their gears to several types of handlines, which may have increased the pressure on some species. The deep-water bottom longline is at present mostly a seamount fishery.

Also in one other fleet component, the medium size boats, ranging from 12 to 16 meters, a change from bottom longline to handlines has been observed during the last 5 or 6 years. All this changes in the fishing pattern of the fleet may explain the changes in the landings of some species that were more vulnerable to the use of bottom longlines.

Mid-Atlantic Ridge

The greatest annual catch of roundnose grenadier (almost 30 000 t) on the MAR was taken by the Soviet Union in 1975, fluctuating in subsequent years between 2800 and 22 800 t. The fishery for grenadier declined after the dissolution of the Soviet Union in 1992. In the last 15 years, there has been a sporadic fishery (Figure 4.7.2) by vessels from Russia (annual catch estimated at 200–3200 t), Poland (500–6700 t), Latvia (700–4300 t) and Lithuania (data on catch are not available). Grenadier has also been taken as bycatch in the Faroese orange roughy fishery and Spanish blue ling fishery. During the entire fishing period to 2006, the catch of roundnose grenadier from the northern MAR amounted to more than 232 000 t, mostly from ICES Subarea XII.

The deep-water fisheries off Iceland tend to be on the continental slopes although a short-lived fishery on spawning blue ling (*Molva dypterygia*) was reported on a "small steep hill" at the base of the slope near the Westman Islands. The fishery began in 1979, peaked at 8000 t in 1980 and subsequently declined rapidly. French trawlers found small seamount in southerly areas of the Reykjanes Ridge and were fishing for blue ling there in 1993 with 390 t of catch. Maximum Icelandic catch in that area was more 3000 t also in 1993, it declined sharply to 300 and 117 t for next two years and no fishery was reported later (Figure 4.7.2). Fishery on the seamount resumed by Spanish trawlers in 2000s with biggest catch about 1000 t.

Orange roughy occurs in restricted areas of the MAR, where it can be abundant on the tops and the slopes of narrow underwater peaks. These are generally difficult to fish, although in 1991 a single trawler made some noteworthy catches of orange roughy off the south coast of Iceland. In 1992 the Faroe Islands began a series of exploratory cruises for orange roughy beginning in their own waters and later extending into international waters. Exploitable concentrations were found in late 1994 and early 1995. Several vessels began a commercial fishery but only one vessel managed to maintain a viable fishery. Most of the fishery took place on 5 banks. In the northern area (ICES Sub area XII) catches peaked in 1995–1998 (570–802 t), and since then have generally been less than 300 t (Figure 4.7.2). Catches from 6 to 470 t per annum were also made in ICES Subarea X in 1996–1998, 2000–2001, 2004–2006 and 2007.

In 1983–1987, dives with a Soviet submersible discovered aggregations of tusk and northern wolffish (*Anarhichas denticulatus)* on the Northern MAR seamounts, and a bottom longline fishery subsequently developed. Catches of tusk were taken on 20 seamounts in the area between 51–57° N. The highest catch rates were on a seamount named Hekate, with 813 kg per 1000 hooks.

In 1996 a small fleet of Norwegian longliners began a fishery for 'giant' redfish and tusk on the Reykjanes Ridge. The fishery was mainly conducted close to the summits of seamounts and a new type of vertical longline was developed for the fishery (Figure 4.7.2). The fishery continued in 1997, but experienced an 84% decrease in cpue. Norway carried out two exploratory longline surveys in 1996 and 1997. Fishery in that area was resumed in 2005–2007 by Russian longliners.

Spain carried out 5 limited exploratory trawl surveys to seamounts on the MAR in 1997–2000 and a longline survey in 2004 but except for sporadic fisheries in the northern area (Division XIVb) there has been a decline in interest.

The first commercial catches of alfonsino in this area were taken by pelagic trawling on the Spectr seamount in 1977 and this and other seamounts were exploited in 1978 and 1979. No commercial fishing took place during the 1980s but 9 exploratory and research cruises yielded about 1000 t of mixed deep-water species, mostly alfonsino, but also commercial catches of cardinal fish, orange roughy, black scabbardfish and silver roughy (*Hoplostethus mediterrraneus)*. A joint Russian-Norwegian survey in 1993 used a bottom trawl to survey three seamounts and a catch of 280 t, mainly alfonsino and cardinal fish, was taken from two of them. Orange roughy, black scabbard fish and wreckfish *(Polyprion americanus)* were also of commercial importance. Commercial fishing yielded more than 2800 t over the next 7 years (Figure 4.7.2). In recent years there have been no indications of fishery of alfonsino. Since the discovery of the seamounts in the North Azores area Soviet and Russian, vessels have taken about 6000 t, mainly of alfonsino. Vessels from the Faroe Islands and the UK have also small catches of the species in the area.

4.7.3 Technical interactions

Azores EEZ

The reported bycatch in this fishery seems rather insignificant, according to a pilot study conducted in 2004 (ICES, 2006). Fisheries occurring outside the ICES area to the south of the Azores EEZ may be exploiting the same stocks as considered here.

Mid-Atlantic Ridge

The possible interactions between local fishing grounds (e.g. seamounts) and the status of the stocks at larger scale are unknown. In particular, seamount aggregating species such alfonsinos and orange roughy are sensitive to sequential local depletion. However, no data were available to assess such effects. Little is understood about the stock structure of these species and it is possible that the industrial fleets fishing on the MAR may be fishing the same stocks that are exploited by the Azorean fishery.

The separation of fishing activities and catch on the MAR and Hatton Bank have been problematic as both these areas are parts of ICES Subarea XII. The Spanish fishery on the Hatton bank is not known to operate of the MAR. However, this fishery is operated by large high-sea freezer trawlers that also fish in the Northwest Atlantic (NAFO area) and could therefore do some fishing also on the northern MAR. The Spanish fishery produces only small landings of aggregating seamount species (orange roughy, alfonsinos) and target mainly roundnose grenadier. Therefore it is unlikely to interact with fisheries in the southern MAR and other fisheries for roundnose grenadier. Landings of non-aggregating species (mainly roundnose grenadier) on the northern ridge have been small over recent years.

4.7.4 Ecosystem considerations

Azores EEZ

The Azores are considered a "seamount ecosystem area" because of its high seamount density. The Azores, as most of the volcanic islands don't have a coastal platform and are surrounded by extended areas of great depths, punctuated by some seamounts where the fisheries occur. The average depth in the Azores EEZ is of 3000 meters, and only 0.8% (7715 km^2) has depths less than 600 meters whereas 6.8% are between 600 and 1500 meters. The deep-water fishery in the Azores is mostly a seamount fishery where only bottom longlines and handlines are used.

Mid-Atlantic Ridge

Most of Divisions XIIa, XIIc, Xb, XIVb1 and Va are covered in abyssal plain with an average depth of >ca 4000 m which currently remains largely unexploited. The major topographic feature is the Northern part of the MAR, located between Iceland and the Azores. Numerous seamounts of variable heights occur all along this ridge along with isolated seamounts in other areas such as Altair and Antialtair. The physical structure of seamounts often amplify water currents and create unique hard substrata environments that are densely populated by filter-feeding epifauna such as sponges, bivalves, brittlestars, sea lilies and a variety of corals such as the reef-building cold-water coral *Lophelia pertusa*. This benthic habitat supports elevated levels of biomass in the form of aggregations of fish such as orange roughy, alfonsinos, etc. and a number of seamounts have been targeted by commercial fleets. Such habitats are however highly susceptible to damage by mobile bottom fishing gear and the fish stocks can be rapidly depleted as a consequence of the life-history traits of the species which are slow growing and longer-living than non-seamount species.

The MAR is isolated from the continental slope except for the relatively continuous shallower connections via the Greenland and Scotland ridges, and some seamount chains, e.g. the New England seamounts provide other linkages to the continents. Along with much of the general biology, the intraspecific status of species inhabiting the MAR is unclear. Based on geographical patterns it is probable that MAR stocks are isolated from the others in the North Atlantic and endemism, especially among benthic species may be high and therefore particularly vulnerable.

The recent efforts to study the distribution and biology of the MAR through the MAR-ECO project will yield a better insight into the status of this remote eco-system (http//:www.mar-eco.no).

4.7.5 Management of fisheries

Azores EEZ

The only known deep-water fisheries in ICES Subdivision Xa are those from the Azores. The fisheries management is based on regulations issued by the European Community, by the Portuguese government and by the Azores regional government. Under the E. C. Common Fisheries Policy, TACs where introduced for some species, e.g. blackspot sea bream, black scabbardfish, and deep-water sharks, in 2003 (EC. Reg. 2340/2002) and maintained in 2004 (EC. Reg. 2270/2004), 2006 (EC. Reg. 2015/2006) and 2008 (EC Reg. 1359 2008). A specific access requirements and conditions applicable to fishing for deep-water stocks was established (EC. Reg 2347/2002). Fishing with trawl gears is forbidden in the Azores region. A box of 100 miles limiting the deep-water fishing to vessels registered in the Azores was created in 2003 under the management of fishing effort of the common fishery policy for deep-water species (EC. Reg. 1954/2003). Some technical measures were also introduced by the Azores regional government since 1998 (including fishing restrictions by area, vessel type and gear, fishing licence based on landing threshold and minimum lengths).

In order to reduce effort on traditional stocks, fishers are encouraged by local authorities to exploit the deeper strata (>700 m), but the poor response of the market has been limiting the expansion of the fishery.

Mid-Atlantic Ridge

EC vessels fishing on the MAR are covered by community TAC. There are NEAFC regulation of efforts in the fisheries for deep-water species and closed area to protect vulnerable habitats.

Table 4.7.1. Overview of landings in Sub-Areas X (a1,a2,b) and XII (c, a1, b1) (does not include information from XIIb, Western Hatton bank).

SPECIES	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ALFONSINOS (Beryx spp.)	631	550	983	229	175	229	199	243	172	139	157	192	211	250
ARGENTINES (Argentina silus)		1			2					4				
BLUE LING (Molva dypterigia)	602	814	438	451	1363	607	675	1270	1069	644	35	65	1	
BLACK SCABBARDFISH (Aphanopus carbo)	304	455	203	253	224	357	134	1062	502	384	198	73		80
BLUEMOUTH (Helicolenus dactylopterus)	589	483	410	381	340	452	301	280	338	282	190	209	275	281
DEEP WATER CARDINAL FISH (Epigonus telescopus)						3		14	16	21	4	10	7	7
GREATER FORKBEARD (Phycis blennoides)	75	47	32	39	41	100	91	63	56	46	1	134	201	18
LING (Molva molva)	50	2	9	2	2	7	59	8	19		2			
MORIDAE						1	88	113	140	91		127	86	
ORANGE ROUGHY (Hoplostethus atlanticus)	676	1289	814	806	441	447	839	28	201	711	324	104	20	108
RABBITFISH (Chimaerids)			32	42	115	48	79	98	81	128	193			
ROUGHHEAD GRENADIER (Macrourus berglax)					3	7	10	7	2	28	8	8		
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	644	1739	8622	11979	9696	8602	7926	11 468	10 805	10 748	513	86	2	12
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)	1096	1036	1012	1114	1222	947	1034	1193	1068	1075	1383	958	1070	1089
SHARKS, VARIOUS	1385	1264	891	1051	50	1069	1208	35	25	6	14	104	63	12
SILVER SCABBARDFISH (Lepidopus caudatus)	789	815	1115	1186	86	28	14	10	25	29	31	35	55	63
SMOOTHHEADS (Alepocephalidae)		230	3692	4643	6549	4146	3592	12538	6883	4368	6872			
TUSK (Brosme brosme)	18	158	30	1	1	5	52	27	83	16	66.26	64	19	
WRECKFISH (Polyprion americanus)	240	240	177	139	133	268	229	283	270	189	279	497	664	513
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008

Table 4.7.2. Summary data on seamount fisheries on the MAR.

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

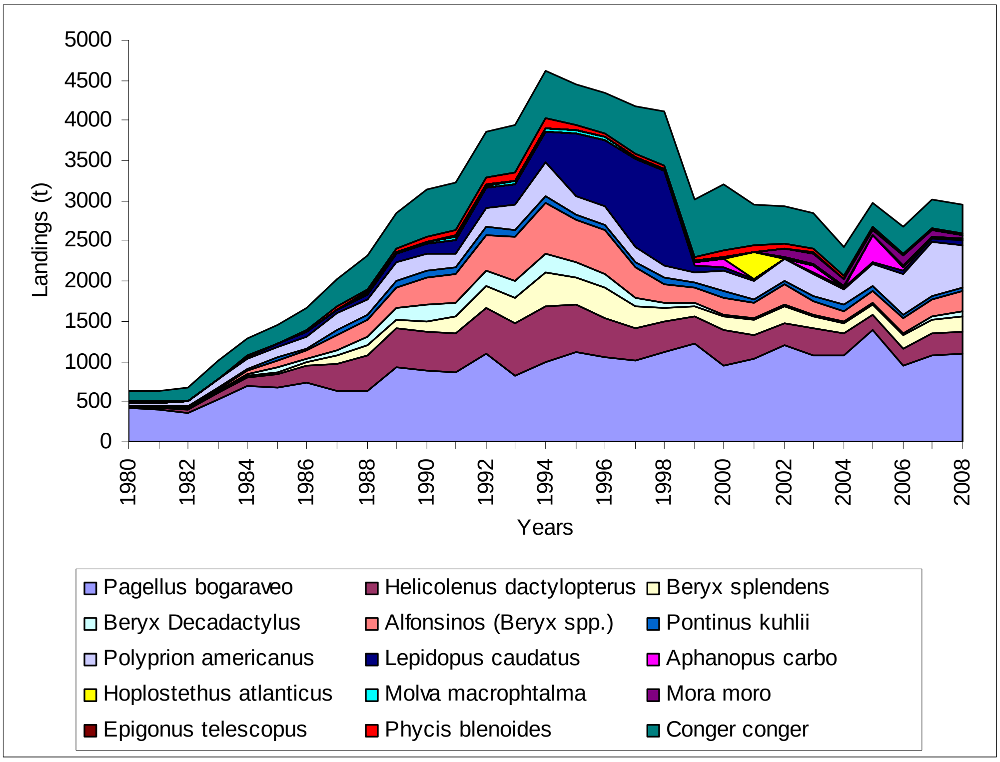
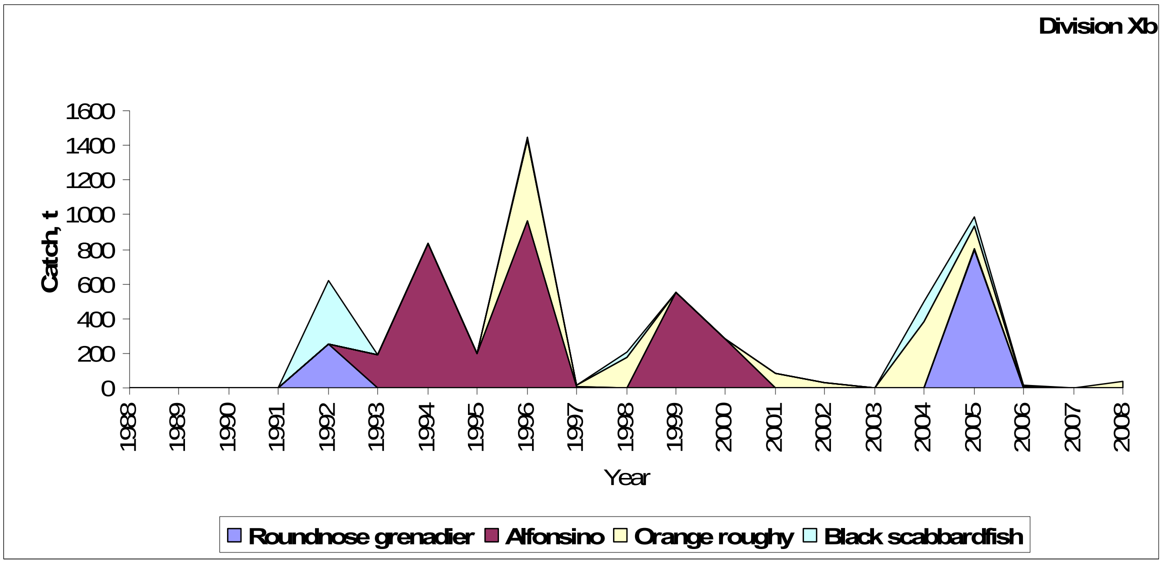
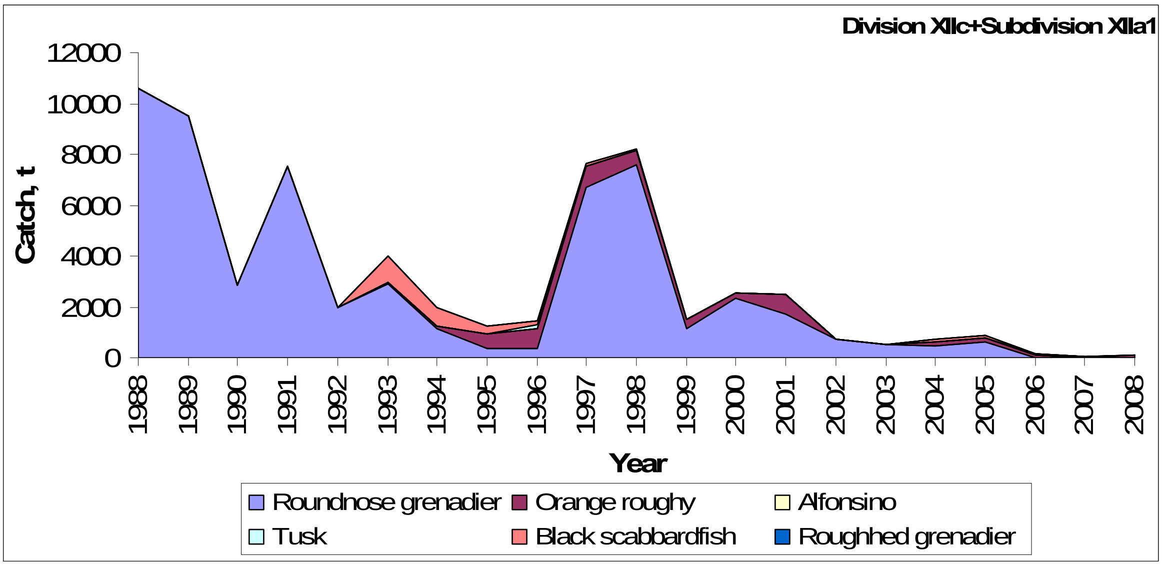


Figure 4.7.1. Annual landings of major deep-water species in Azores from hook and line fishery (1980–2007).





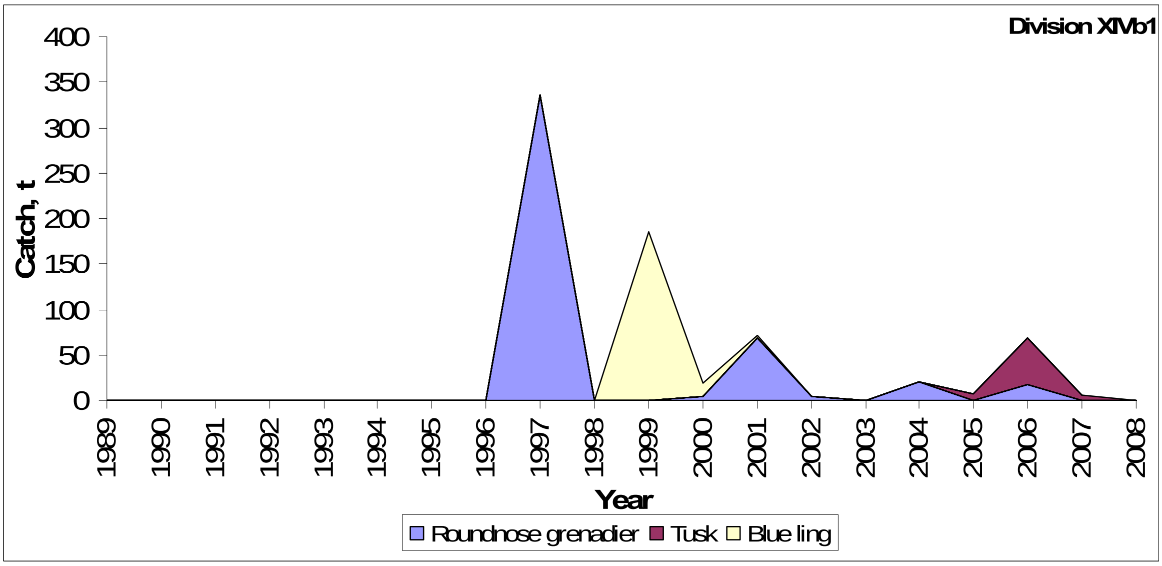


Figure 4.7.2. Annual catch of major deep-water species on MAR in 1988–2008.

5 Ling (*Molva molva*) in the Northeast Atlantic

5.1 Stock description and management units

WGDEEP 2006 indicated: '*There is currently no evidence of genetically distinct populations within the ICES area. However, ling at widely separated fishing grounds may still be sufficiently isolated to be considered management units, i.e. stocks, between which exchange of individuals is limited and has little effect on the structure and dynamics of each unit. It was suggested that Iceland (Va), the Norwegian Coast (II), and the Faroes and Faroe Bank (Vb) have separate stocks, but that the existence of distinguishable stocks along the continental shelf west and north of the British Isles and the northern North Sea (Subareas IV, VI, VII and VIII) is less probable. Ling is one of the species included in a recently initiated Norwegian population structure study using molecular genetics, and new data may thus be expected in the future*'.

WGDEEP 2007 examined available evidence on stock discrimination and concluded that available information is not sufficient to suggest changes to current ICES interpretation of stock structure.

Catches data for ling in 2006 and 2007 aggregated at the level of statistical rectangle were provided to the working group by France, Ireland, the UK (England and Wales and Scotland) and Iceland. These are shown in Figures 5.1.1 and 5.1.2.

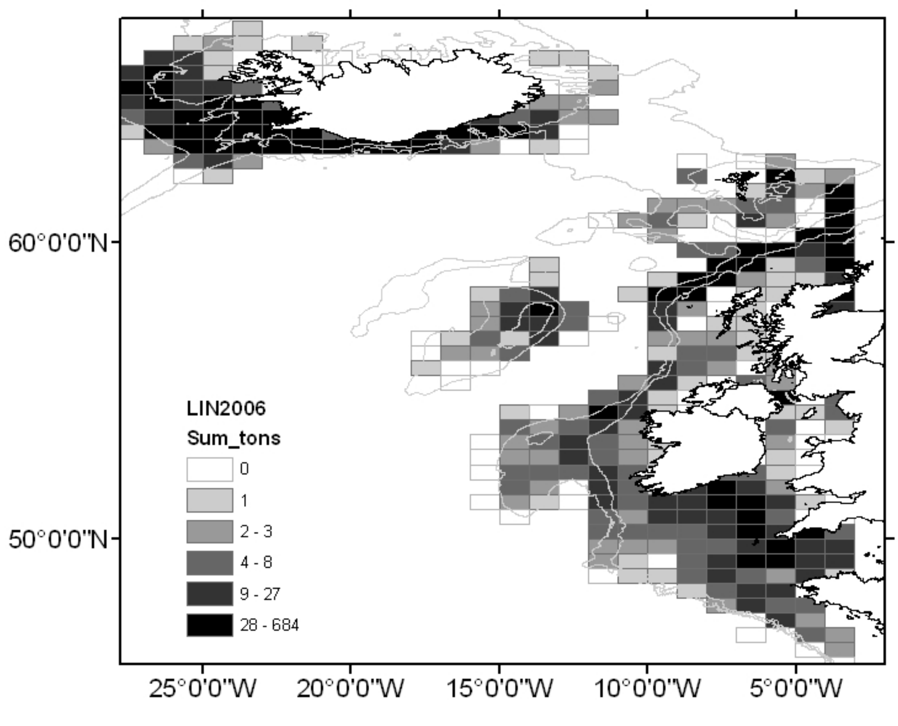


Figure 5.1.1. Catches of ling by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2006.

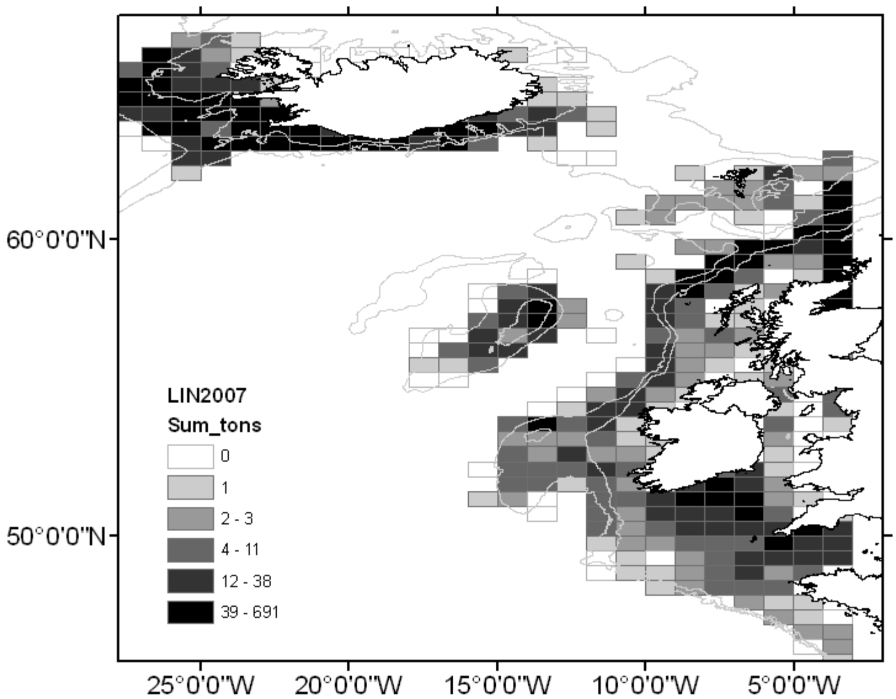


Figure 5.1.2. Catches of ling by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

5.2 Ling (*Molva Molva*) in Division Vb

5.2.1 The fishery

Description of fisheries in this area is provided in Section 4.3.

5.2.2 Landings trends

Landings data for this stock are available from 1904 onwards; however, landing statistics for ling by nation are available for the period 1988–2008 and are given in Tables 5.2.0a–5.2.0c and Figure 5.2.1. Landings in Division Vb have varied between about 4000 and 6000 tonnes since 1980, except for low landings in 1993 (about 3000 tonnes). The preliminary landings of ling in 2008 are 4730 tonnes, of which Norwegian longliners took about 860 tonnes and the Faroese fleets 3800 tonnes. Other nations account for 70 tonnes.

The 2007 Faroese landings by fleet were:

Longliners <110GRT	Longliners >110GRT	OB trawlers <1000HP	OB trawlers >1000HP	Pairtrawlers <1000HP	Pairtrawlers >1000HP	Others
9%	48%	2%	19%	5%	15%	2%

(2008 data were not available).

5.2.3 ICES advice

The latest advice is from ICES ACOM in May 2008: ICES reiterates the advice that effort should not be allowed to increase and to collect information that can be used to evaluate a long-term sustainable level of exploitation.

5.2.4 Management

For the Faroese fleets, there is no species-specific management of ling in Vb, although licenses are needed in order to fish. The minimum landing size is 60 cm. Other nations are regulated by TACs. Details on management measures in Faroese waters are given in Section 4.3.5.

5.2.5 Data available

There are data on length, weights and age available for ling from the Faroese landings; Table 5.2.1 gives an overview of the levels of sampling. There are also catch and effort data from logbooks for the Faroese longliners and pairtrawlers, and from the two annual Faroese groundfish surveys for cod, haddock and saithe are biological data (length and weight) as well as catch and effort data available. In addition, there are also data available on catch, effort and mean length from Norwegian longliners fishing in Faroese waters (Helle *et al*., WD 2, 2009). No further data for the latter were provided for 2008.

5.2.5.1 Landings and discards

Landings were available for all relevant fleets. No estimates of discards of ling are available. There is a ban on discarding in Vb and incentives for illegal discarding are believed to be low. The landings statistics are therefore regarded as being adequate for assessment purposes.

5.2.5.2 Length compositions

Length distributions are available for Faroese commercial landings (Figure 5.2.2) and two Faroese groundfish surveys in Division Vb (Ofstad, WD 12, 2009). There are also length distributions from the Norwegian longliners "reference fleet" for the period 2003–2005 (ICES 2007a). The length distributions for the Norwegian longliners fishing in Faroese waters, in the period 2003–2005, were almost the same as for the Faroese longliners in the same period. A few length measurements for ling (N=74) from Russian longliners demonstrated a higher length composition (Vinnichenko *et al*., WD 17, 2009).

5.2.5.3 Catch-at-age

Catch-at-age data were provided for Faroese landings in Vb 1996–2007 (ICES 2008). No new catch-at-age data are for 2008. Age distribution for commercial landings from longliners and trawlers are presented in Figure 5.2.3.

5.2.5.4 Weight-at-age

Mean weight-at-age data are provided for the Faroese fishery in Vb 1996–2007 (ICES 2008). No new data presented for 2008.

5.2.5.5 Maturity and natural mortality

Ling become mature at ages 5–7 (60–75 cm lengths) in most areas, with males maturing at a slightly lower age than females (Magnusson *et al*., 1997). No annual measurements of maturity-at-age were available and knife-edge maturity for age 7 and older was assumed for the assessment.

A natural mortality of 0.15 was assumed for all ages.

5.2.5.6 Catch, effort and research vessel data

Commercial cpue series. There are catch per unit of effort (cpue) data available for three different commercial series, for Faroese longliners, Faroese pairtrawlers and Norwegian longliners (Figure 5.2.4-5.2.5). It was not possible to update the Norwegian series to 2008. All the commercial cpue series demonstrate a small decreasing trend in the last 3–4 years.

The Faroese cpue data are from all available logbooks, for the period 1986–2008, from 6–8 pairtrawlers (HP>1000) and 5 longliners (GRT>110). These data are stored in a database at the Faroese Fisheries Laboratory. The data are corrected and quality controlled. The effort obtained from the logbooks is estimated as number of fishing (trawling) hours from the trawlers, 1000 hooks from the longliners and the catch as kg stated in the logbooks. The third series is data from the Norwegian longliners "reference fleet".

Sets where the catch of blue ling, ling and tusk combined represented more than 80% of the total catch and depth was >150 m were selected for the longliner cpue series. The bycatch series for ling from the Faroese pairtrawlers > 1000 HP is limited to hauls where the catch of saithe is more than 60 % of the total catch in the haul and depth was >150 m.

Fisheries independent cpue series. Cpue estimates (kg/hour) for ling are available from two annual groundfish surveys for cod, haddock and saithe in Faroese waters (Figure 5.2.6). Both surveys are restricted to the area within the 500 m contour of the Faroe Plateau and do not cover the whole distribution area for ling. This series have so far not been used as a tuning series because no age data are available.

The spring survey has been carried out in February–March since 1982 (100 fixed stations), and the summer survey in August–September since 1996 (200 fixed stations). For the spring survey, however, data are only available for the period 1994–2008 as a consequence of problems with extraction of data from the database.

5.2.6 Data analyses

No assessment was required in 2009.

5.2.7 Comments on assessment

No new assessment.

5.2.8 Management consideration

No advice was required for this stock in 2009.

Table 5.2.0a. Ling in Vb1. Nominal landings (1988–2008).

YEAR	DENMARK (2)	FAROES	FRANCE	GERMANY	NORWAY	E&W (1)	SCOTLAND (1)	RUSSIA	TOTAL
1988	42	1383	53	4	884	1	5		2372
1989		1498	44	2	1415		3		2962
1990		1575	36	1	1441		9		3062
1991		1828	37	2	1594		4		3465
1992		1218	3		1153	15	11		2400
1993		1242	5	1	921	62	11		2242
1994		1541	6	13	1047	30	20		2657
1995		2789	4	13	446	2	32		3286
1996		2672			1284	12	28		3996
1997		3224	7		1428	34	40		4733
1998		2422	6		1452	4	145		4029
1999		2446	18	3	2034	0	71		4572
2000		2103	8	1	1305	2	61		3480
2001		2069	14	3	1496	5	99		3686
2002		1638	6	2	1640	3	239		3528
2003		2139	13	2	1526	3	215		3898
2004		2733	15	1	1799	3	178	2	4731
2005		2886	3		1553	3	175		4620
2006	3	3563	6		850		136		4558
2007	2	3004	8		1071		6		4091
2008*		3343	4		740	32	25	11	4155

***Preliminary. (1) Includes Vb2. (2) Greenland.**

Table 5.2.0b. Ling in Vb2. Nominal landings (1988–2008).

YEAR	FAROES	FRANCE	NORWAY	TOTAL
1988	832		1284	2116
1989	362		1328	1690
1990	162		633	795
1991	492		555	1047
1992	577		637	1214
1993	282		332	614
1994	479		486	965
1995	281		503	784
1996	102		798	900
1997	526		398	924
1998	511		819	1330
1999	164	4	498	666
2000	229	1	399	629
2001	420	6	497	923
2002	150	4	457	611
2003	624	4	927	1555
2004	1058	3	247	1308
2005	575	7	647	1229
2006	472	6	177	655
2007	327	4	309	640
2008*	454	2	120	576

Table 5.2.0c. Ling in Vb. Nominal landings (1988–2008) (* preliminary data).

Year	Vb1	Vb2	Vb
1988	2372	2116	4488
1989	2962	1690	4652
1990	3062	795	3857
1991	3465	1047	4512
1992	2400	1214	3614
1993	2242	614	2856
1994	2657	965	3622
1995	3286	784	4070
1996	3996	900	4896
1997	4733	924	5657
1998	4029	1330	5359
1999	4572	666	5238
2000	3480	629	4109
2001	3686	923	4609
2002	3528	611	4139
2003	3898	1555	5453
2004	4731	1308	6039
2005	4620	1229	5849
2006	4558	655	5213
2007	4091	640	4731
2008*	4155	576	4731

***Preliminary.**

Table 5.2.1. Ling in Vb. Overview of the sampling of the commercial landings.

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Lengths	6399	7900	5912	4536	3512	3805	4299	6585	6827	7167	6503	4031	2579
Weights	410	541	538	360	360	420	180	360	1169	3217	4038	1713	570
Ages	1084	1526	1081	480	360	420	300	661	659	540	276	120	60

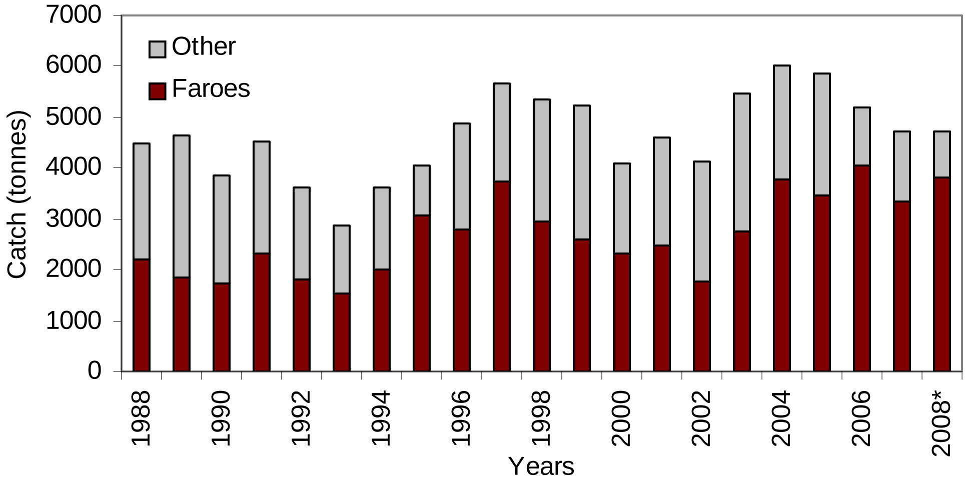
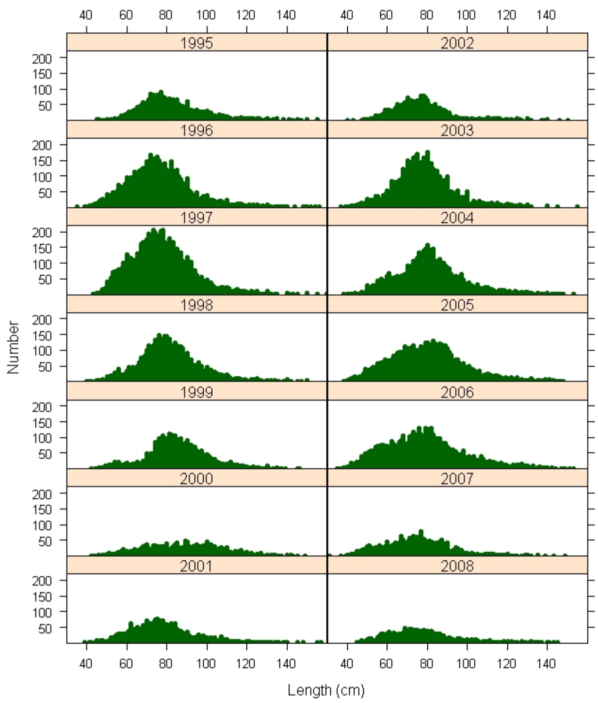


Figure 5.2.1. Ling in Vb. Nominal landings (thousand tonnes) 1904–2007.



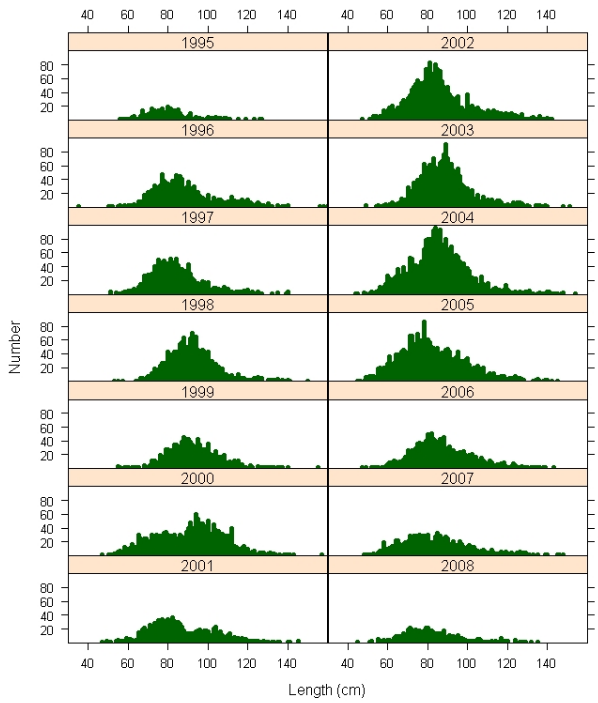
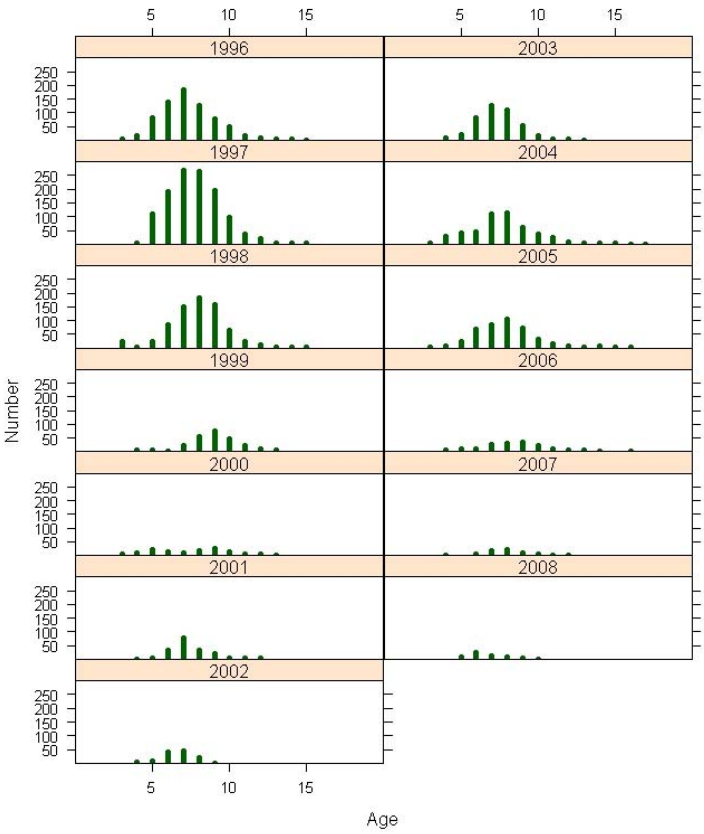


Figure 5.2.2. Ling in Vb. Length distribution in the landings from Faroese longliners >110 GRT (left) and pairtrawlers >1000 HP (right).



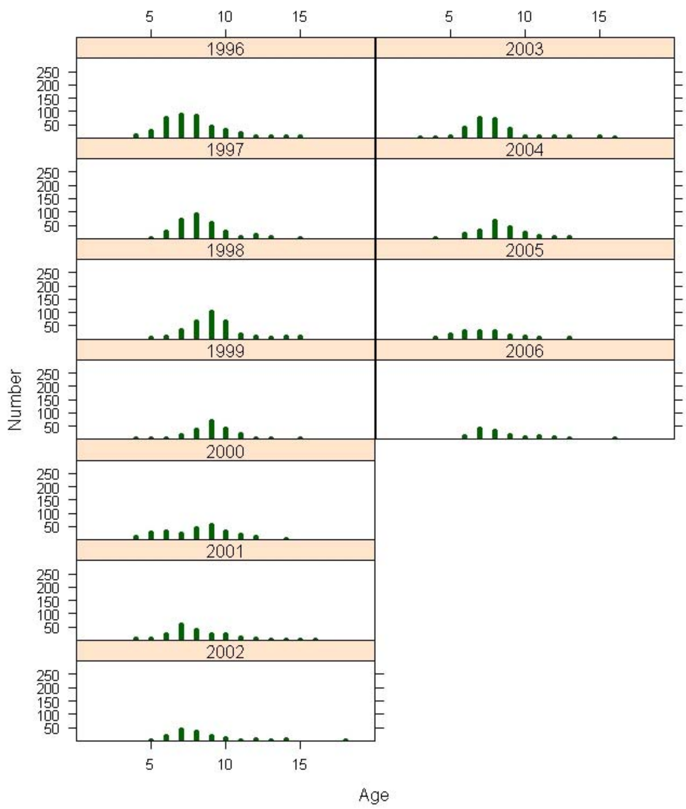


Figure 5.2.3. Ling in Vb. Age distribution in the landings from Faroese longliners >110 GRT (left) and pairtrawlers >1000 HP (right).

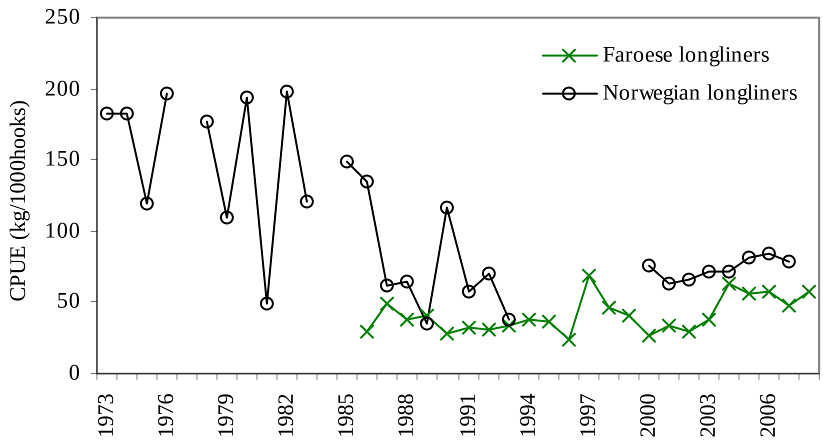


Figure 5.2.4. Ling in Vb. Cpue (kg/1000 hooks) from Faroese longliners >110 GRT and Norwegian longliners.

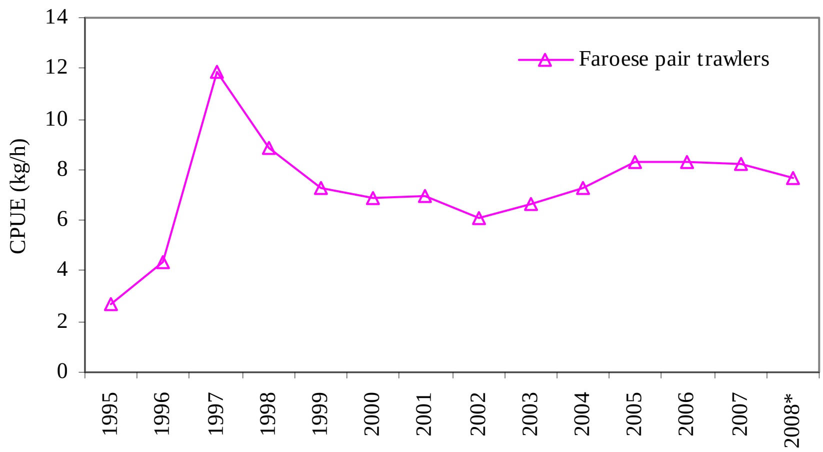


Figure 5.2.5. Ling in Vb. Cpue (kg/hour) from Faroese pairtrawlers (bycatch serie).

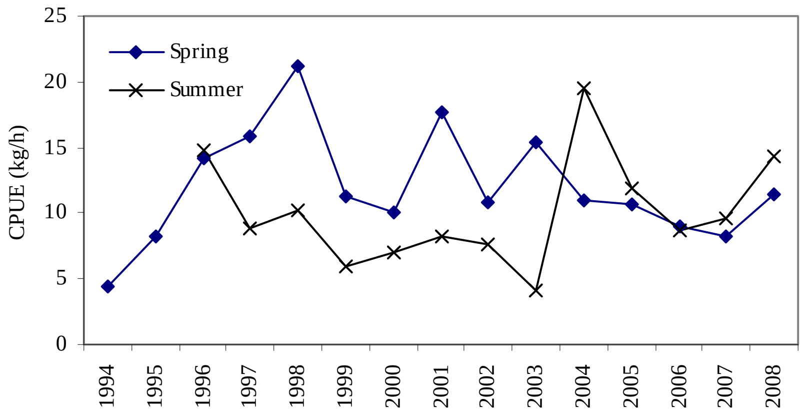


Figure 5.2.6. Ling in Vb. Cpue (kg/h) in the two annual Faroese groundfish surveys.

5.3 Ling (*Molva Molva*) in Subareas I and II

5.3.1 The fishery

Ling has been fished in these Subareas for centuries, and the historical development is described in, e.g. Bergstad and Hareide (1996). In particular, the post-World War II increase in catch, because of a series of technical advances, is well documented. Currently the major fisheries in Subareas I and II are the Norwegian longline and gillnet fisheries, but there are also bycatches by other gears, i.e. trawls and handlines. Around 50% of the Norwegian landings are taken by longlines and 45% by gillnets, partly in the directed ling fisheries and partly as bycatch in fisheries for other groundfish. Other nations catch ling as bycatch in their trawl fisheries.

5.3.2 Landings trends

Landing statistics by nation in the period 1988–2008 are in Tables 5.3.0a–d. During the period 2000–2005 the landings varied between 6000 and 7000 tonnes, which are about the same catches as in the preceding decade. In 2006 the landings increased to 8845 tons and preliminary data demonstrate that the landings increased further to 11 320 tonnes in 2008.

5.3.3 ICES advice

The advice statement from 2008 was: *Cpue in Areas I and II has been at a reduced level. ICES reiterates the advice to constrain catches to 6000 t and to collect information that can be used to evaluate a long-term sustainable level of exploitation*

5.3.4 Management

There is no species-specific management of the ling fishery in Subareas I and II, but the exploitation is influenced by regulations aimed at other groundfish species, e.g. cod and haddock (see Section 4.2.1). There is no quota set for the Norwegian fishery. The quota for the EC in Areas I and II in the Norwegian zone for bycatch species such as ling and tusk is in 2009 set to 5000 tons. There is no minimum landing size in the Norwegian EEZ. The quota for the EC in Areas I and II in the Norwegian zone for bycatch species such as ling and tusk is in 2009 set to 350 tonnes.

The quota in EC and international waters was set at 45 tonnes in 2009.

5.3.5 Data available

5.3.5.1 Landings and discards

The amount of landings was available for all relevant fleets. New discard data were not available, but within the Norwegian EEZ discarding is prohibited and therefore assumed to be minor.

5.3.5.2 Length compositions

Length compositions and mean lengths from 1976 to the present, based on data from Norwegian longliners, are in Bergstad and Hareide, (1996); Helle and Pennington, WD6, 2007 and Helle *et al.*, WD 2, 2009. During this period, when the ling was fully or heavily exploited, the mean length has varied but without any clear trend.

Length composition of ling in the trawl catches in Norwegian Sea (Subarea II) in January–May 2008 is in Figure 5.3.1 Vinnichenko *et al.*, WD 17, 2009.

5.3.5.3 Age compositions

No new age compositions were available.

5.3.5.4 Weight-at-age

No new data were presented.

5.3.5.5 Maturity and natural mortality

No new data were presented.

5.3.5.6 Catch, effort and research vessel data

Catch and effort data for Norwegian longliners were presented, both for the overall fleet and for a set of 4 vessels, "the reference fleet", with which there is a special agreement on reporting measurements, etc., to the IMR. No research vessel data were available.

The extensive Norwegian longliner cpue data, based on skippers' logbooks presented in the 1996 report, have not been updated after 1994. In the 1998 report (Table 6.5 of ICES, 1998), effort data were given for the period 1974–1996 based on official statistics.

To resume the cpue-series, Norway has adopted two approaches:

> *Official logbooks from longliners.* Entering of data from official logbooks in an electronic database was begun in 2001 and data are now available for the period 2000–2007.(Because the WGDEEP meeting is relatively early this year, the logbook data, the reference fleet data and associated estimates are not yet available for 2008). Vessels were selected that had a total landed catch of ling, tusk and blue ling exceeding 8 tons in a given year. The logbooks contain records of the daily catch, date, position, and number of hooks used per day.
>
> *Reference fleet information*. Since 2001 special agreements were made with selected vessels, "the reference fleet", providing data on the species composition of the catch (in weight), and number of hooks used per day (Helle *et al*., WD2 2009). There are currently four longline vessels in the reference fleet.

An analyses based on these two sources of data was presented in a WD by Helle *et al.*, WD2 2009.

5.3.6 Data analyses

No new assessments were carried out in 2009.

5.3.7 Comments on the assessment

No assessment was carried out this year.

5.3.8 Management considerations

No advice was required for this stock in 2009.

Table 5.3.0a. Ling I. WG estimates of landings.

Year	Norway	Iceland	Scotland	Faroes	Total
1996	136				136
1997	31				31
1998	123				123
1999	64				64
2000	68	1			69
2001	65	1			66
2002	182		24		206
2003	89				89
2004	323			22	345
2005	107				107
2006	58				58
2007	96				96
2008*	54				54

*Preliminary

Table 5.3.0b. Ling IIa. WG estimates of landings.

Year	Faroes	France	Germany	Norway	E & W	Scotland	Russia	Ireland	Total
1988	3	29	10	6070	4	3			6119
1989	2	19	11	7326	10	-			7368
1990	14	20	17	7549	25	3			7628
1991	17	12	5	7755	4	+			7793
1992	3	9	6	6495	8	+			6521
1993	-	9	13	7032	39	-			7093
1994	101	n/a	9	6169	30	-			6309
1995	14	6	8	5921	3	2			5954
1996	0	2	17	6059	2	3			6083
1997	0	15	7	5343	6	2			5373
1998		13	6	9049	3	1			9072
1999		12	7	7557	2	4			7581
2000		9	39	5836	5	2			5891
2001	6	9	34	4805	1	3			4858
2002	1	4	21	6886	1	4			6917
2003	7	3	43	6001		8			6062
2004	15	0	3	6114		1	5		6138
2005	6	5	6	6085	2		2		6106
2006	9	8	6	8685	6	1	11		8726
2007	18	6	7	9970	1	0	55	1	10 058
2008*	22	4	7	11 041	1	1	29	0	11 105

*Preliminary

Table 5.3.0c. Ling IIb. WG estimates of landings.

Year	Norway	E & W	Faroes	Total
1988		7		7
1989		-		
1990		-		
1991		-		
1992		-		
1993		-		
1994		13		13
1995		-		
1996	127	-		127
1997	5	-		5
1998	5	+		5
1999	6			6
2000	4	-		4
2001	33	0		33
2002	9	0		9
2003	6	0		6
2004	77			77
2005	93			93
2006	64			64
2007	180		0	180
2008*	161	0	0	161

***Preliminary**

Table 5.3.0d. Ling I and II. Total landings by subareas or Divisions.

Year	I	IIa	IIb	All areas
1988		6119	7	6126
1989		7368		7368
1990		7628		7628
1991		7793		7793
1992		6521		6521
1993		7093		7093
1994		6309	13	6322
1995		5954		5954
1996	136	6083	127	6346
1997	31	5373	5	5409
1998	123	9072	5	9200
1999	64	7581	6	7651
2000	69	5891	4	5964
2001	66	4858	33	4957
2002	206	6917	9	7132
2003	89	6062	6	6157
2004	345	6138	77	6560
2005	107	6106	93	6306
2006	58	8726	64	8848
2007	96	10 058	180	10 334
2008*	54	11 105	161	11 320

***Preliminary**

Table 5.3.1 Summary statistics for the Norwegian longliner fleet during the period 1995–2008 (vessels exceeding 21 m). This list only includes vessels that landed 8 tonnes or more of ling, blue ling and tusk in a given year.

Year	Number of longliners
1995	65
1996	66
1997	65
1998	67
1999	71
2000	72
2001	65
2002	58
2003	52
2004	43
2005	39
2006	35
2007	38
2008	36

Table 5.3.2 Estimated number of days that the Norwegian longliner fleet (selected using criteria described in the text) operated in Subareas I and II in the period 2000–2007.

Ling	2000	2001	2002	2003	2004	2005	2006	2007
IIa	23	40	50	40	37	51	54	65

Table 5.3.3. Estimated number of hooks that the Norwegian longliners set per day in Subarea I and II in the fishery for tusk, ling and blue ling during the period 2000–2007. n= the total number of days with hook information contained in the logbooks.

All	2000		2001		2002		2003		2004		2005		2006		2007	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
I	31 688	353	33 325	163	35 432	263	35 045	376	32 431	433	32 671	316	33 182	187	34 380	318
IIa	31 439	1916	30 703	2196	33 431	2031	34 766	1839	33 475	1389	32 861	1248	35 140	1252	35 207	2103
IIb	35 409	71	34 638	315	34 756	45	34 776	67	31 859	217	35 082	207	39 298	57	37 881	328

Table 5.3.4. Estimated total number of hooks (in thousands) the Norwegian longliner fleet used in Subareas I and II for the years 2000–2007 in the fishery for tusk, ling and blue ling.

All	2000	2001	2002	2003	2004	2005	2006	2007
I	20 534	10 831	20 551	21 868	27 891	29 306	12 775,07	19 081
IIa	117 708	127 724	143 486	131 972	107 957	103 808	89 783	131 569
IIb	5099	20 263	4032	5425	15 069	19 155	4126	29 434

Table 5.3.5. Estimated mean cpue ([kg/hook]x1000) in IIa based on logbook data. Standard error (se) and number of catches sampled (n) is also given.

All vessels submitting logbooks.

LING																								
		2000			2001			2002			2003			2004			2005			2006			2007	
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
IIA	23,9	1064	0,7	21,9	1352	0,6	24,2	1345	0,5	29,1	925	0,7	37,3	630	0,9	49,8	775	1,1	42,3	928	0,9	40	1334	0,6

Reference vessels.

LING	2001			2002			2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
IIA	9,4	19	2,17	27	88	2,08	33	134	2,03	47,1	183	2,46	54,4	275	2,4	54,9	366	2,33	52,7	402	1,61

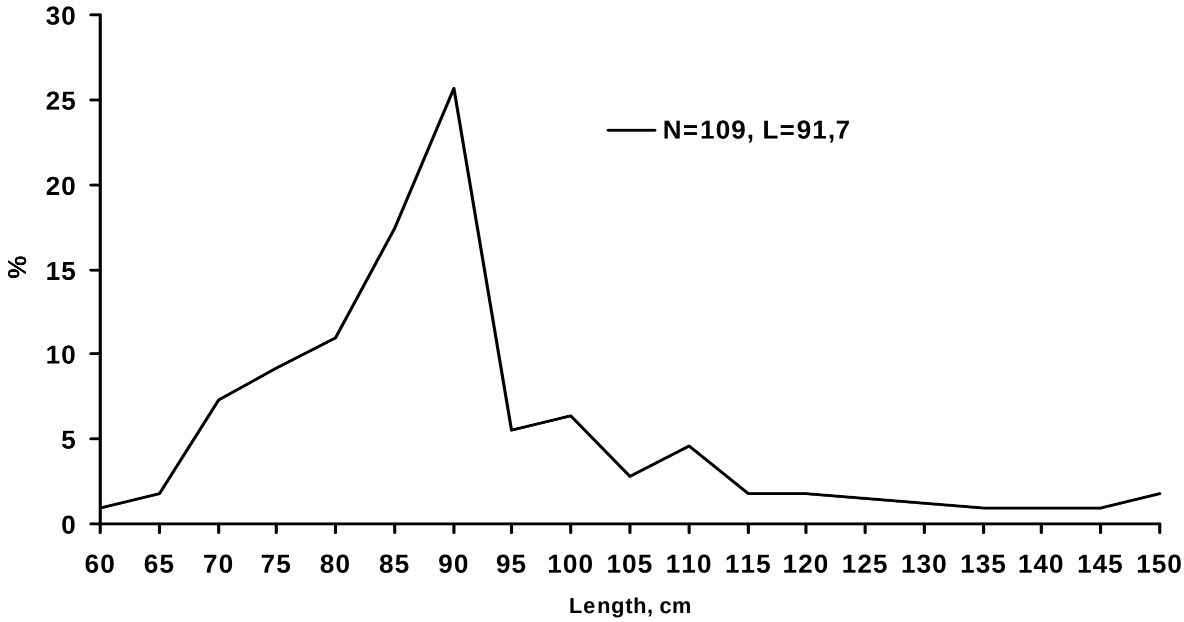
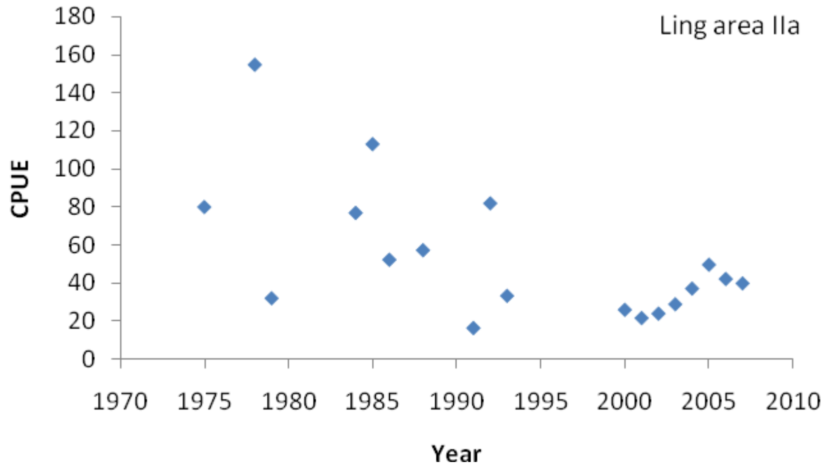
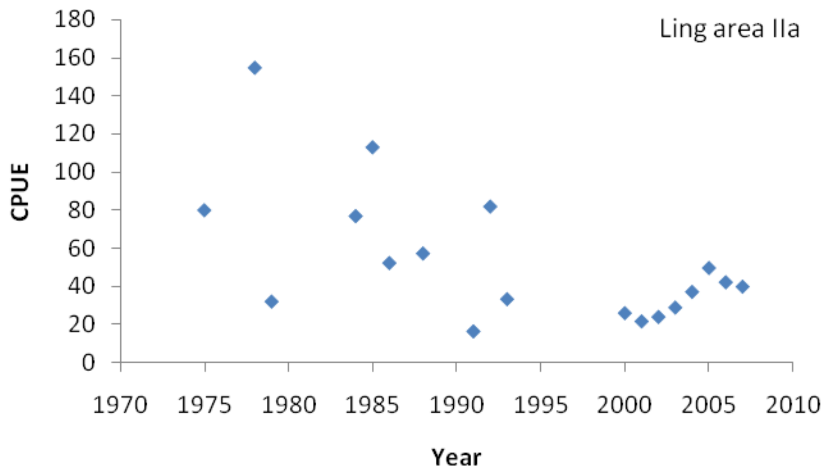


Figure 5.3.1. Length composition of ling in trawl catches in Norwegian Sea (Subarea II) in January–May 2008.





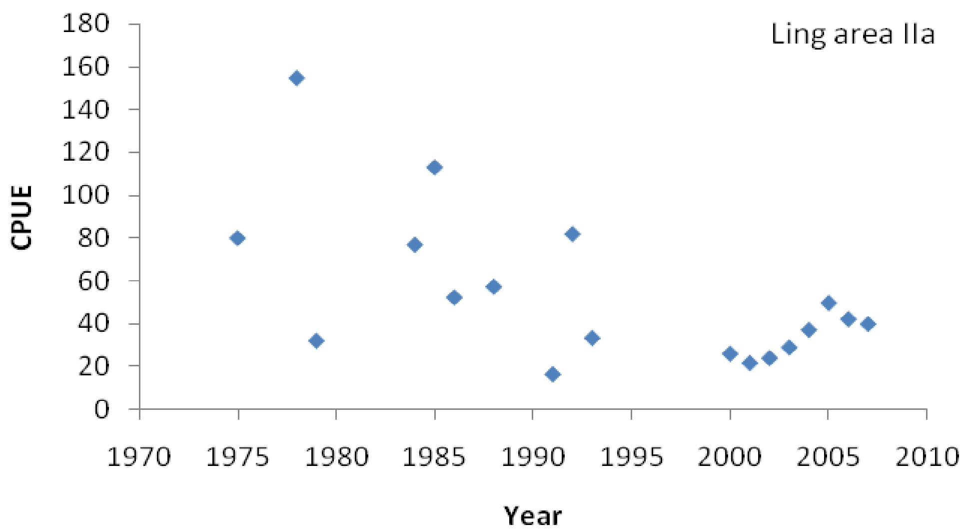


Figure 5.3.2. Ling in IIa. Estimates of cpue (kg/1000 hooks) based on skipper's logbooks (pre-2000) and official logbooks (post 2000). Combination of data from Bergstad and Hareide, 1996 and WD2 by Helle *et al.*, 2009.

5.4 Ling (*Molva Molva*) in Division Va

5.4.1 The fishery

The fishery for ling in Va has not changed substantially in recent years, over Icelandic 550 vessels have been reporting catches of ling, from less than 0.1 t to over 170 t per year. Ling is largely a bycatch in the fisheries targeting other species, being taken by various gear types but in recent years, with around 50% being caught by longline, 25% by trawlers and about 20% by gillnets. Most of the native longline catches are taken at depths less than 275 m. In the native bottom trawl, most of the catches are taken at depths less than 400 m.

Since 1980s, Icelandic vessels have, on average caught 85% of the ling in Va, but in 1950–1970, vessels from other nations caught more than 50%. The fishing grounds in 1996, 2000, 2006 and 2007, as recorded in logbooks, are shown in Figure 5.4.1a and for 2008 in Figure 5.4.1b. It seems that the ling main fishing grounds have slightly expanded to the northwest and the southeast since 1996. In spite of that the main fishing takes place in the southwest part of the Icelandic shelf.

5.4.2 Landings trends

In 1950s and 1960s, the total international landings in Va were between 9000 and 15 000 tonnes but after with the extension of the Icelandic EEZ to in the early 1970s it declined to a level of between 3000 and 7000 t. Since 1980, the catches have been varied between 3200 t and 5200 t, lowest in 2002 (Table 5.4.1 and Figure 5.4.2). The Icelandic fishing fleet has been restricted by a ling TAC since the quota year 2001/2002 and landings in recent years thus largely a reflection of those measures.

In 2008, total of 7740 tonnes were landed by around 500 Icelandic vessels, whereof the majority was caught by longlines. In addition to above mention landings, there are reported 992 tonnes of ling in Icelandic waters taken by Faroe Islands and Norwegian vessels. The preliminary total international landings in 2008 amounted therefore to 8846 t.

5.4.3 ICES advice

The latest advice is from ICES ACOM in May 2008. ICES recommends constraining catches to 7500 t (recent average 2006–2007) and to collect information that can be used to evaluate a long-term sustainable level of exploitation.

5.4.4 Management

The Icelandic Ministry of Fisheries is responsible for management of the Icelandic fisheries and implementation of the legislation. The Ministry issues regulations for commercial fishing for each fishing year (1 September–31 August), including an allocation of the TAC for each of the stocks subject to such limitations. For ling, the national TAC for the quota year 1 September 2008–31 August 2009 was set to 7000 tonnes an increase by 1000 tonnes from the previous quota year. In addition vessels from Norway and Faroe Island have rights to catch deep-sea species in Icelandic waters, but the amount of ling is not set. The annual catch of vessels from Norway and Faroe Island has varied between 500 and 1000t tonnes in last 5 years.

5.4.5 Data available

5.4.5.1 Landings and discards

Landings by Icelandic vessels are given by the Icelandic Directorate of Fisheries. Landings of Norwegian and Faroese vessels are given by the Icelandic Coast Guard.

Discard is banned by law in the Icelandic demersal fishery and at present there is no information on ling discards.

5.4.5.2 Length compositions

Detailed overview of the sampling in the catches and surveys was given in WGDEEP 2007 report (ICES 2007a). The sampling intensity in 2009 was similar as in recent years. The length distributions from Icelandic commercial catches and the Icelandic spring and autumn surveys are shown in Figures 5.4.3 and 5.4.6, respectively.

5.4.5.3 Age compositions

No data available. Otoliths have been collected randomly from the catch since 1980s, but no age readings have been done since 1998.

5.4.5.4 Weight-at-age

No data available.

5.4.5.5 Maturity and natural mortality

The estimated length at which 50% of the ling becomes mature (L_{50}) was estimated 76.13 cm (Figure 5.4.4). All available data since 1986 was used in the analysis.

5.4.5.6 Catch, effort and research vessel data

Icelandic survey data

The Icelandic spring groundfish survey, which has been conducted annually in March since 1985, gives trends on fishable biomass of many exploited stocks on Icelandic fishing grounds. In total, about 550 stations are taken annually at depths down to 500 meters. The survey area does cover the most important distribution area of the ling fishery (Figure 5.4.1.b). Figure 5.4.5 show both a recruitment index and the trends in biomass. Survey length distributions are shown in Figure 5.4.6.

In addition, the autumn survey was commenced in 1996 covering 150 stations of the 550 stations that have been taken in spring survey (i.e. shallower than 500 m). From its commencement in 1996 to 1999 an additional 150 stations were taken in deeper waters off the west, north, east and southeast continental slopes off Iceland (primarily targeting Greenland halibut). In 2000, 69 stations were added to the survey, covering the continental slopes to the south of Iceland and the Reykjanes ridge. Thus since 2000, the autumn survey has consisted of 369 stations, covering the continental shelf and slopes of Icelandic waters, to a depth down to 1200 m (The stations taken since 2000 are presented in Figure 6.2.1b). Figure 5.4.5 shows both a recruitment index and the trends in various biomass indices all of which have been increasing in recent years. Survey length distributions are shown in Figure 5.4.6.

Catch per unit of effort and effort data from the commercial fleets

Figures 5.4.9 shows catch per unit of effort of ling in the Icelandic trawl and longline fisheries. The longline cpue (L-cpue) is calculated using all longline data where catches of the species was registered, with no standardization attempted. L-cpue estimates of ling in Va are not considered representative of stock abundance.

5.4.6 Data analyses

No assessment was required for this stock in 2009.

5.4.7 Comments on the assessment

No assessment was required for this stock in 2009.

5.4.7.1 Management considerations

No advice was required for this stock in 2009.

Table 5.4.1. Ling. Landings in ICES division Va. Source: STATLANT database.

YEAR	BELGIUM	FAROE	FRANCE	GERMANY	ICELAND	NORWAY	UK	TOTAL
1973	1080	984	0	586	3564	418	829	7461
1974	681	890	0	486	3868	318	532	6775
1975	736	732	23	375	3748	522	562	6698
1976	431	498	0	404	4538	502	268	6641
1977	442	613	0	254	3433	506	0	5248
1978	541	534	0	0	3439	484	0	4998
1979	508	536	0	0	3759	399	0	5202
1980	445	607	0	0	3149	423	0	4624
1981	196	489	0	0	3348	415	0	4448
1982	116	524	0	0	3733	612	0	4985
1983	128	644	0	0	4256	115	0	5143
1984	103	450	0	0	3304	21	0	3878
1985	59	384	0	0	2980	17	0	3440
1986	88	556	0	0	2946	4	0	3594
1987	157	657	0	0	4161	6	0	4981
1988	134	619	0	0	5098	10	0	5861
1989	95	614	0	0	4896	5	0	5610
1990	42	399	0	0	5153	0	0	5594
1991	69	530	0	0	5206	0	0	5805
1992	34	526	0	0	4556	0	0	5116
1993	20	501	0	0	4333	0	0	4854
1994	3	548	0	0	4049	0	0	4600
1995	0	463	0	0	3729	0	0	4192
1996	0	358	0	0	3670	20	0	4048
1997	0	299	0	0	3634	0	0	3933
1998	0	699	0	0	3603	0	0	4302
1999	0	500	0	0	3973	120	1	4594
2000	0	0	0	0	3196	67	3	3266
2001	0	362	0	2	2852	116	1	3333
2002	0	1629	0	0	2779	45	0	4453
2003	0	565	0	2	3855	108	5	4535
2004	0	739	0	1	3721	139	0	4600
2005	0	682	0	1	4311	180	20	5194
2006	0	960	0	1	6283	158	0	7402
2007	0	807	0	0	6592	185	0	7584
20081)		928			7736	180		8844

1) **Provisional figures.**

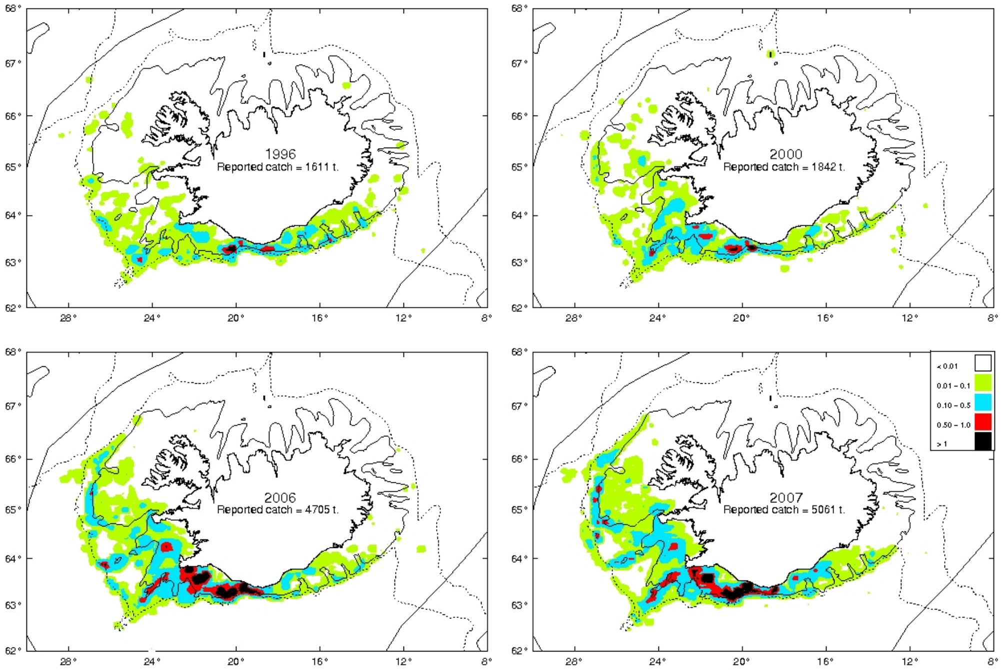


Figure 5.4.1a. Ling. Geographical distribution (tonnes/square mile) of the Icelandic ling fishery in 1996, 2000, 2006 and 2007 as reported in the logbooks. All gear types combined.

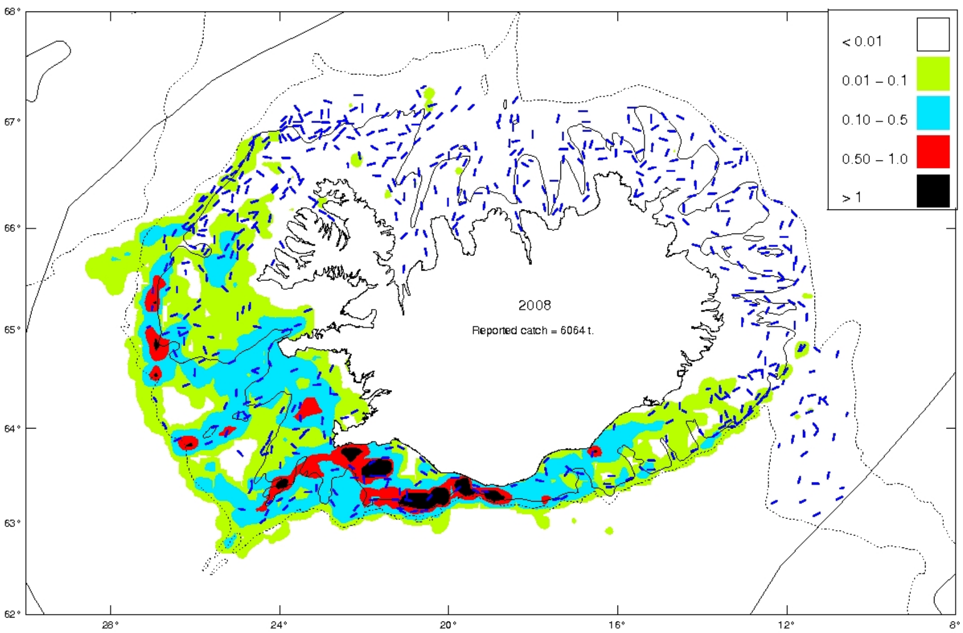


Figure 5.4.1b. Ling. Location of the spring trawl survey and geographical distribution (tonnes/square mile) of the Icelandic ling fishery in 2009 as reported in the logbooks. All gear types combined. The contours show 200 and 500 meters depth lines.

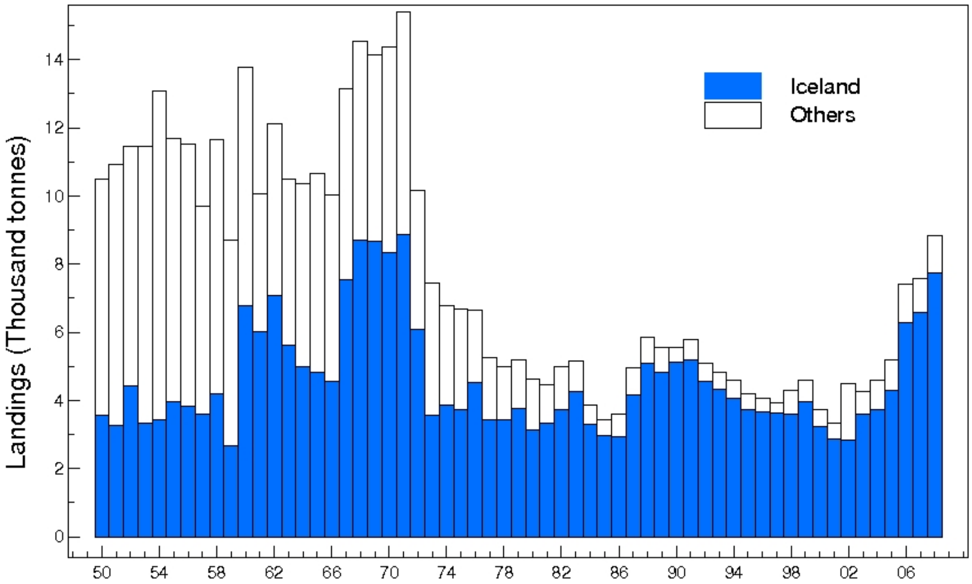


Figure 5.4.2. Ling in Va. Estimated total landings.

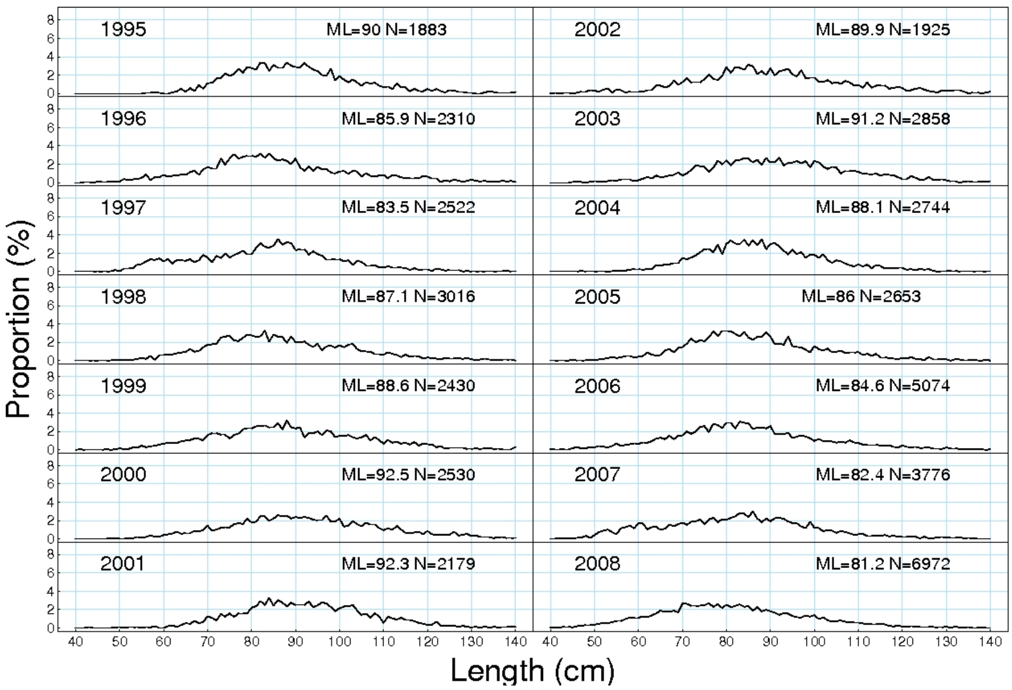


Figure 5.4.3. Length distribution of ling in the commercial landings of the Icelandic fleet in Va 1996–2007. The number of measured fish (N) and mean length (ML) is also given.

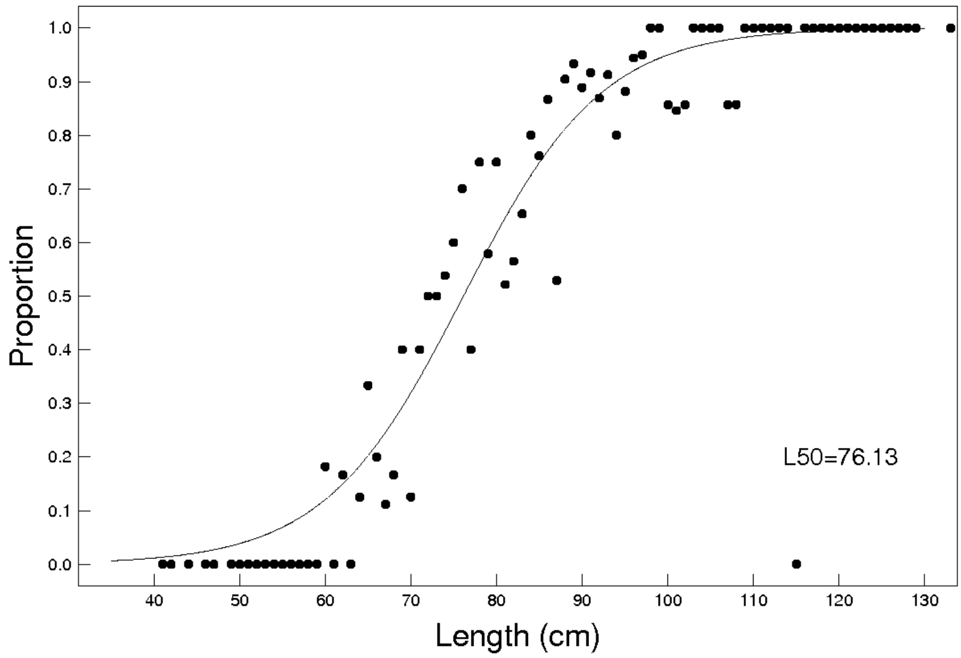


Figure 5.4.4. The proportion of mature of ling as a function of length in the Icelandic catches. The data points show the observed proportion mature and the lines the fitted maturity. Also given is L_{50}.

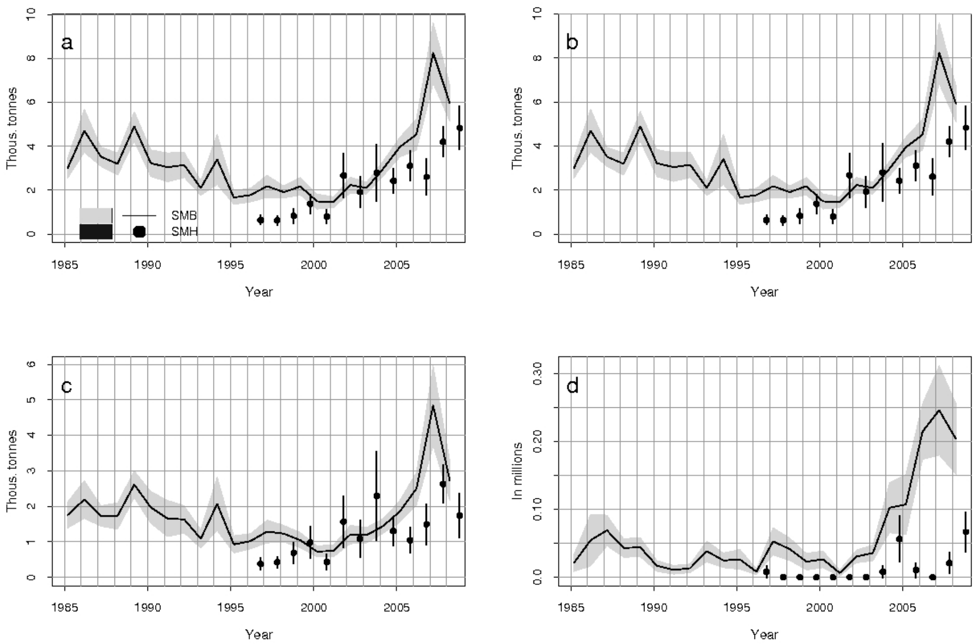


Figure 5.4.5. Ling. Indices from the groundfish survey in March 1985–2008 (SMB, line, shaded area) and October 1996–2008 (SMH, points, vertical lines). a) Total biomass index, b) Biomass of 40 cm and larger, c) Biomass 90 cm and larger, d) Abundance of <40 cm. The shaded area and the vertical bar show ±1 standard error of the estimate.

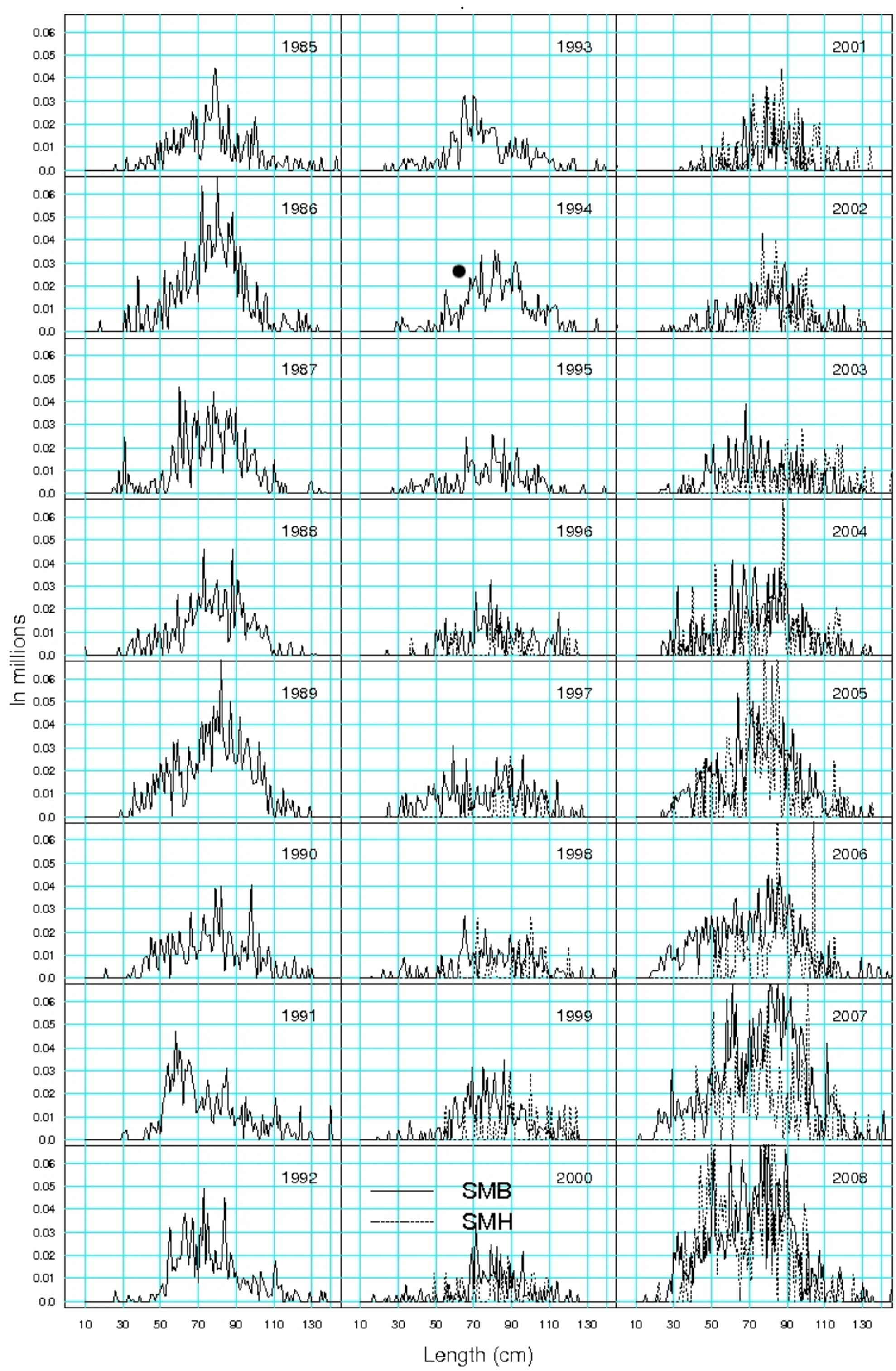


Figure 5.4.6. Length distributions of ling in the Icelandic groundfish survey in March 1985–2008 (SMB, solid line) and in October 1996–2008 (SMH, dotted line).

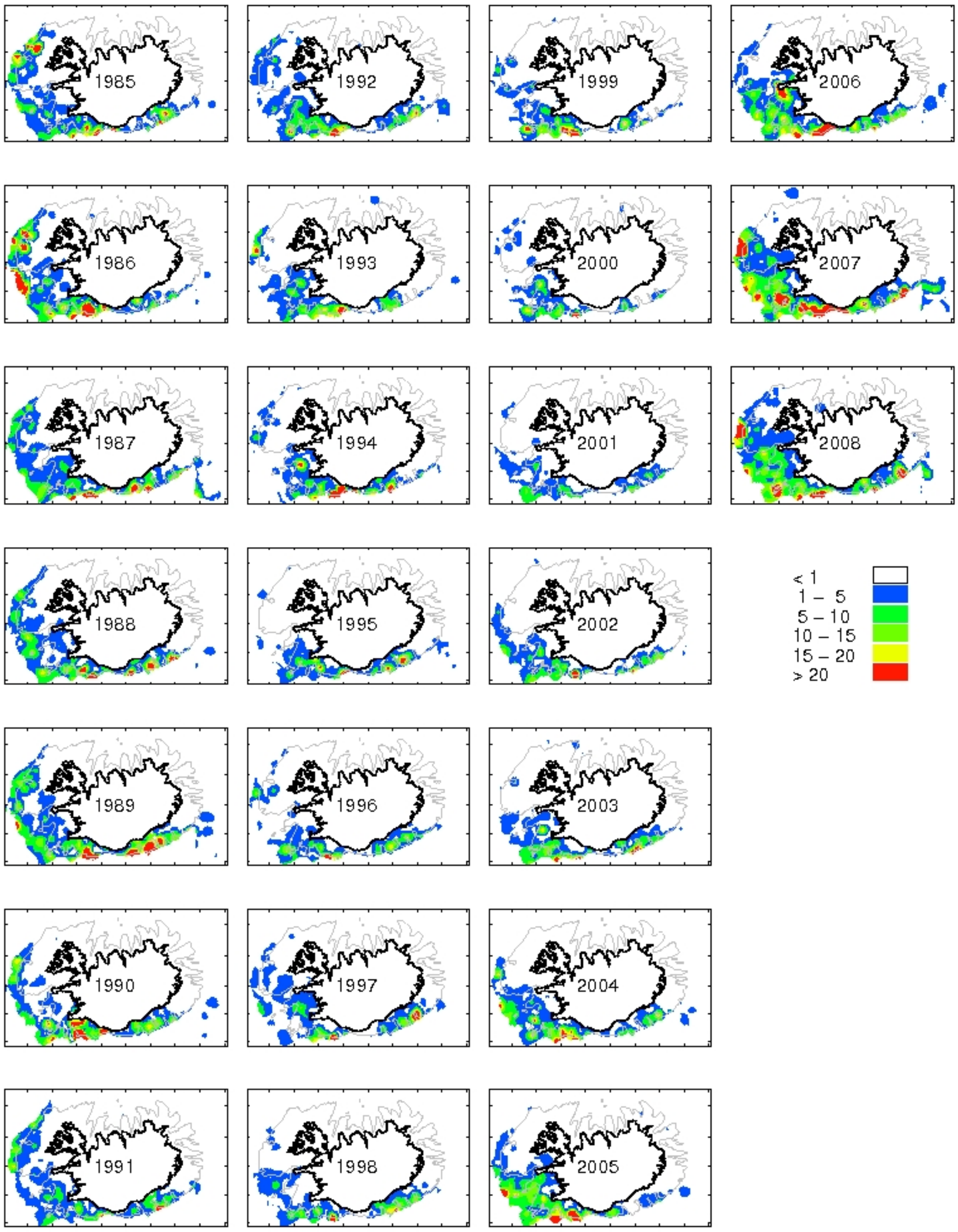


Figure 5.4.7. Distribution of ling (kg per standardized) in the groundfish survey in March 1985–2008.

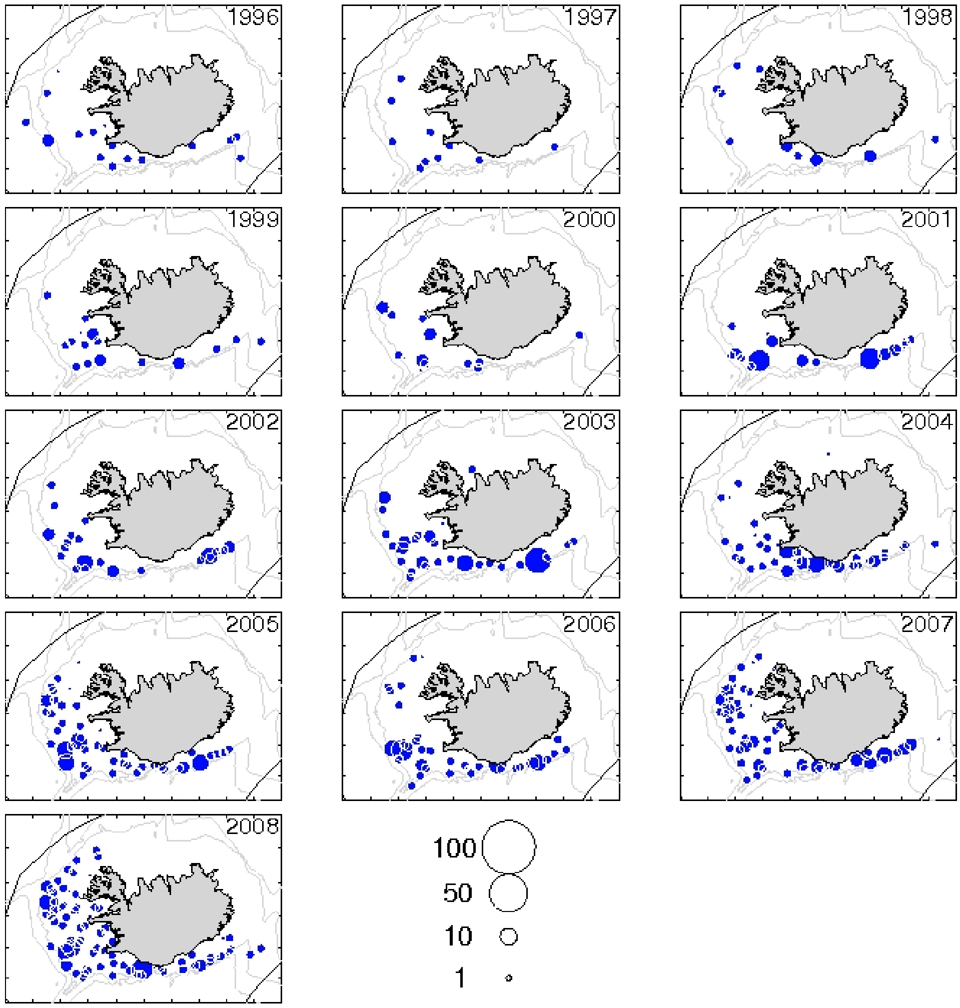


Figure 5.4.8. Distribution of ling in the groundfish survey in October 1996–2008. The sizes of the circles indicate kg/station.

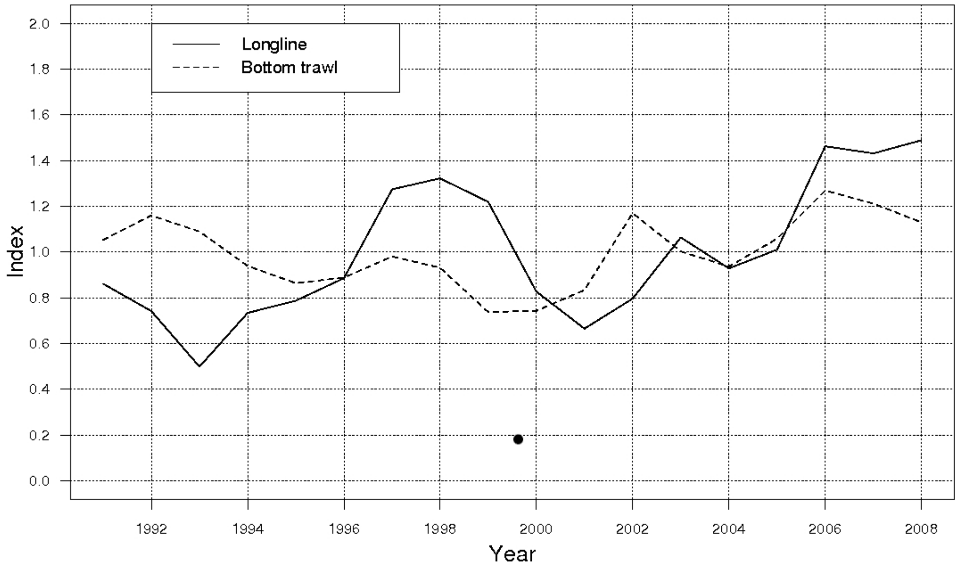


Figure 5.4.9. Index of raw cpue (sum(yield)/sum(effort)) of ling from the Icelandic bottom-trawl fishery (dotted line) and the longline fishery (solid line) 1991–2008. The criteria for the calculations were all tows or sets where tusk was reported in the logbooks.

5.5 Ling (*Molva Molva*) in areas (IIIa, IV, VI, VII, VIII, IX, X, XII, XIV)

5.5.1 The fishery

Significant fisheries for ling have been conducted in Subarea III and IV at least since the 1870s, pioneered by Swedish longliners. Since the mid-1900s and currently, the major targeted ling fishery in IVa is the Norwegian longliners conducted around Shetland and in the Norwegian Deep. There is little activity in IIIa. Of the total Norwegian landings about 75% are taken by longlines, 15% by gillnets, and the remainder by trawls. The bulk of the landings from other countries were taken by trawls as bycatches in other fisheries, and the landings from the UK (Scotland) are the most substantial. The comparatively low landings from the central and southern North Sea (IVb,c), are bycatches in various other fisheries.

The major directed ling fishery in VI is the Norwegian longline fishery. Trawl fisheries by the UK (Scotland) and France primarily take ling as bycatch.

In Subarea VII the Divisions b, c, and g-k provide most of the landings of ling. Norwegian landings, and some of Irish and Spanish are from targeted longline fisheries, whereas other landings are primarily bycatches in trawl fisheries. Data split by gear type were not available for all countries, but the bulk of the total landings (at least 60–70%) are taken by trawls in these areas.

In Subareas VIII and IX, XII and XIV all landings are bycatches in various fisheries.

5.5.1.1 Landings trends

Landing statistics by nation in the period 1988–2008 are given in Table 5.5.1. In Division IVa the total landings have varied between 10 000 and 13 000 t until 1998, then declined until 2003 to about half that level, and has remained stable since.

In Division VIa the statistics are incomplete for the period 1989–1993. In the period 1994–2007 when the data are complete, they demonstrate a declining trend towards a level less than half that in the 1990s. The Norwegian landings declined substantially since the mid-1990s compared with earlier years. In Division VIb landings decreased in the late 1990s and reach a minimum in 2002, after which a gradual increase has occurred. In the last two years landings were about 60% of the mean annual landings for the period 1988–1995.

In Subarea VII landings were around 10 000t in the period 1995–1998. After this a gradual decrease and the preliminary estimate of catch for 2008 is only 1977 t.

In Subarea VIII annual ling landings have been only a few hundred tons since 1999, and in Subareas IX, XII, and XIV the landings have remained minor.

5.5.1.2 ICES advice

The advice statement from 2008 was: *the cpue in these areas has been at a reduced level. ICES reiterates the advice to constrain catches to 10 000 t and to collect information that can be used to evaluate a long-term sustainable level of exploitation.*

5.5.1.3 Management

Since 2003, the European Union has set TACs for EU vessels fishing in community waters and waters not under the control of Third Countries. Between 2003 and 2007, ling was covered by the biennial regulations for deep-water species; however, from 2008 it has been included in annual TAC regulation covering other species.

EU TACs for ling in 2009 are:

Subarea IIIa and EC waters of IIIc,d:	100 tonnes
EC waters of Subarea IV:	2856 tonnes
Subarea VI, VII, VIII, IX, X, XII, XIV:	10776 tonnes

There is no species-specific regulation in the Norwegian EEZ, but a TAC is negotiated for Norwegian vessels fishing in EU waters. The quota of ling to Norway in the EC zone was set for 2008 at 5638 tonnes. The quota to the EC in Area IV was 850 tonnes.

5.5.2 Data available

5.5.2.1 Landings and discards

Landings were available for all relevant fleets. New discard data were not available, but within the Norwegian EEZ discarding is prohibited and assumed to be minor. Discard data from some fleets have been reported previously to WGDEEP.

5.5.2.2 Length compositions

Length composition of ling in longline catches on southwestern slope of Rockall Bank (Subdivision VIb1) in June–July 2008 are in Figure 5.5.1 (Vinnichenko *et al.,* WD 17, 2009).

5.5.2.3 Age compositions

No new age compositions were available.

5.5.2.4 Weight-at-age

No new data were presented.

5.5.2.5 Maturity and natural mortality

No new data were presented.

5.5.2.6 Catch, effort and research vessel data

Catch and effort data for Norwegian longliners were updated for the period up to 2007. Data for 2008 were not available in time for the WG meeting. Trends from Danish and Basque trawlers were presented. No research vessel data were available.

The extensive Norwegian longliner cpue series based on private skippers' logbooks presented in the 1996 report were not updated after 1994. In the 1998 report (Table 6.5 of ICES, 1998), effort data were given for the period 1974–1996 based on official statistics.

In order to resume the cpue-series Norway has adopted two approaches:

1) *Official logbooks from longliners.* Entering of data from official logbooks in an electronic database was begun in 2001 and data are now available for the period 2000–2007. Vessels were selected that had a total landed catch of ling, tusk and blue ling exceeding 8 tons in a given year. The logbooks contain records of the daily catch, date, position, and number of hooks used per day.

2) *Reference fleet information*. Since 2001 special agreements were made with selected vessels, "the reference fleet", providing data for the species composition of the catch (in weight), and number of hooks used per day (Helle

et al., WD 2, 2009). There are currently four longline vessels contributing data.

An analyses based on these two sources of data was presented in WD 2 by Helle *et al.*, 2009. And both the analyses from the 1990s and after 2000 include data from Subareas IV, VI and VII.

A cpue series for Danish trawlers fishing in IIIa and IV were available for the period 1992–2008.

5.5.3 Data analyses

No assessment was required for this stock in 2009.

5.5.4 Comments on the assessment

No assessment was required for this stock in 2009.

5.5.5 Management considerations

No advice was required for this stock in 2009.

Table 5.5.0. Ling IIIa, IVa, VI, VII, VIII, IX, XII and XIV. WG estimates of landings.

LING III

YEAR	BELGIUM	DENMARK	GERMANY	NORWAY	SWEDEN	E & W	TOTAL
1988	2	165	-	135	29	-	331
1989	1	246	-	140	35	-	422
1990	4	375	3	131	30	-	543
1991	1	278	-	161	44	-	484
1992	4	325	-	120	100	-	549
1993	3	343	-	150	131	15	642
1994	2	239	+	116	112	-	469
1995	4	212	-	113	83	-	412
1996		212	1	124	65	-	402
1997		159	+	105	47	-	311
1998		103	-	111	-	-	214
1999		101	-	115	-	-	216
2000		101	+	96	31		228
2001		125	+	102	35		262
2002		157	1	68	37		263
2003		156		73	32		261
2004		130	1	70	31		232
2005		106	1	72	31		210
2006		95	2	62	29		188
2007		82	3	68	21		174
2008*		59	1	88	20		168

***Preliminary**

Table 5.5.0. (continued).

LING Iva

Year	Belgium	Denmark	Faroes	France	Germany	Neth.	Norway	Sweden1)	E&W	N.I.	Scot.	Total
1988	3	408	13	1143	262	4	6473	5	55	1	2856	11 223
1989	1	578	3	751	217	16	7239	29	136	14	2693	11 677
1990	1	610	9	655	241	-	6290	13	213	-	1995	10 027
1991	4	609	6	847	223	-	5799	24	197	+	2260	9969
1992	9	623	2	414	200	-	5945	28	330	4	3208	10 763
1993	9	630	14	395	726	-	6522	13	363	-	4138	12 810
1994	20	530	25	n/a	770	-	5355	3	148	+	4645	11 496
1995	17	407	51	290	425	-	6148	5	181		5517	13 041
1996	8	514	25	241	448		6622	4	193		4650	12 705
1997	3	643	6	206	320		4715	5	242		5175	11 315
1998	8	558	19	175	176		7069	-	125		5501	13 631
1999	16	596	n.a.	293	141		5077		240		3447	9810
2000	20	538	2	147	103		4780	7	74		3576	9246
2001		702		128	54		3613	6	61		3290	7854
2002	6	578	24	117			4509		59		3779	9072
2003	4	779	6	121	62		3122	5	23		2311	6433
2004		575	11	64	34		3753	2	15		1852	6306
2005		698	18	47	55		4078	4	12		1537	6449
2006		637	2	73	51		4443	3	55		1455	6719
2007		412	-	100	60		4109	3	31		1143	5858
2008*		446	1	174	52		4725	12	20		1549	6979

***Preliminary. (1) Includes IVb 1988–1993.**

Table 5.5.0. (continued).

LING IVbc

Year	Belgium	Denmark	France	Sweden	Norway	E & W	Scotland	Germany	Netherlands	Total
1988					100	173	106	-		379
1989					43	236	108	-		387
1990					59	268	128	-		455
1991					51	274	165	-		490
1992		261			56	392	133	-		842
1993		263			26	412	96	-		797
1994		177			42	40	64	-		323
1995		161			39	301	135	23		659
1996		131			100	187	106	45		569
1997	33	166	1	9	57	215	170	48		699
1998	47	164	5		129	128	136	18		627
1999	35	138	-		51	106	106	10		446
2000	59	101	0	8	45	77	90	4		384
2001	46	81	1	3	23	62	60	6	2	284
2002	38	91		4	61	58	43	12	2	309
2003	28	0		3	83	40	65	14	1	234
2004	48	71		1	54	23	24	19	1	241
2005	28	56		5	20	17	10	13		149
2006	26	53		8	16	20	8	13		144
2007	28	42	1	5	48	20	5	10		159
2008*	15	40	2	5	87	25	10	11		195

***Preliminary**

Table 5.5.0. (continued).

LING Via

Year	Belgium	Denmark	Faroes	France (1)	Germany	Ireland	Norway	Spain(2)	E&W	IOM	N.I.	Scot.	Total
1988	4	+	-	5381	6	196	3392	3575	1075	-	53	874	14556
1989	6	1	6	3417	11	138	3858		307	+	6	881	8631
1990	-	+	8	2568	1	41	3263		111	-	2	736	6730
1991	3	+	3	1777	2	57	2029		260	-	10	654	4795
1992	-	1	-	1297	2	38	2305		259	+	6	680	4588
1993	+	+	-	1513	92	171	1937		442	-	13	1133	5301
1994	1	1		1713	134	133	2034	1027	551	-	10	1126	6730
1995	-	2	0	1970	130	108	3156	927	560	n/a		1994	8847
1996			0	1762	370	106	2809	1064	269			2197	8577
1997			0	1631	135	113	2229	37	151			2450	6746
1998				1531	9	72	2910	292	154			2394	7362
1999				941	4	73	2997	468	152			2264	6899
2000	+	+		737	3	75	2956	708	143			2287	6909
2001				774	3	70	1869	142	106			2179	5143
2002				402	1	44	973	190	65			2452	4127
2003				315	1	88	1477	75	108			1257	3321
2004				252	1	96	791	43	8			1619	2810
2005			18	423		89	1389	61	1			1108	3089
2006			5	499	2	121	998	61	137			811	2634
2007			88	626	2	45	1544	1	33			782	3121
2008*			21	987	2	49	1265	10	1			475	2810

***Preliminary. (1) Includes VIb until 1996 (2) Includes minor landings from VIb.**

Table 5.5.0. (continued).

LING VIb

Year	Faroes	France (2)	Germany	Ireland	Norway	Spain (3)	E & W	N.I.	Scotland	Russia	Total
1988	196		-	-	1253		93	-	223		1765
1989	17		-	-	3616		26	-	84		3743
1990	3		-	26	1315		10	+	151		1505
1991	-		-	31	2489		29	2	111		2662
1992	35		+	23	1713		28	2	90		1891
1993	4		+	60	1179		43	4	232		1522
1994	104		-	44	2116		52	4	220		2540
1995	66		+	57	1308		84		123		1638
1996	0		124	70	679		150		101		1124
1997	0		46	29	504		103		132		814
1998		1	10	44	944		71		324		1394
1999		26	25	41	498		86		499		1175
2000	+	18	31	19	1172		157		475	7	1879
2001	+	16	3	18	328		116		307		788
2002		2	2	2	289		65		173		533
2003		2	3	25	485		34		111		660
2004	+	9	3	6	717		6		141	182	1064
2005		31	4	17	628		9		97	356	1142
2006	30	4	3	48	1171		19		130	6	1411
2007	4	10	35	54	971		7		183	50	1314
2008*	69	6	20	47	1021		1		135	214	1513

***Preliminary. (1) Includes XII. (2) Until 1966 included in VIa. (3) Included in Ling VIa.**

LING VII

Year	France	Total
1988	5,057	5,057
1989	5,261	5,261
1990	4,575	4,575
1991	3,977	3,977
1992	2,552	2,552
1993	2,294	2,294
1994	2,185	2,185
1995	-1	
1996	-1	
1997	-1	
1998	-1	
1999	-1	

***Preliminary**

Table 5.5.0. (continued).

LING VIIa

Year	Belgium	France	Ireland	E & W	IOM	N.I.	Scotland	Total
1988	14	-1	100	49	-	38	10	211
1989	10	-1	138	112	1	43	7	311
1990	11	-1	8	63	1	59	27	169
1991	4	-1	10	31	2	60	18	125
1992	4	-1	7	43	1	40	10	105
1993	10	-1	51	81	2	60	15	219
1994	8	-1	136	46	2	76	16	284
1995	12	9	143	106	1	-2	34	305
1996	11	6	147	29	-	-2	17	210
1997	8	6	179	59	2	-2	10	264
1998	7	7	89	69	1	-2	25	198
1999	7	3	32	29		-2	13	84
2000	3	2	18	25			25	73
2001	6	3	33	20			31	87
2002	7	6	91	15			7	119
2003	4	4	75	18			11	112
2004	3	2	47	11			34	97
2005	4	2	28	12			15	61
2006	2	1	50	8			27	88
2007	2	0	32	1			8	43
2008*	1	0	12	1			0	14

Preliminary. (1) French catches in VII not split into divisions, see Ling VII. (2) Included with UK (EW)

Table 5.5.0. (continued).

LING VII b,c

Year	France (1)	Germany	Ireland	Norway	Spain (3)	E & W	N.I.	Scotland	Total
1988	-1	-	50	57		750	-	8	865
1989	-1	+	43	368		161	-	5	577
1990	-1	-	51	463		133	-	31	678
1991	-1	-	62	326		294	8	59	749
1992	-1	-	44	610		485	4	143	1286
1993	-1	97	224	145		550	9	409	1434
1994	-1	98	225	306		530	2	434	1595
1995	78	161	465	295		630	-2	315	1944
1996	57	234	283	168		1117	-2	342	2201
1997	65	252	184	418		635	-2	226	1780
1998	32	1	190	89		393		329	1034
1999	51	4	377	288		488		159	1366
2000	123	21	401	170		327		140	1182
2001	80	2	413	515		94		122	1226
2002	132	0	315	207		151		159	964
2003	128	0	270			74		52	524
2004	133	12	255	163		27		50	640
2005	145	11	208			17		48	429
2006	173	1	311	147		13		23	668
2007	173	5	62	27		71		20	358
2008*	121	16	39	0		14		3	193

***Preliminary. (1) See Ling VII. (2) Included with UK (EW). (3) Included with VIIg–k.**

Table 5.5.0. (continued).

LING VIId,e

YEAR	BELGIUM	DENMARK	FRANCE (1)	IRELAND	E & W	SCOTLAND	CH. ISLANDS	TOTAL
1988	36	+	-1	-	743	-		779
1989	52	-	-1	-	644	4		700
1990	31	-	-1	22	743	3		799
1991	7	-	-1	25	647	1		680
1992	10	+	-1	16	493	+		519
1993	15	-	-1	-	421	+		436
1994	14	+	-1	-	437	0		451
1995	10	-	885	2	492	0		1389
1996	15		960		499	3		1477
1997	12		1049	1	372	1	37	1472
1998	10		953		510	1	26	1500
1999	7		545	-	507	1		1060
2000	5		454	1	372		14	846
2001	6		402		399			807
2002	7		498		386	0		891
2003	5		531	1	250	0		787
2004	13		573	1	214			801
2005	11		539		236			786
2006	9		470		208			687
2007	15		428	0	267			710
2008*	5		275		214			494

***Preliminary**

Table 5.5.0. (continued).

LING VIIf

Year	Belgium	France (1)	Ireland	E & W	Scotland	Total
1988	77	-1	-	367	-	444
1989	42	-1	-	265	3	310
1990	23	-1	3	207	-	233
1991	34	-1	5	259	4	302
1992	9	-1	1	127	-	137
1993	8	-1	-	215	+	223
1994	21	-1	-	379	-	400
1995	36	110	-	456	0	602
1996	40	121	-	238	0	399
1997	30	204	-	313		547
1998	29	204	-	328		561
1999	16	108	-	188		312
2000	15	91	1	111		218
2001	14	114	-	92		220
2002	16	139	3	295		453
2003	15	79	1	81		176
2004	18	73	5	65		161
2005	36	59	7	82		184
2006	10	42	14	64		130
2007	16	52	2	55		125
2008*	32	82	4	63		181

***Preliminary. (1) See Ling VII.**

Table 5.5.0. (continued).

LING VIIg–k

Year	Belgium	Denmark	France	Germany	Ireland	Norway	Spain (2)	E&W	IOM	N.I.	Scot.	Total
1988	35	1	-1	-	286	-	2652	1439	-	-	2	4415
1989	23	-	-1	-	301	163		518	-	+	7	1012
1990	20	+	-1	-	356	260		434	+	-	7	1077
1991	10	+	-1	-	454	-		830	-	-	100	1394
1992	10	-	-1	-	323	-		1130	-	+	130	1593
1993	9	+	-1	35	374			1551	-	1	364	2334
1994	19	-	-1	10	620		184	2143	-	1	277	3254
1995	33	-	1597	40	766	-	195	3046		-3	454	6131
1996	45	-	1626	169	771		583	3209			447	6850
1997	37	-	1574	156	674		33	2112			459	5045
1998	18	-	1362	88	877		1669	3465			335	7814
1999	-	-	1220	49	554		455	1619			292	4189
2000	17		1062	12	624		639	921			303	3578
2001	16		1154	4	727	24	559	591			285	3360
2002	16		1025	2	951		568	862			102	3526
2003	12		1240	5	808		607	382			38	3092
2004	14		982		686		530	335			5	2552
2005	15		771	12	539		484	313			4	2138
2006	10		676		935		571	264			18	2474
2007	11		661	1	430		484	217			6	1810
2008*	11		551	8	312		83	130				1095

***Preliminary. (1) See Ling VII. (2) Includes VIIb,c. (3) Included in UK (EW).**

Table 5.5.0. (continued).

LING VIII

Year	Belgium	France	Germany	Spain	E & W	Scot.	Total
1988		1018			10		1028
1989		1214			7		1221
1990		1371			1		1372
1991		1127			12		1139
1992		801			1		802
1993		508			2		510
1994		n/a		77	8		85
1995		693		106	46		845
1996		825	23	170	23		1041
1997	1	705	+	290	38		1034
1998	5	1220	-	543	29		1797
1999	22	234	-	188	8		452
2000	1	227		106	5		339
2001		245		341	6	2	594
2002		316		141	10	0	467
2003		333		147	36		516
2004		385		112	53		550
2005		339		141	19		499
2006		324		73	45		442
2007		282		47	10		339
2008*		224		42	15		281

LING IX

Year	Spain	Total
1997	0	0
1998	2	2
1999	1	1
2000	1	1
2001	0	0
2002	0	0
2003*	0	0

***Preliminary**

Table 5.5.0. (continued).

LING XII

YEAR	FAROES	FRANCE	NORWAY	E & W	SCOTLAND	GERMANY	IRELAND	TOTAL
1988				-				0
1989				-				0
1990				3				3
1991				10				10
1992				-				0
1993				-				0
1994				5				5
1995	5			45				50
1996	-		2					2
1997	-		+	9				9
1998	-	1	-	1				2
1999	-	0	-	-	+	2		2
2000		1	-		6			7
2001		0	29	2	24		4	59
2002		0	4	4	0			8
2003			17	2	0			19
2004								
2005				1				1
2006	1							1
2007								0
2008*								0

Table 5.5.0. (continued).

LING XIV

Year	Faroes	Germany	Iceland	Norway	E & W	Scotland	Total
1988		3	-	-	-	-	3
1989		1	-	-	-	-	1
1990		1	-	2	6	-	9
1991		+	-	+	1	-	1
1992		9	-	7	1	-	17
1993		-	+	1	8	-	9
1994		+	-	4	1	1	6
1995	-	-		14	3	0	17
1996	-			0			0
1997	1			60			61
1998	-			6			6
1999	-			1			1
2000			26	-			26
2001	1			35			36
2002	3			20			23
2003				83			83
2004				10			10
2005							0
2006							0
2007				5			5
2008*					1		1

***Preliminary**

Ling. Total landings by Subarea or Division.

Year	III	IVa	IVbc	VIa	VIb	VII	VIIa	VIIbc	VIIde	VIIf	VIIg-k	VIII	IX	XII	XIV	All areas
1988	331	11 223	379	14556	1765	5057	211	865	779	444	4415	1028		0	3	41 056
1989	422	11 677	387	8631	3743	5261	311	577	700	310	1012	1221		0	1	34 253
1990	543	10 027	455	6730	1505	4575	169	678	799	233	1077	1372		3	9	28 175
1991	484	9969	490	4795	2662	3977	125	749	680	302	1394	1139		10	1	26 777
1992	549	10 763	842	4588	1891	2552	105	1286	519	137	1593	802		0	17	25 644
1993	642	12 810	797	5301	1522	2294	219	1434	436	223	2334	510		0	9	28 531
1994	469	11 496	323	6730	2540	2185	284	1595	451	400	3254	85		5	6	29 823
1995	412	13 041	659	8847	1638		305	1944	1389	602	6131	845		50	17	35 880
1996	402	12 705	569	8577	1124		210	2201	1477	399	6850	1041		2	0	35 557
1997	311	11 315	699	6746	814		264	1780	1472	547	5045	1034	0	9	61	30 097
1998	214	13 631	627	7362	1394		198	1034	1500	561	7814	1797	2	2	6	36 142
1999	216	9810	446	6899	1175		84	1366	1060	312	4189	452	1	2	1	26 013
2000	228	9246	384	6909	1879		73	1182	846	218	3578	339	1	7	26	24 916
2001	262	7854	284	5143	788		87	1226	807	220	3360	594	0	59	36	20 720
2002	263	9072	309	4127	533		119	964	891	453	3526	467	0	8	23	20 756
2003	261	6433	234	3321	660		112	524	787	176	3092	516		19	83	16 219
2004	232	6306	241	2810	1064		97	640	801	161	2552	550		0	10	15 464
2005	210	6449	149	3089	1142		61	429	786	184	2138	499		1	0	15 137
2006	188	6719	144	2634	1411		88	668	687	130	2474	442		1	0	15 586
2007	174	5858	159	3121	1314		43	358	710	125	1810	339		0	5	14 016
2008*	168	6979	195	2810	1513		14	193	494	181	1095	281		0	1	13 924

***Preliminary**

Table 5.5.1. Estimated number of days that the Norwegian longliner fleet (selected using criteria described in the text, Ch 4.2) operated in Subareas III to VII (not V) in the period 2000–2007.

Ling	2000	2001	2002	2003	2004	2005	2006	2007
IIIa	+			1				
IVa	19	22	29	20	22	25	38	27
IVb	1	+		1				3
VIa	13	13	11	12	14	23	13	10
VIb	4	5	7	4	5	8	7	6
VIIc	3	1			1	+		1
All areas	76	100	114	104	115	126	126	128

Table 5.5.2. Estimated number of hooks that the Norwegian longliners set per day in Subarea III–IV and VI–XIV in the period 2000–2007. n= the total number of days with hook information contained in the logbooks.

All	2000		2001		2002		2003		2004		2005		2006		2007	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
IIIa	30 250	4					33 037	27							35 000	8
IVa	29 378	685	30 553	727	32 291	667	33 484	510	30 934	439	34 039	331	34 561	673	33 414	587
IVb	30 263	38	33 500	10	33 867	15	32 559	34							38 086	58
VIa	22 763	435	24 419	447	21 484	186	29 421	302	25 636	308	24 807	369	22 504	248	25 958	249
VIb	30 471	227	30 340	140	31 557	149	31 325	97	31 559	111	35 949	137	32 273	139	36 400	145
VIIc	29 600	80	33 108	37					25 250	28	33 429	7			31 071	14
XII	18 136	22	17 548	175			13 063	48								
XIVa	28 333	6														
XIVb	2815	191	2465	135	9458	251	11 515	228	12 474	105	18 960	91				

Table 5.5.3. Estimated total number of hooks (in thousands) the Norwegian longliner fleet used in Subareas III–IV and VI–XIV for the years 2000–2007 in the fishery for ling (with a bycatch of tusk and blue ling).

ALL	2000	2001	2002	2003	2004	2005	2006	2007
IIIa	218			1718				
IVa	50 765	43 691	54 313	36 565	29 264	33 188	45 966	33 381
IVb	4358			1693				4228
VIa	19 667	22 221	14 953	18 359	15 433	24 187	10 239	9604
VIb	21 939	11 833	14 642	9773	6785	11 216	7907	80 808
VIIc	4262	2152			1086	521		1150
XII	1306	5703		2038				
XIVb	1216	481	4389	5389	4827	3697		

Table 5.5.4. Estimated mean cpue ([kg/hook]x1000) in IIIa–IV and VI–XIV based on logbook data. Standard error (se) and number of catches sampled (n) is also given.

Official logbook data

LING	2000			2001			2002			2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
IIIA	4,53	3	13,3							2,4	25	4,4										6,52	8	7,7
IVA	56,5	669	0,9	48,1	729	0,8	55,5	618	0,7	57,2	505	1,0	78,5	439	1,1	85,1	328	1,7	92,5	672	1,0	76,6	586	0,9
IVB	8,3	25	4,6	2,4	12	6,0	1,4	3	11,0	2,9	29	4,1										5,18	56	2,9
VIA	101	421	1,1	85,9	424	1,0	77,8	177	1,4	76,4	296	1,3	102	308	1,3	117	369	1,6	94,5	248	1,7	107	248	1,4
VIB	45,4	211	1,6	33,5	127	1,8	37,6	149	2,2	67,9	85	2,4	71,9	110	2,3	68,8	137	2,6	90,4	138	2,2	89,2	145	1,8
VIIC	82,9	78	2,6	78,4	37	3,4			0,0				122	28	4,5	66,4	7	11,6				79,2	14	5,9
XIVA	3,75	6	9,4																					

Reference fleet data

LING	2001			2002			2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
IVA							31,1	40	3,71	99,8	83	3,66	82,6	99	4	78,2	90	4,71	81,9	59	4,2
VIA							83,3	43	3,58										87,1	22	6,88
VIB				59,4	5	8,71	31,1	34	4,02							114	32	7,9	113	24	6,58

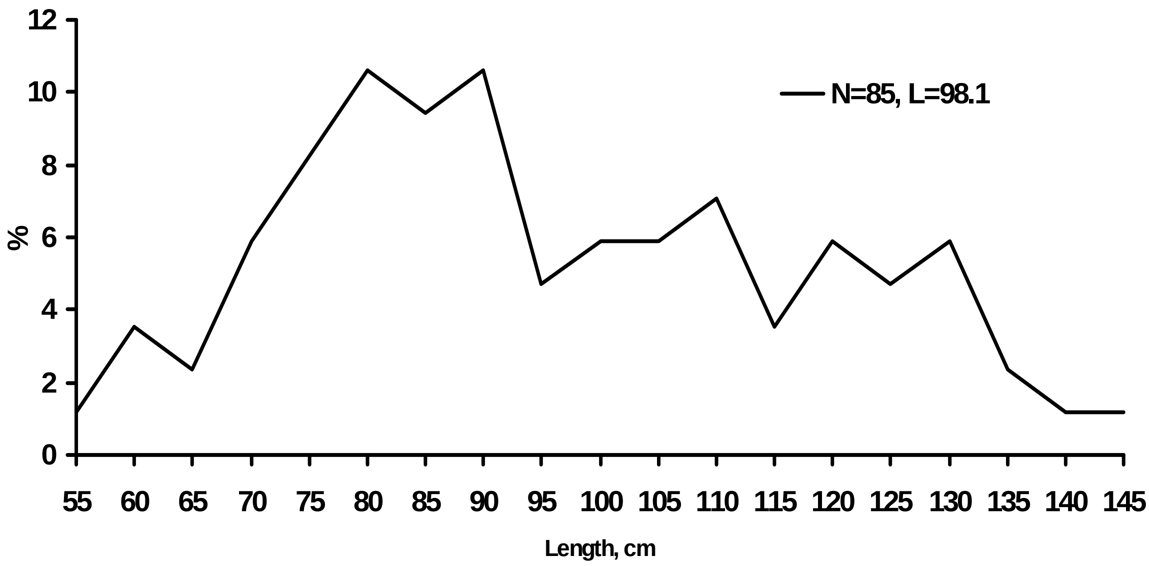


Figure 5.5.1. Length composition of ling in longline catches on southwestern slope of Rockall Bank (Subdivision VIb1) in June–July 2008.

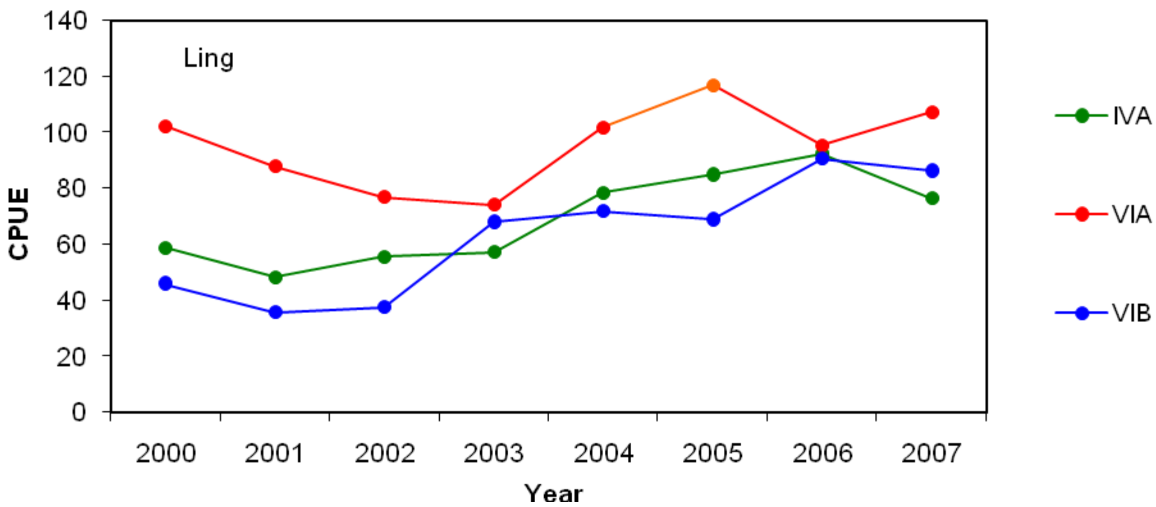
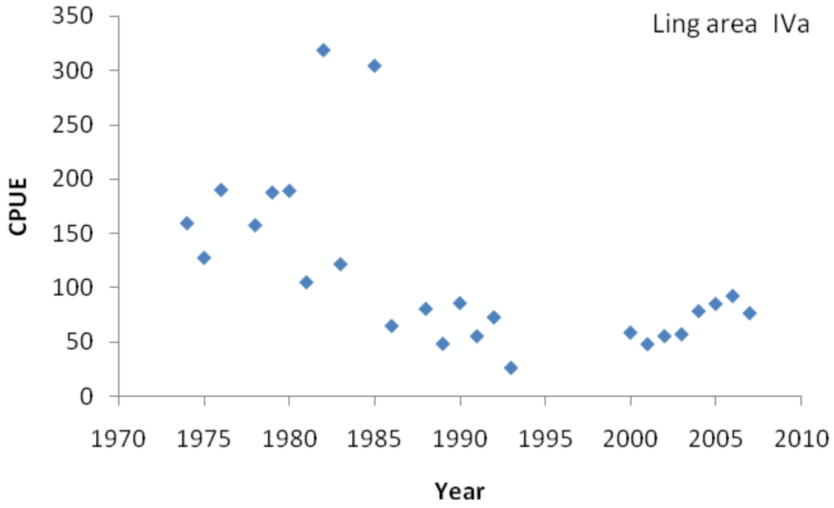
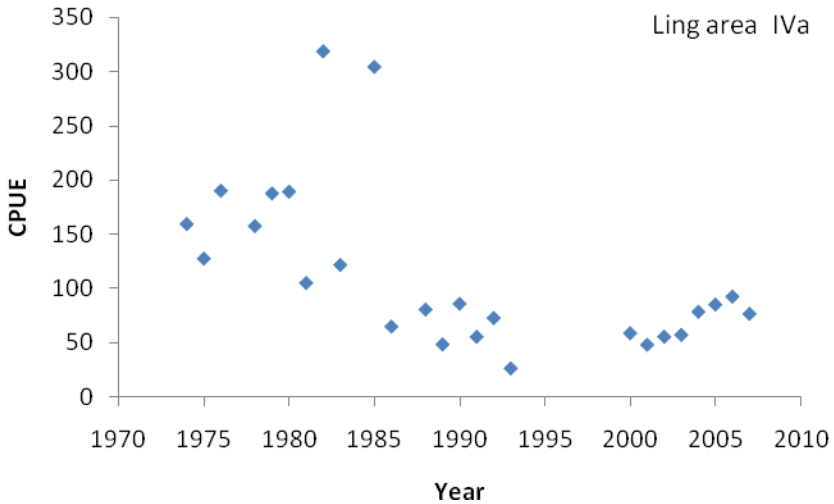
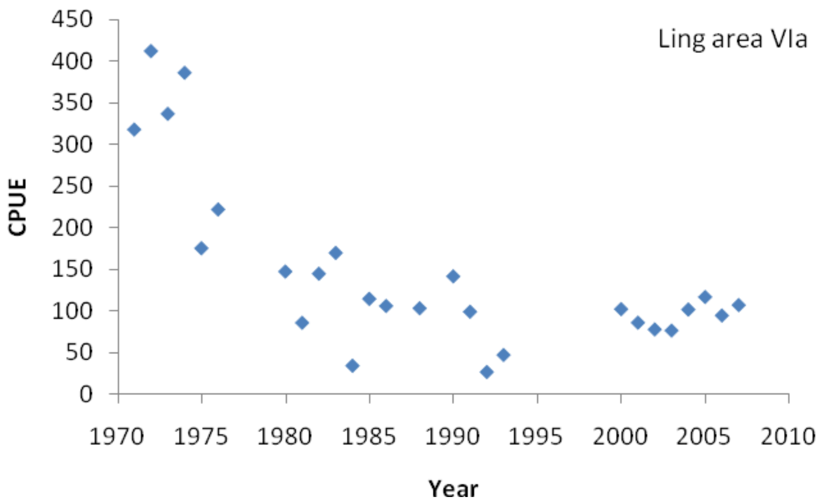


Figure 5.5.2. Estimated mean cpue ([kg/hook]x1000) based on data from the official logbooks for tusk and ling in each ICES Subarea and all areas combined for the years 2000–2007.


Ling area IVa
CPUE
350
300
250
200
150
100
50
0
1970 1975 1980 1985 1990 1995 2000 2005 2010
Year


Ling area IVa
CPUE
350
300
250
200
150
100
50
0
1970 1975 1980 1985 1990 1995 2000 2005 2010
Year


Ling area VIa
CPUE
450
400
350
300
250
200
150
100
50
0
1970 1975 1980 1985 1990 1995 2000 2005 2010
Year

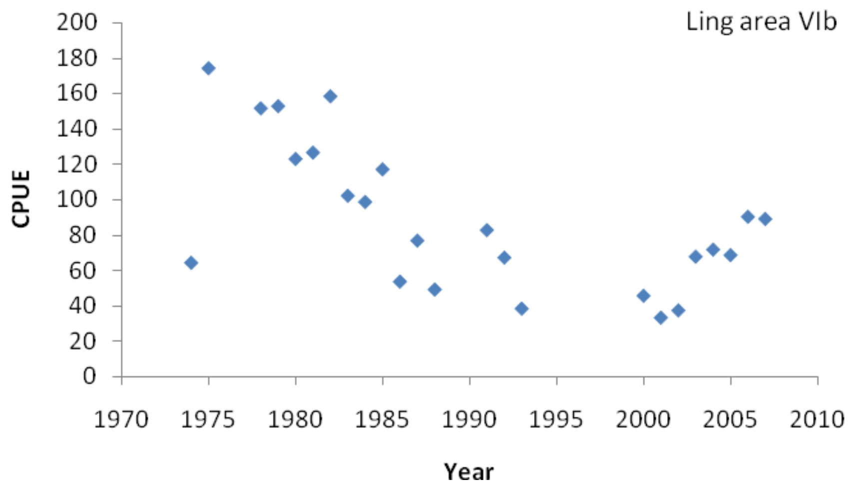
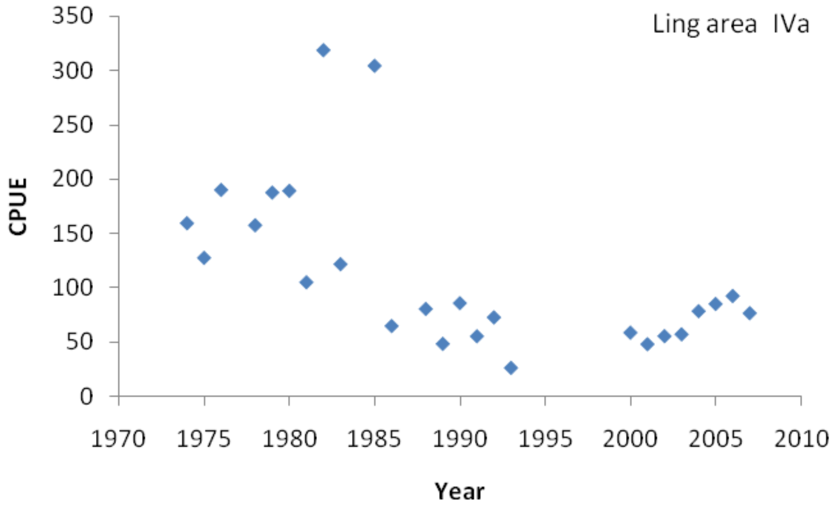
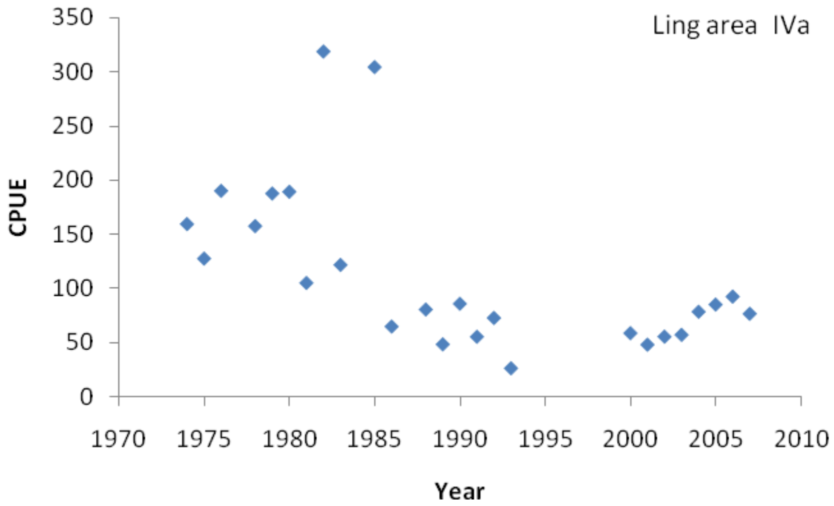
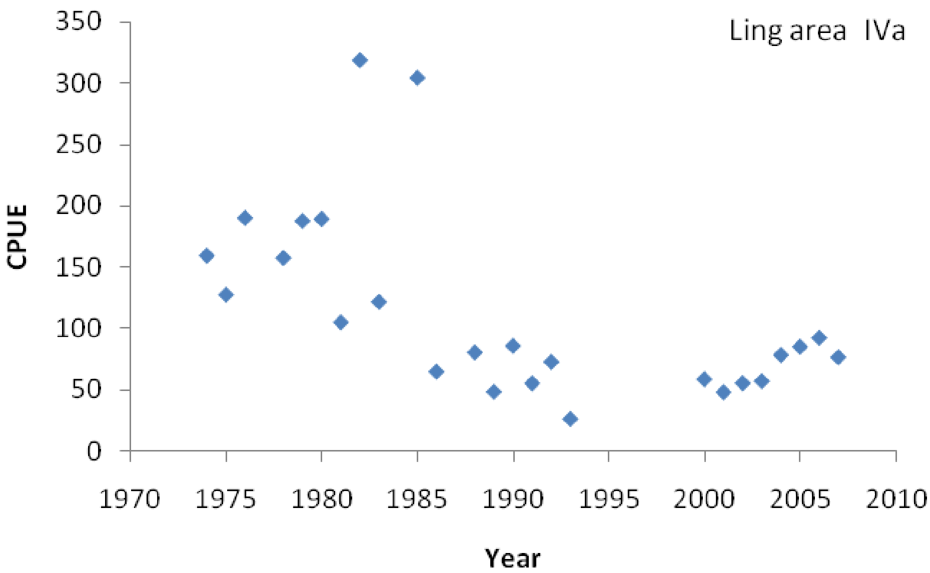


Figure 5.5.3. Estimates of cpue (kg/1000 hooks) of ling based on skipper's logbooks (pre-2000) and official logbooks (post-2000). Combination of data from Bergstad and Hareide, 1996 and Helle *et al.*, WD 2, 2009. Note gap in time-series between 1993 and 2000, and the differences in cpue scale between areas.


Ling area IVa
CPUE
350
300
250
200
150
100
50
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
Year


Ling area IVa
CPUE
350
300
250
200
150
100
50
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
Year


Ling area IVa
CPUE
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300
250
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1970
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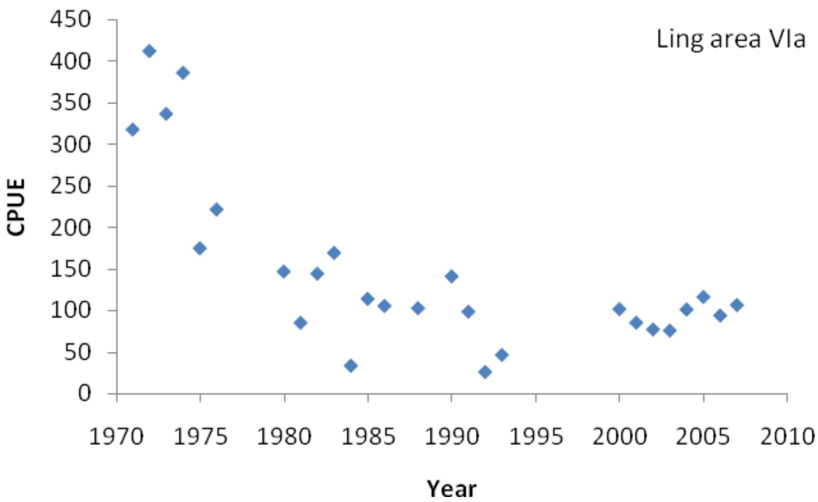


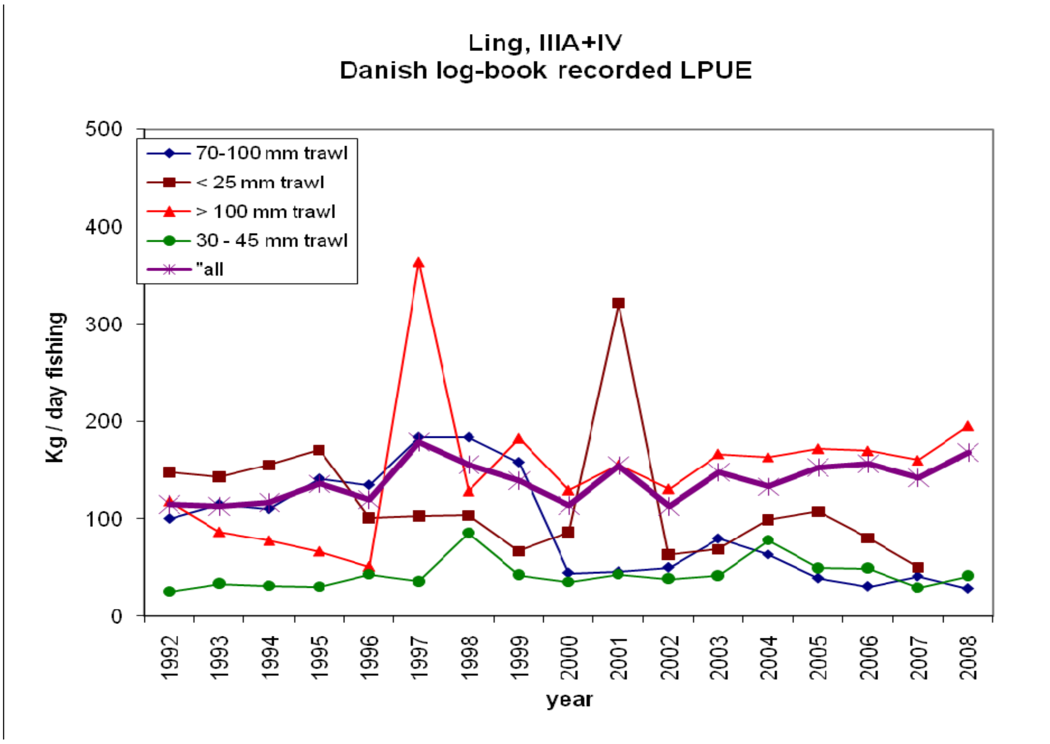


Figure 5.5.4. Cpue of ling for Danish trawlers in Subareas IIIa and IV. Based on logbook data.

6 Blue Ling (*Molva dypterygia*) in the Northeast Atlantic

6.1 Stock description and management units

Biological investigations in the early 1980s suggested that at least two adult stock components were found within the Area, a northern stock in Subarea XIV and Division Va with a small component in Vb, and a southern stock in Subarea VI and adjacent waters in Division Vb. However, the observations of spawning aggregations in each of these areas and elsewhere suggest further stock separation. This is supported by differences in length and age structures between areas as well as in growth and maturity. Egg and larval data from early studies also suggest the existence of many spawning grounds. The conclusion is that stock structure is uncertain within the areas under consideration.

However, as in previous years, on the basis of similar trends in the cpue series from Division Vb and Subareas VI and VII, blue ling from these areas has been treated for assessment purposes as a single southern stock. Blue ling in Va and XIV has been treated as a single northern stock. All remaining areas are grouped together as “other areas.

Catches data for blue ling in 2006 and 2007 aggregated at the level of statistical rectangle were provided to the working group by France, Ireland, the UK (England and Wales and Scotland) and Iceland. These are shown in Figures 6.1.1 and 6.2.2.

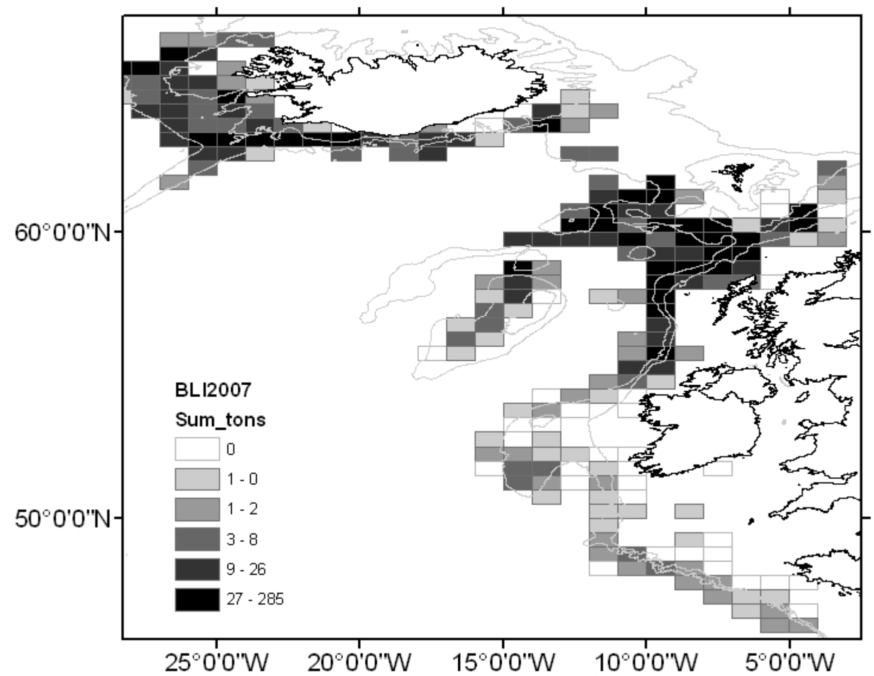


Figure 6.1.1. Catches of blue ling by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2006.

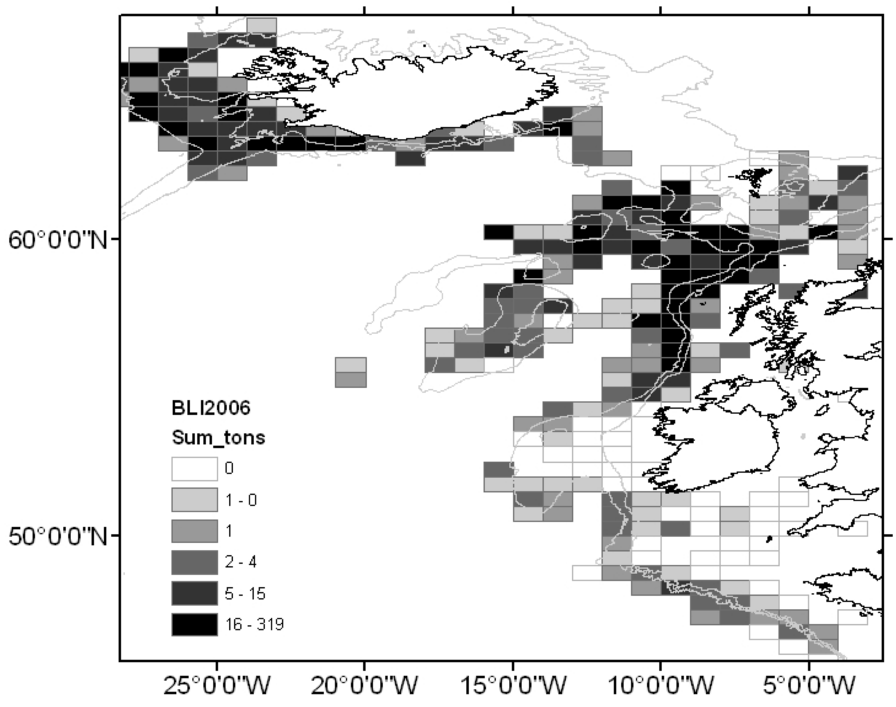


Figure 6.1.2. Catches of blue ling by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

6.2 Blue Ling (*Molva Dypterygia*) In Division Va and Subarea XIV

6.2.1 The fishery

The change in geographical distribution of the Icelandic blue ling fisheries from 1996, to 2007 (Figure 6.2.1a) indicates that there has been an expansion of the fishery of blue ling to northwestern waters. This increase is likely to be the result of increased availability of blue ling in the northwestern area, rather than being the result of an increase in effort or reporting.

The fishery for blue ling in Va changed substantially in nature and extent in the early 1980s. At the start of this period catches were high (Figure 6.2.3), in part because of fisheries on spawning aggregations. These aggregations diminished relatively quickly and since the mid 1980s blue ling has largely been a bycatch in the redfish and Greenland halibut fishery. In 1993, the Icelandic fleet fished on aggregations of spawning blue ling in a small area on the Reykjanes ridge at the border between Subareas Va and XIV (Figure 6.2.2). This was a transient fishery that declined rapidly in the years thereafter.

In recent years major portion of the landings are taken by bottom-trawl fisheries, as bycatch where the main target species are cod, haddock and other demersal species. 50% of the bottom-trawl catches in 2007 were taken within the depth range of 300–700 m, with 50% of the catches taken at depths greater than 400 m. In 2008 the amount of blue ling caught by longliners almost tripled from 375 tonnes to 1454. It seems that the reason for this is the increased targeting of blue ling by the longline fleet (see Subsection 4.1).

Historically the fisheries in Subarea XIV have been relatively small.

6.2.1.1 Landings trends

The gross fluctuation in historical landing is most likely a reflection transient fishery on spawning grounds (Figure 6.2.3).

As a result of depletion of fish on spawning grounds, total international landings in Va declined from around 8500 t in 1980 to a level of between 2000 and 3000 t in the late 1980s. Landings were at a historical low in the late 1990s, but have increased in recent years (Table 6.2.1a and Figure 6.2.3). The preliminary total landings in Va 2008 were 3758 t of which the Icelandic fleet caught 3653 t. Catches of blue ling in Va have nearly doubled since 2006, the main part of this increases can be attributed to increased targeting of blue ling by the longline fleet (see Subsection 4.1.2 and Figure 4.1.3).

Total international landings from XIV (Table 6.2.1b) have been highly variable over the years, ranging from a few tonnes in some years to around 3700 t in 1993 and 950 t in 2003. Most of the landings in 2003 were taken by Spanish trawlers (390 t), but there is no further information available on this fishery. These larger landings are very occasional and in most years total international landings have been between 50 and 200 t. Preliminary landings in 2008 were 40.5 t.

6.2.1.2 ICES advice

The latest advice is from ICES ACOM in May 2008 states: *There should be no directed fisheries for blue ling in Areas Va and XIV and measures should be implemented to minimize catches in mixed fisheries. Blue ling is susceptible to sequential depletion of spawning aggregations and closed areas to protect spawning aggregations should therefore be maintained and expanded where appropriate.*

6.2.1.3 Management

In 2007 there is an EC TAC for EU vessels fishing in EU and international waters in II, IV and V of 95 t per annum. These in 2008 this was reduced to 78 t. EU landings from II, IV and Va were less than the EU TAC in II, IV and V (see below).

EU TAC AREA	EU TAC IN 2007 (T)	EU LANDINGS IN 2007 (T)
II, IV and V	95	83 (Va)

The Icelandic fishery is not regulated by a national TAC or ITQs. The only restrictions on the Icelandic fleet regarding the blue ling fishery was the introduction of closed areas in 2003 to protect known spawning locations of blue ling, which are in effect (Figure 6.2.2). The increased targeting of blue ling by the longline fleet in 2008 contradicts the latest advice from ICES.

6.2.2 Data available

6.2.2.1 Landings and discards

Landings data are given in Tables 6.2.1 and 6.2.2. Discarding is banned in the Icelandic fishery. There is no available information on discarding of blue ling in Va and XIV.

6.2.2.2 Length compositions

Length distributions from the Icelandic trawl catches for the period 1996–2007 are shown in Figure 6.2.4 and from the Icelandic groundfish surveys (described later) in Figure 6.2.7. Detailed overview of the sampling from catches and surveys was given in ICES 2007a report. The sampling intensity in 2008 was similar as in recent years.

6.2.2.3 Age compositions

No new data were available. Existing data are not presented as a consequence of the difficulties in the ageing of this species.

6.2.2.4 Weight-at-age

No new data were available. Existing data are not presented because of difficulty in ageing.

6.2.2.5 Maturity and natural mortality

Length-at-maturity from available data since 1986 is shown in Figure 6.2.5. L_{50} was estimated at roughly 77 cm.

No information was available on natural mortality (M). However, an estimate of M is can be estimated using the relationship:

$$M = LN(100)/\text{maximum age}$$

The maximum age can be set at the age where 1% of a year class is still alive. Based on age readings from the 1980s and 1990s, it is reasonable to assume the maximum age for blue ling in Va and XIV is around 30 years. Given this and the relationship above, M may be in the order of 0.15.

6.2.2.6 Catch, effort and RV data

Effort and cpue data from the Icelandic trawl fleet are given in Table 6.2.3 and Figure 6.2.10.

The Icelandic spring groundfish survey, which has been conducted annually in March since 1985, gives fisheries-independent data for many exploited stocks in Va including blue ling (Figure 6.2.8) In all more than 550 stations are taken annually in the survey at depths down to 500 meters. However, the spring survey area does not cover the most important distribution area of blue ling as their distribution area goes to greater depths.

In addition, an autumn survey was commenced in 1996 covering 150 stations of the 550 stations that have been taken in spring survey (i.e. shallower than 500 m). From its commencement in 1996 to 1999 an additional 150 stations were taken in deeper waters off the west, north, east and southeast continental slopes off Iceland (primarily targeting Greenland halibut). In 2000, 74 stations were added to the survey, covering the continental slopes to the south of Iceland and the Reykjanes ridge. The station coverage of the autumn survey from the year 2000 is thought to represent a reasonable coverage of the distribution of the blue ling bycatch fishery.

Time-series stratified abundance and biomass indices from the spring and autumn trawl surveys are shown in Figure 6.2.6.

6.2.2.7 Data analyses

No assessment was required for this stock in 2009.

6.2.2.8 Comments on the assessment

No assessment was required for this stock in 2009.

6.2.3 Management considerations

No advice was required for this stock in 2009.

Table 6.2.1. Blue ling: Landing in ICES Division Va.

Year	Faroe	Germany	Iceland	Norway	UK	Total
1973	74	1678	548	6	61	2367
1974	34	1959	331	140	32	2496
1975	69	1418	434	366	89	2376
1976	29	1222	624	135	28	2038
1977	39	1253	700	317	0	2309
1978	38	0	1237	156	0	1431
1979	85	0	2019	98	0	2202
1980	183	0	8133	83	0	8399
1981	220	0	7952	229	0	8401
1982	224	0	5945	64	0	6233
1983	1195	0	5117	402	0	6714
1984	353	0	3122	31	0	3506
1985	59	0	1407	7	0	1473
1986	69	0	1774	8	0	1851
1987	75	0	1693	8	0	1776
1988	271	0	1093	7	0	1371
1989	403	0	2124	5	0	2532
1990	1029	0	1992	0	0	3021
1991	241	0	1582	0	0	1823
1992	321	0	2584	0	0	2905
1993	40	0	2193	0	0	2233
1994	89	1	1542	0	0	1632
1995	113	3	1519	0	0	1635
1996	36	3	1284	0	0	1323
1997	25	0	1319	0	0	1344
1998	59	9	1086	0	0	1154
1999	31	8	1525	8	11	1583
2000	0	7	1605	25	8	1645
2001	95	12	752	49	23	931
2002	28	4	1256	74	10	1372
2003	16	16	1098	6	24	1160
2004	38	9	1083	49	20	1199
2005	24	25	1497	20	26	1592
2006	63	22	1734	27	9	1855
2007	78	0	1999	4	10	2091
2008 [1)]	101		3653	4		3758

[1)] **Provisional figures**

Table 6.2.2. Blue ling: Landing in ICES Division XIV. Source: STATLANT database.

Year	Faroe	Germany	Greenland	Iceland	Norway	Russia	Spain	UK	Total
1973	0	50	0	10	0	0	0	0	60
1974	0	90	0	6	0	0	0	0	96
1975	0	285	0	90	3	0	0	0	378
1976	0	65	0	21	0	0	0	13	99
1977	0	491	0	0	0	0	0	6	497
1978	0	933	0	0	4	0	0	0	937
1979	0	1026	0	0	0	0	0	0	1026
1980	0	746	0	0	0	0	0	0	746
1981	0	1206	0	0	0	0	0	0	1206
1982	0	1946	0	0	0	0	0	0	1946
1983	0	621	0	0	0	0	0	0	621
1984	0	537	0	0	0	0	0	0	537
1985	0	315	0	0	0	0	0	0	315
1986	214	149	0	0	0	0	0	0	363
1987	0	199	0	0	0	0	0	0	199
1988	21	218	3	0	0	0	0	0	242
1989	13	58	0	0	0	0	0	0	71
1990	0	64	5	0	0	0	0	10	79
1991	0	105	5	0	0	0	0	45	155
1992	0	27	2	0	50	0	0	32	111
1993	0	16	0	3124	103	0	0	22	3265
1994	1	15	0	300	11	0	0	57	384
1995	0	5	0	117	0	0	0	19	141
1996	0	12	0	0	0	0	0	2	14
1997	1	1	0	0	0	0	0	2	4
1998	48	1	0	0	1	0	0	6	56
1999	0	0	0	0	1	0	66	7	74
2000	0	1	0	4	0	0	889	2	896
2001	1	0	0	11	61	0	1631	6	1710
2002	0	0	0	11	1	0	0	0	12
2003	0	0	0	0	36	0	670	5	711
2004	0	0	0	0	1	0	0	7	8
2005	2	0	0	0	1	0	176	8	187
2006	0	0	0	0	3	1	0	0	4
2007	19	0	0	0	1	0	0	0	20
2008 [1)]	0.5				40				

[1)] Provisional figures

Table 6.2.3. Blue ling. Registered catch, hours trawled and cpue from the Icelandic trawler fleet. Tows used for calculations of cpue are those where blue ling was more than 10% of total catch in each particular haul.

YEAR	CATCH (T)	HOURS	CPUE
1991	515	968	532
1992	643	1207	533
1993	3587	2805	1279
1994	659	1571	419
1995	406	1141	356
1996	185	764	242
1997	186	928	201
1998	267	1008	265
1999	723	2096	345
2000	236	1494	158
2001	132	934	141
2002	230	1846	124
2003	195	1492	131
2004	201	1355	148
2005	305	2302	133
2006	338	2813	120
2007	423	2304	184
2008	664	4895	136

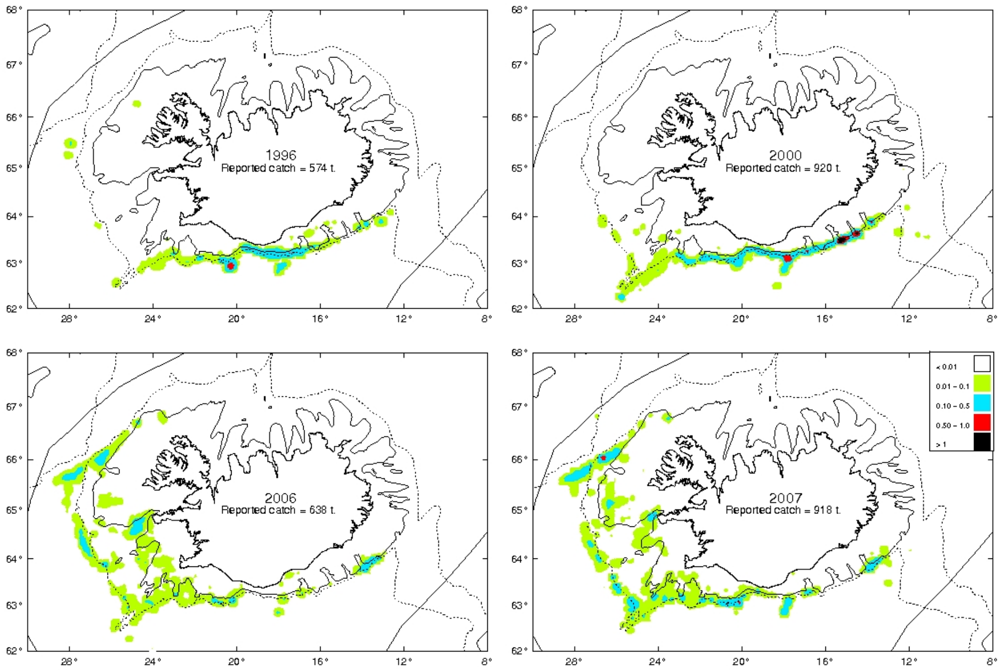


Figure 6.2.1a. Geographical distribution (tonnes/square mile) of the Icelandic blue ling fishery in 1996, 2000, 2006 and 2007 as reported in the logbooks. All gear types combined.

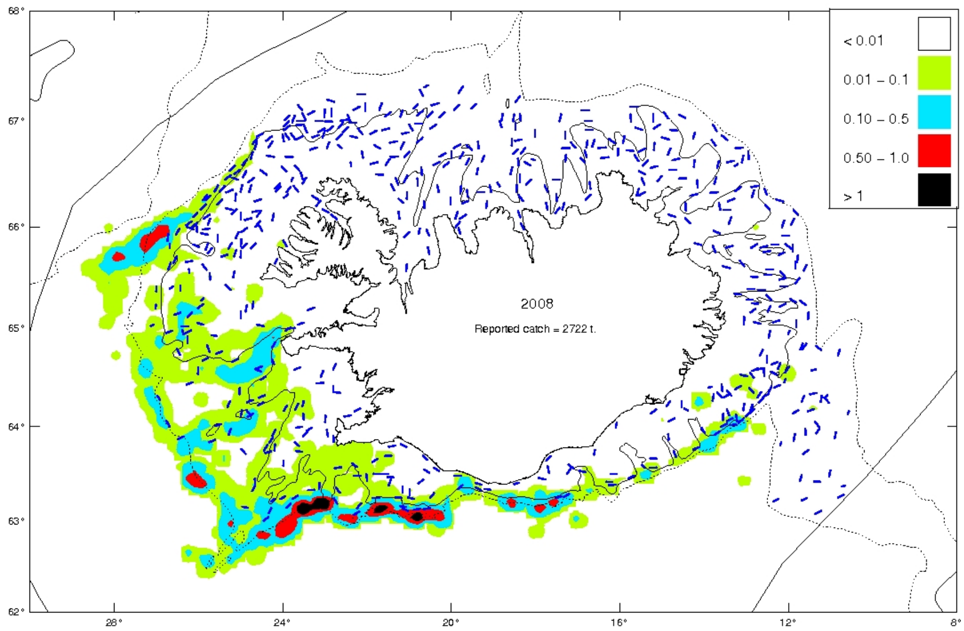


Figure 6.2.1b. Location of the autumn trawl survey and geographical distribution (tonnes/square mile) of the Icelandic blue ling fishery in 2008 as reported in the logbooks. All gear types combined.

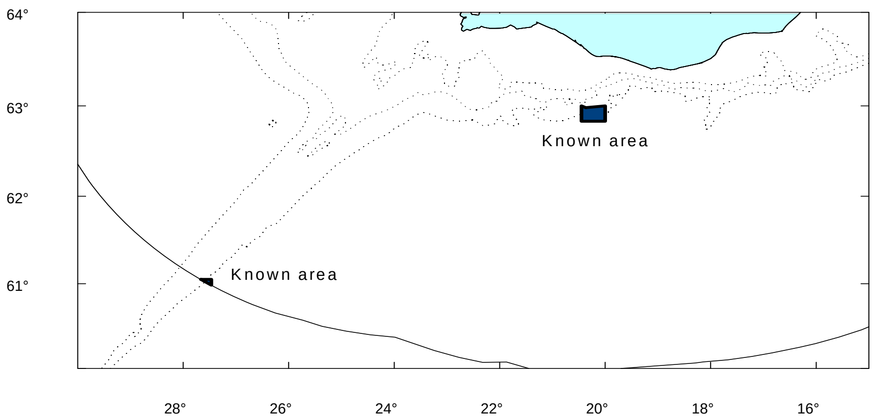


Figure 6.2.2. Known spawning grounds for blue ling in Icelandic waters.

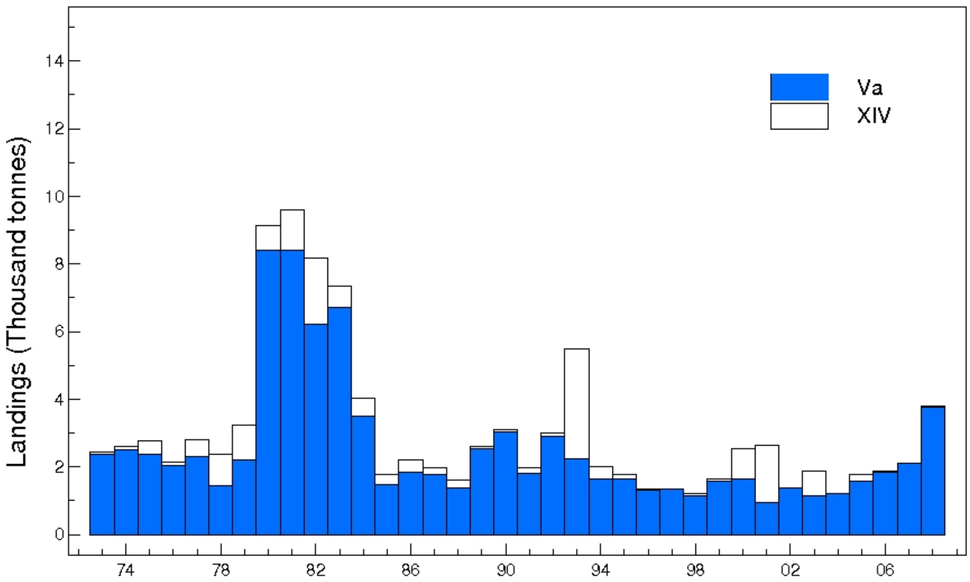


Figure 6.2.3. Blue ling in Va and XIV. Estimated total landings.

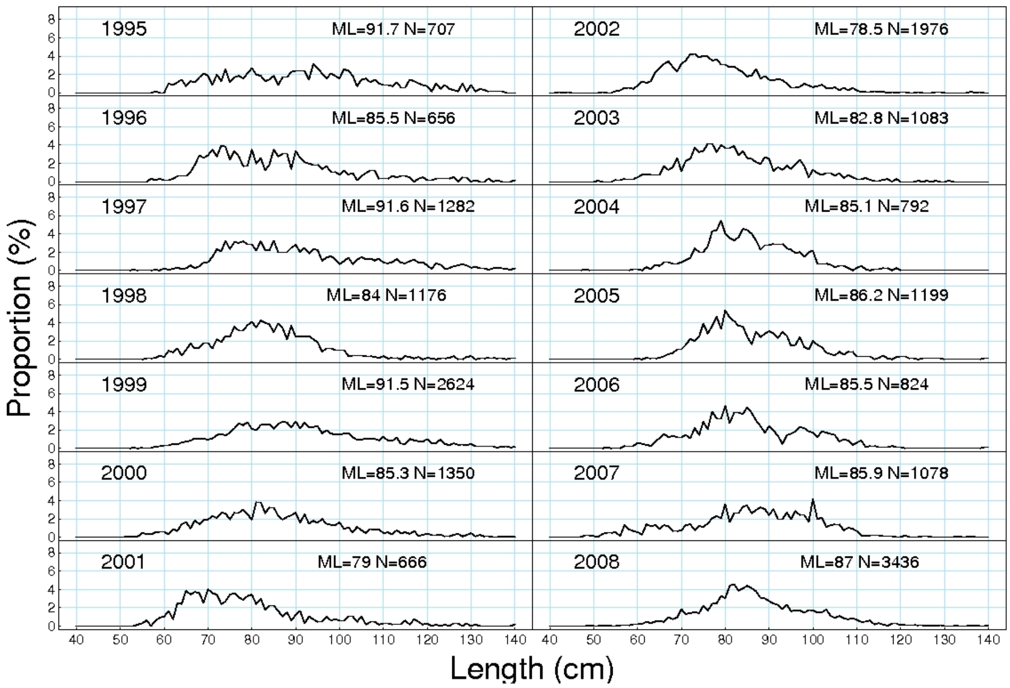


Figure 6.2.4. Length distribution of blue ling in the commercial landings of the Icelandic fleet in Va 1996–2008. The number of measured fish (N) and mean length (ML) is also given.

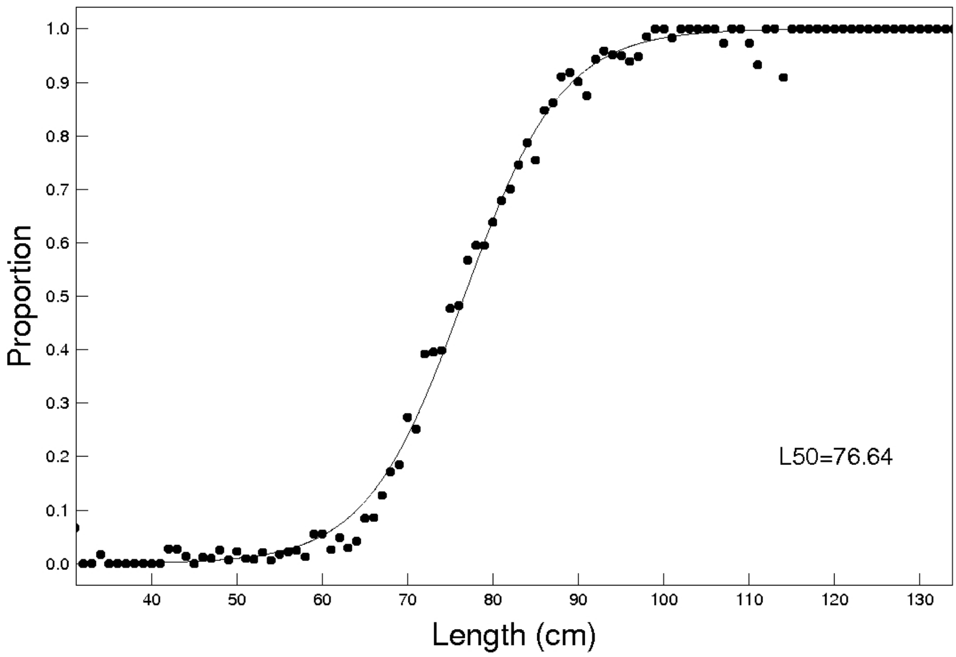


Figure 6.2.5. The proportion of mature of blue ling as a function of length in Va, using both commercial catch and survey data. The data points show the observed proportion mature and the lines the fitted maturity. Also given is L50.

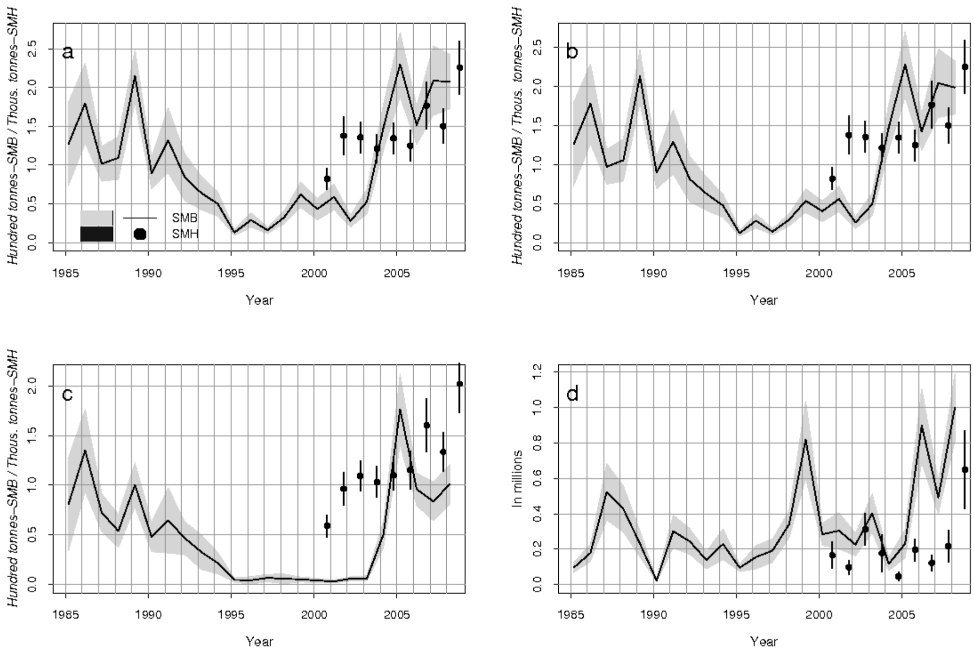


Figure 6.2.6. Abundance indices for blue ling in Icelandic groundfish survey in March 1985–2008 (SMB, line, shaded area) and October 1996–2008 (SMH, points, vertical lines). a) Total biomass index, b) Biomass of 40 cm and larger, c) Biomass 70 cm and larger, d) Abundance of < 40 cm. The shaded area and the vertical bar show ±1 standard error of the estimate.

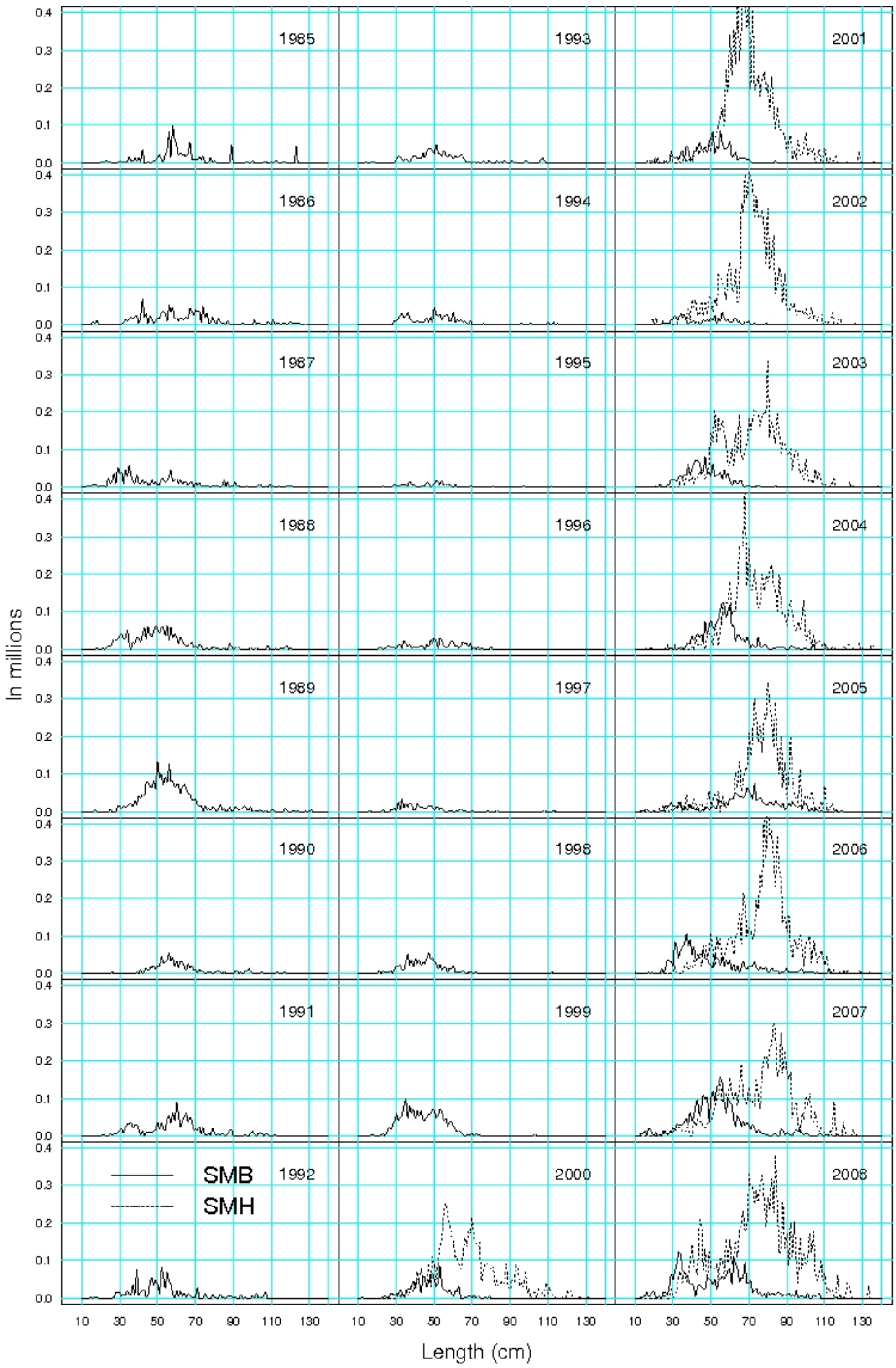


Figure 6.2.7. Length distributions of blue ling in the Icelandic groundfish survey in March 1985–2008 (SMB, solid line) and in October 2000–2008 (SMH, dotted line).

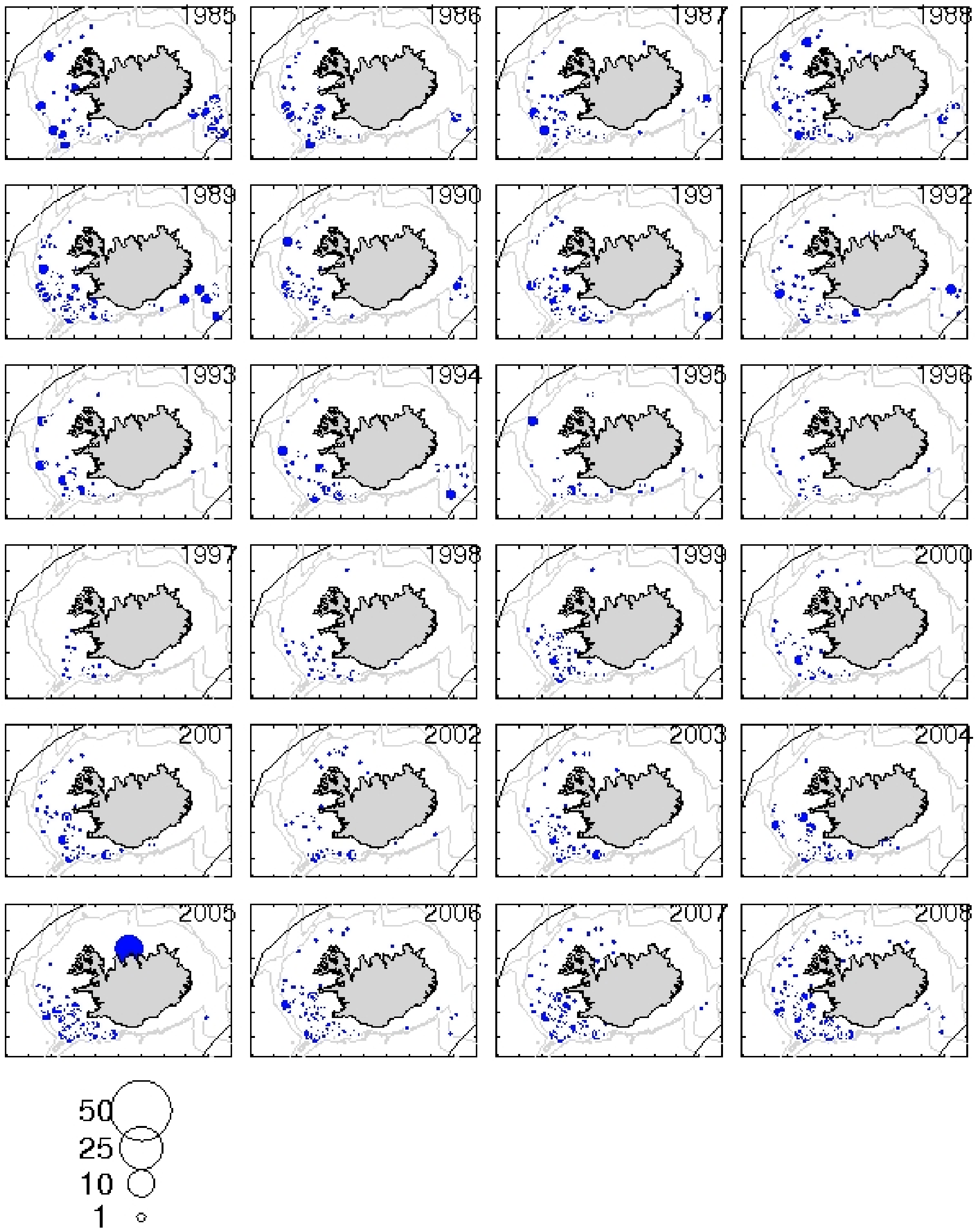


Figure 6.2.8. Blue ling. Distribution of cpue in the groundfish survey in March–1985-2008. The size of the circles indicates kg/station.

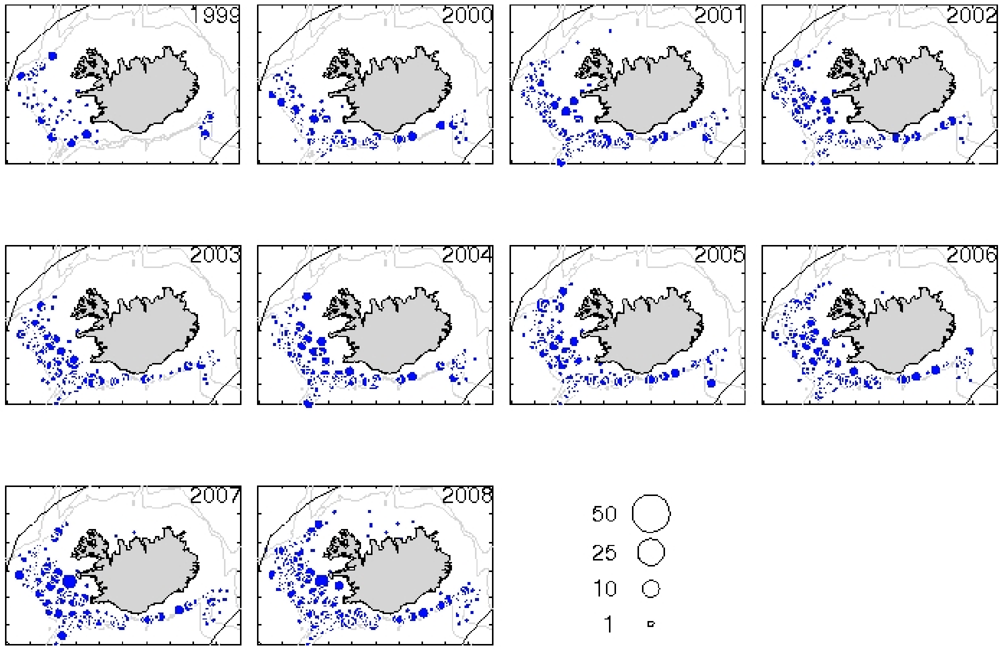


Figure 6.2.9. Distribution of blue ling in the groundfish survey in October 1999–2008. The sizes of the circles indicate kg/station.

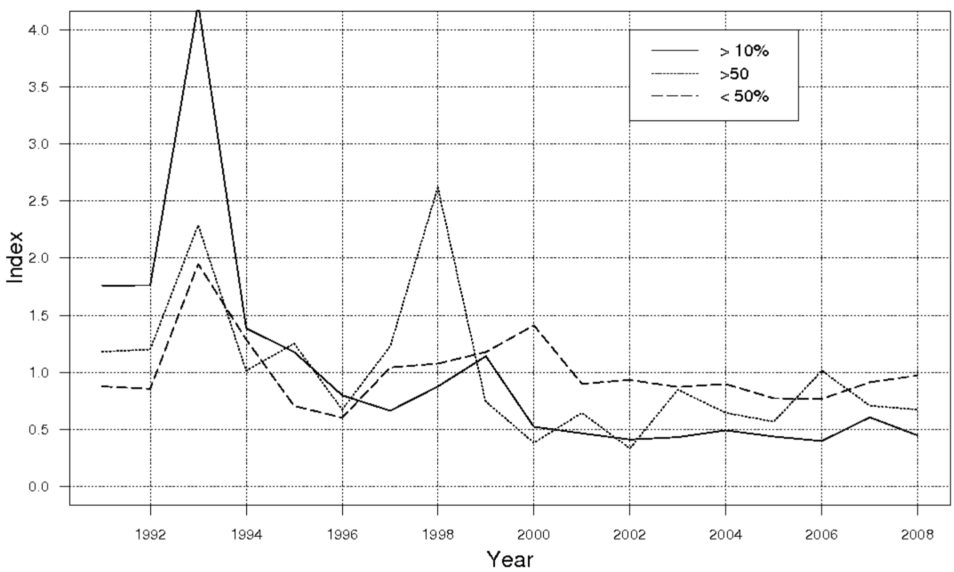


Figure 6.2.10. Index of raw cpue (sum(yield)/sum(effort)) of blue from the Icelandic bottom-trawl fishery based on logbooks 1991–2008. The criteria for the calculations were tows where blue ling composed at least 10% and 50% as well as less than 50% of the total catch.

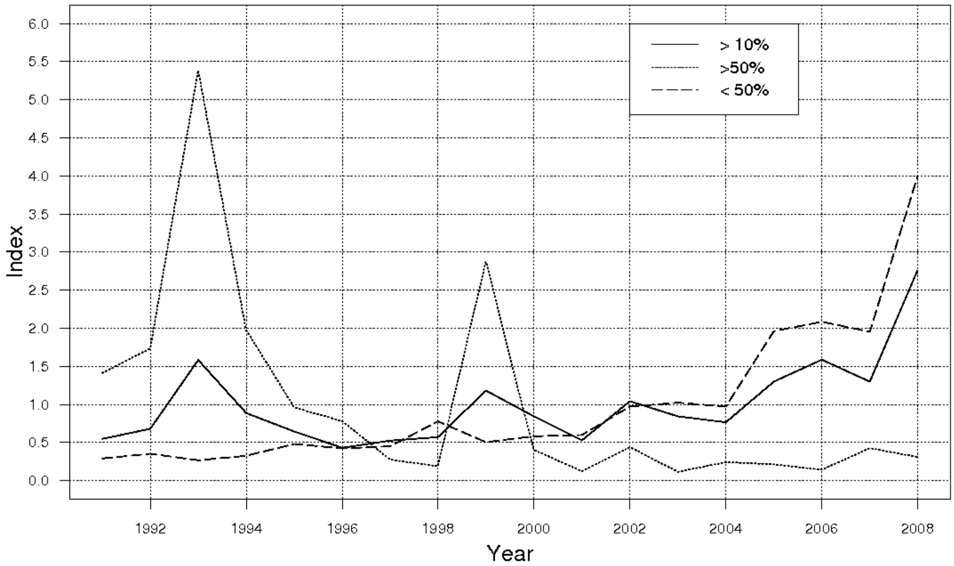


Figure 6.2.11. Index of fishing effort of blue ling from the Icelandic bottom-trawl fishery based on logbooks 1991–2008. The criteria for the calculations were tows where blue ling composed at least 10% and 50% as well as less than 50% of the total catch.

6.3 Blue Ling (*Molva Dypterygia*) in Division Vb, Subarea VI and VII

6.3.1 The fishery

The main fisheries are those by Faroese trawlers in Vb and French trawlers in VI and, to a lesser extent, Vb. Total international landings from Subarea VII are very small and are bycatches in other fisheries.

Landings by Faroese trawlers are mostly taken in the spawning season. Historically, this was also the case for French trawlers fishing in Vb and VI. However, in recent years blue ling has been taken mainly as a bycatch in French trawl fisheries for roundnose grenadier, black scabbardfish and deep-water sharks.

6.3.2 Landings trends

The rapid increase in the size of this fishery in the early 1970s is believed to be related to the expansion of national fisheries limits to 200 nautical miles and the resultant displacement of fishing effort and the associated development of markets.

Total international landings from Division Vb (Table 6.3.0a–e and Figure 6.3.1) peaked in the late 1970s at around 20 000 t, stabilized in the 1980s at around 5000–10 000 t and have since declined to a stable low level of around 3000 t with a reduction in 2008 to around 2000 t.

The landings from Subarea VI peaked at about 18 000 t in 1973–74 and fluctuated throughout the 1980s within the range of 5000–10 000 t. and have since gradually declined to around 1700 t in 2008.

Landings from Subarea VII are comparatively small and are mostly less than 500 t per annum and have mostly declined in recent years to < 100 t.

The overall trend in total international landings for all areas combined demonstrates a series of peaks in the 1970s and 1980s, then a strong decline until a smaller peak in the late 1990s and a gradual decline thereafter. It should be noted that EU TACs were introduced in 2003 and these may have had a limiting factor on landings by EU member states.

6.3.2.1 ICES advice

The latest advice is from ICES in 2008 is: *There should be no directed fisheries for blue ling in Subdivisions Vb, VI, and VII and measures should be implemented to minimize bycatches in mixed fisheries. Blue ling is susceptible to sequential depletion of spawning aggregations and closed areas to protect spawning aggregations should therefore be maintained and expanded where appropriate.*

6.3.2.2 Management

Prior to 2009, EU deep-water TACs have been set on a biennial basis; however from 2009 onwards annual TACs will be applied for the component of this stock in VI and VII. In 2008, the TAC for Subareas II, IV and V was 78 t and for Subareas VI and VII, 2009 t.

For 2009, a combined EU TAC for blue ling and ling is set in Faroese waters of Vb at 3065 t. The EU TAC for blue ling in VI and VII is maintained at 2009 t. The TAC for Subareas II, IV and V is 66 t, Norway and the Faroes have a TAC of 330 t which can be taken from IIa, IV, Vb, VI and VII.

For 2009, protection areas have been introduced for spawning aggregations of blue ling on the edge of the Scottish continental shelf and at the edge of Rosemary Bank (both in VIa). Entry/exit regulations apply and vessels cannot retain >6 t of blue ling from these areas per trip. On retaining 6 t vessels must exit and cannot re-enter these areas before landing. These vessels cannot discard any quantity of blue ling.

From 2009 onwards, Member State Observer Sampling Plans, developed in accordance with EC Regulation 2347/2002, will be revised to include a sampling protocol for sex and maturity of sampled blue ling (based on sampling advice provided by ICES in 2009).

According to landings data supplied to ICES WGDEEP, the TAC in VI and VII in 2008 was not fully taken and the TAC in II, IV V may have been substantially exceeded by landings from Vb alone (although quota swaps have not been taken into consideration).

EU TAC AREA	EU TAC IN 2008	EU LANDINGS IN 2008
VI and VII	2009	1717
II, IV and V	78	850 (Vb only)

There is minimum landing size of 60cm for blue ling landings into the Faroes.

6.3.3 Data availability

6.3.3.1 Landings and discards

In 2008, the landings time-series from the southern blue ling stock was extended back to 1966 based upon North Western Working Group reports from 1989–1991 and data in Moguedet, 1988. It is known that landings data in the 1980s for French freezer trawlers may be underestimated in some years.

Large French catches were reported as ling at the start of the fishery in 1973–1975. In order to derive a best estimate of blue ling landings, the average ling landings in the years preceding the start of the French blue ling fishery were deducted from estimates of blue ling and ling combined.

Landings data are given in Table 6.3.0a–e. Landings data were provided by France, (UK) Scotland, UK (England and Wales) and Ireland at the level of ICES statistical rectangles and these have been aggregated by quarter and plotted to display the geographical distribution of the fishery in Figure 6.3.2.The figures presented are for 2007 and 2008 but plots back to 2001 are presented under TOR g)

Information collected under the French deep-water sampling programme indicates there are no discards of this species in the French trawl fishery. There is no information available on discards in other fleets.

6.3.3.2 Length compositions

Length composition data of blue ling from Faroese trawlers in Division Vb are presented in Figure 6.3.3. Further details can be found in WGDEEP08 WD 15 (update) Information on the mean length in annual landings was not available.

Time-series data (1984–2008, excluding 1985 and 1986) of the raised length composition of French trawl landings of blue ling in VIa are given in Figure 6.3.4. The trend in annual mean length in Division VIa is shown in Figure 6.3.5.

Length composition of catches of blue ling taken in September on Spanish bottom-trawl surveys at Porcupine Bank, previously presented have now been deleted because recent information indicates they are for Spanish ling (*Molva macrophalma*) rather than blue ling (*Molva dypterygia*). Mean lengths of blue ling from the Norwegian reference fleet in divisions Vb, VIa, VIb and Subarea XII are given Table 6.3.1. Details of sampling can be found in WGDEEP09 Update.

6.3.3.3 Age compositions

No new data were available but existing data are available for some years and ICES areas. These are not presented as a result of the difficulties in the ageing of this species.

6.3.3.4 Weight-at-age

No new weight-at-age data were available. Existing data are sparse and are not presented because of difficulty in ageing.

6.3.3.5 Maturity and natural mortality

No new data on maturity were available. No information was available on natural mortality (M). However, an estimate of M is can be estimated using the relationship:

$$M = LN(100)/\text{maximum age}$$

The maximum age can be set at the age where 1% of a year class is still alive. Based on Faroese and French age readings, it is reasonable to assume the maximum age for blue ling is around 30 years. Given this and the relationship above, M may be in the order of 0.15.

6.3.3.6 Catch, effort and RV data

Cpue data are available for Faroese trawlers in Division Vb 1994–2008 (Figure 6.3.6).

Catch, effort and cpue data from Faroese trawl surveys (1994–2008) are demonstrated in Table 6.3.2 and Figure 6.3.7. Small numbers of juvenile blue ling are caught in the Faroese bottom-trawl surveys (Figure 6.3.8. Data for 2008 are not available). Owing to the small numbers caught, these data do not constitute any stock or recruitment index. It may, however, be worth following the blue ling catch in these surveys as it may track future changes in the recruitment.

A French deep-water tallybook database (based on fishers' own records) developed by the French industry and updated to include data for 2008, was provided to French scientists and presented to WGDEEP (Pawlowski *et al*., 2009 WD1). Based on these data, an analysis of blue ling lpues was carried out (Lorance *et al*., 2009 WD18). Consistent with preliminary analyses of the same data presented last year (Biseau, 2008 WD1), lpues depend upon several variables including season, fishing depth, location (ICES statistical rectangle) and vessels. Lpue trends over years were estimated for four different areas (Figure 6.3.10 and 6.3.11). Trends are not presented for the area in Division VII (in blue in Figure 6.3.9) as landings from this area are very small. A description of the methodology used is given in the general section on data availability (Section 3.1.5).

6.3.4 Data analyses

An updated exploratory assessment for this stock was not attempted this year as the French abundance index (used in previous assessments) needs to be re-analysed as the vessels in the reference fleet previously used to generate an index back in time to the start of the fishery have stopped fishing.

No other data analyses were attempted this year.

6.3.5 Comments on assessment

No assessment was carried out this year.

6.3.6 Management considerations

Management advice for deep-water stocks is not required this year.

Table 6.2.0a Landings of Blue ling in Sub-division Vb1.

YEAR	FAROES	FRANCE(2)	GERMANY(2)	NORWAY(3)	E & W(2)	SCOTLAND (1)	IRELAND	RUSSIA (2)	TOTAL
1966		839		430					**1269**
1967			1006	238					**1244**
1968			1838	823					**2661**
1969			303	798					**1101**
1970			348	2718					**3066**
1971			1367	557					**1924**
1972			2730	1203					**3933**
1973	51	80	3009	4003	4				**7147**
1974	43	390	1808	1554	3				**3798**
1975	17	2147	1528	2492	1				**6185**
1976	42	10475	896	1482					**12 895**
1977	23	6977	870	858	4			12 500	**21 232**
1978	423	3369	744	237	35				**4808**
1979	1072	2683	691	331					**4777**
1980	1187	2427	5905	304		1			**9824**
1981	1481	371	2867	167					**4886**
1982	2761	843	2538	121					**6263**
1983	3933	668	222	256					**5079**
1984	6453	515	214	105					**7287**
1985	4038	1193	217	140					**5588**
1986	4830	2578	197	94					**7699**
1987	3361	3246	152	81					**6840**
1988	3487	3036	49	94					**6666**
1989	2468	1802	51	228					**4549**
1990	946	3073	71	450					**4540**
1991	1573	1013	36	196	1				**2819**
1992	1918	407	21	390	4				**2740**
1993	2088	192	24	218	19				**2541**
1994	1065	147	3	173					**1388**
1995	1606	588	2	38	4				**2238**
1996	1100	301	3	82					**1486**
1997	778	1656		65	11				**2510**
1998	1026	1411	0	24	1				**2462**
1999	1730	1067	4	38	4				**2843**
2000	1677	575	1	163	33			1	**2450**
2001	1407	430	4	130	11		2		**1984**
2002	1003	578		274	8				**1863**
2003	2465	1133		12	1				**3611**
2004	751	1132		20				13	**1916**
2005	1028	781		15	1				**1825**
2006	1276	839		21	1			16	**2153**
2007	1220	1166		212	8			36	**2642**
2008*	626	784		35				110	**1555**

***Preliminary. (1) Included in Vb2. (2) Includes Vb2 (3) includes Vb2 up to 1974.**

Table 6.3.0b Landings of Blue ling in Sub-division Vb2.

Year	Faroes	Norway	Scotland (1)	E & W	Total
1966					**0**
1967					**0**
1968					**0**
1969					**0**
1970					**0**
1971					**0**
1972					**0**
1973					**0**
1974					**0**
1975	1				**1**
1976	6	37			**43**
1977		86			**86**
1978	7	83			**90**
1979	14	87			**101**
1980	36	159			**195**
1981	48	93			**141**
1982	128	66			**194**
1983	463	182			**645**
1984	757	50			**807**
1985	396	70			**466**
1986	81	41			**122**
1987	209	90			**299**
1988	2788	72			**2860**
1989	622	95			**717**
1990	68	191			**259**
1991	71	51	21		**143**
1992	1705	256	1		**1962**
1993	182	22	91		**295**
1994	239	16	1		**256**
1995	162	36	4		**202**
1996	42	62	12		**116**
1997	229	48	11		**288**
1998	64	29	29		**122**
1999	15	49	24		**88**
2000	0	37	37		**74**
2001	0	69	63		**132**
2002		21	140		**161**
2003		84	120		**204**
2004	710	6	68		**784**
2005	609	14	68		**691**
2006	647	34	16		**697**
2007	632	6	16		**654**
2008*	298		66		**364**

***Preliminary. (1) Includes Vb1.**

Table 6.3.0c Landings of Blue ling in DivisionVIa.

Year	Faroes	France	Germany	Ireland	Norway	Spain (2)	E & W	Scotland	Lithuania(1)	Total
1966					20					**20**
1967			37		35					**72**
1968					126					**126**
1969			6		112					**118**
1970					176					**176**
1971					15					**15**
1972		696			14					**710**
1973		18 000			25					**18 025**
1974	33	15 000	1218		371		164			**16 786**
1975		5000	2941		20		8			**7969**
1976		5462	818		10		1			**6291**
1977		7940	470		16		556			**8982**
1978		5495	2498		19		21			**8033**
1979		3064	993		2		279			**4338**
1980		2124	773		10					**2907**
1981		3338	335		11			1		**3685**
1982		3430	79		16		99			**3624**
1983		5233	11		118		13			**5375**
1984		3653	183		45		5			**3886**
1985	56	5670	5		75		2			**5808**
1986		8254	7		47		2	1		**8311**
1987		9389	45		51		1			**9486**
1988	14	6614	2		29		2	1		**6662**
1989	6	7382	2		143					**7533**
1990		4882	44		54			1		**4981**
1991	8	4261	18		63		1	35		**4386**
1992	4	5483	4		129			24		**5644**
1993		4311	48	3	27		13	42		**4444**
1994		2999	24	73	90	433	1	91		**3711**
1995	0	2835		11	96	392	34	738		**4106**
1996	0	4115	4		50	681	9	1407		**6266**
1997	0	3845		1	29	190	789	1021		**5875**
1998	0	4644	3	1	21	142	11	1416		**6238**
1999	0	3731		10	55	119	5	1105		**5025**
2000		4544	94	9	102	108	24	1300		**6181**
2001		2877	6	52	117	797	116	2136		**6101**
2002		2172		62	61	285	16	2027		**4623**
2003	7	2010		2	106	195	3	428		**2751**
2004	10	2264		1	24	24	1	482		**2806**
2005	17	2019		2	33	210		390	29	**2700**
2006	13	1794		1	49	27	3	433		**2320**
2007	13	1722			31	49		113	1	**1929**
2008*	14	1552			73			97		**1736**

***Preliminary. (1) Includes VIb for all countries up to (and including) 1974, (2) Includes VIb.**

Table 6.3.0d Landings of Blue ling in DivisionVIb.

YEAR	POLAND	RUSSIA	FAROES	FRANCE	GERMANY	NORWAY	E & W	SCOTLAND	ICELAND	IRELAND	ESTONIA	TOTAL
1975			1			37						**38**
1976			13			6						**19**
1977			6	36		7						**49**
1978			3	58		8						**69**
1979			4	652	187	28						**871**
1980				3827	5526	8						**9361**
1981				534	3944	5						**4483**
1982				263	554	13		1				**831**
1983				243	38	50		2				**333**
1984			133	3281		43						**3457**
1985			11	7263	31	38						**7343**
1986			1845	2928	39	66	7	1				**4886**
1987			350	10	356	76	3	10				**805**
1988			2000	499	37	42	9	14				**2601**
1989			1292	61	22	217		16				**1608**
1990			360	703		127		2				**1192**
1991			111	2482	6	102	5	15				**2721**
1992			231	348	2	50	2	14				**647**
1993			51	373	109	50	66	57				**706**
1994			5	89	104	33	3	25				**259**
1995			1	305	189	12	11	38				**556**
1996			0	87	92	7	37	74				**297**
1997			138	331		6	65	562	1			**1103**
1998			76	469		13	190	287	122	11		**1168**
1999			204	654		9	168	2411	610	4		**4060**
2000				514		184	500	966		7		**2171**
2001			238	210	1	256	337	1803		4	85	**2934**
2002		3	79	345		273	141	497		1		**1339**
2003	4	2		510		102	14	113			5	**750**
2004	1	5	4	514		2	10	96			3	**635**
2005		15	1	235		1	9	80				**341**
2006			3	313		2	4	29				**351**
2007		1	15	109		4	7	30				**166**
2008*		12	2	29		2	2	7				**54**

***Preliminary.**

Table 6.3.1e Blue ling landings in Division Vb and Subareas VI and VII.

Blue ling	Vb	VI	VII	Total
1966	1269	20		**1289**
1967	1244	72		**1316**
1968	2661	126		**2787**
1969	1101	118		**1219**
1970	3066	176		**3242**
1971	1924	15		**1939**
1972	3933	710		**4643**
1973	7147	18 025		**25 172**
1974	3798	16 786		**20 584**
1975	6186	11 426		**17 612**
1976	12 938	13 634		**26 572**
1977	21 318	13 868		**35 186**
1978	4898	8838		**13 736**
1979	4878	6939		**11 817**
1980	10 019	4515		**14 534**
1981	5027	4877		**9904**
1982	6457	6345		**12 802**
1983	5724	6022		**11 746**
1984	8094	4592		**12 686**
1985	6054	6067		**12 121**
1986	7821	8867		**16 688**
1987	7139	9783		**16 922**
1988	9526	7765	22	**17 313**
1989	5266	8701	293	**14 260**
1990	4799	9041	223	**14 063**
1991	2962	6557	212	**9731**
1992	4702	8578	406	**13 686**
1993	2836	5783	321	**8940**
1994	1644	4461	339	**6444**
1995	2440	4741	230	**7411**
1996	1602	6607	365	**8574**
1997	2798	6226	383	**9407**
1998	2584	6404	598	**9586**
1999	2931	5079	391	**8401**
2000	2524	6181	286	**8991**
2001	2116	6101	695	**8912**
2002	2024	4623	490	**7137**
2003	3815	2751	122	**6688**
2004	2700	2806	61	**5567**
2005	2516	2700	72	**5288**
2006	2850	2320	67	**5237**
2007	3296	1929	164	**5389**
2008*	1919	1736	30	**3685**

***Provisional.**

Table 6.3.1. Unweighted estimates of the mean length in catches of blue ling by the Norwegian longline reference fleet during 2003–2007, along with standard errors (se) and number of fish measured.

BLUE LING						
ICES-area		2003	2004	2005	2006	2007
IIa	Mean	89,44	77,46	91,91	79,5	65,04
	se	1,52	3,73	1,9	1,7	1,98
	N	61	13	56	146	22
IVa	Mean			54,19	74,9	74
	se			3,56	4,5	
	N			16	20	1
Va	Mean		58,72			
	se		0,62			
	N		460			
Vb	Mean		96,35	107,79	104,5	109,25
	se		1,32	3,81	5,2	3,29
	N		103	14	15	8
VIa	Mean	83,6				91,49
	se	1,88				0,57
	N	40				263
VIb	Mean	91,26				96,86
	se	0,16				1,55
	N	5743				36
XII	Mean	91,07				
	se	0,56				
	N	445				
All areas	Mean	91,18	87,434	87,48	81,33	90,69
	N	6290	576	86	184	330

Table 6.3.2. Blue ling catch, effort and cpue in the Faroese trawl surveys in Vb.

	Spring survey			Summer survey		
	Catch (kg)	Effort (h)	cpue (kg/h)	Catch (kg)	Effort (h)	cpue (kg/h)
1994	83	91	0.91			
1995	82	91	0.90			
1996	122	100	1.22	710	200	3.55
1997	199	98	2.03	237	200	1.18
1998	79	99	0.80	477	201	2.37
1999	8	100	0.08	287	199	1.44
2000	45	100	0.45	203	200	1.02
2001	70	100	0.70	350	200	1.75
2002	36	100	0.36	119	199	0.60
2003	119	100	1.19	156	200	0.78
2004	105	100	1.05	825	200	4.13
2005	95	100	0.95	846	200	4.23
2006	110	100	1.10	330	200	1.65
2007	115	100	1.15	253	199	1.27
2008	43	99	0.43	175	200	0.88

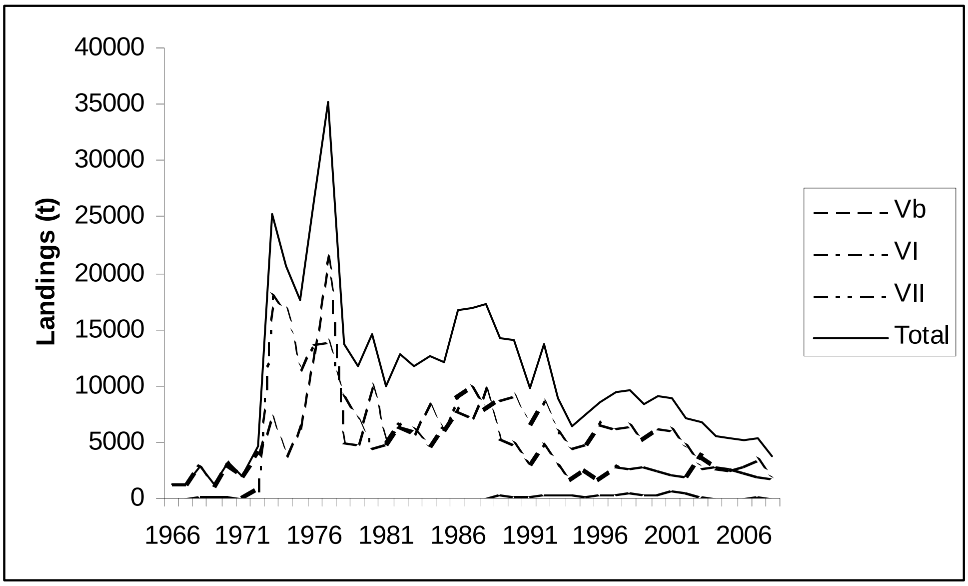


Figure 6.3.1. Trends in total international landings for southern blue ling (Vb, VI, VII).

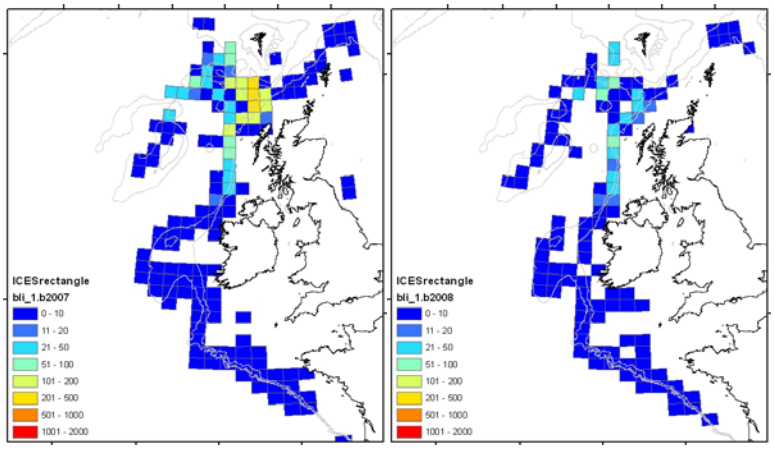


Figure 6.3.2. Geographical distribution of landings France, (UK) Scotland, UK (England and Wales) and Ireland at the level of ICES statistical rectangles. The figures presented are for 2007 and 2008 but plots back to 2001 are presented under TOR g).

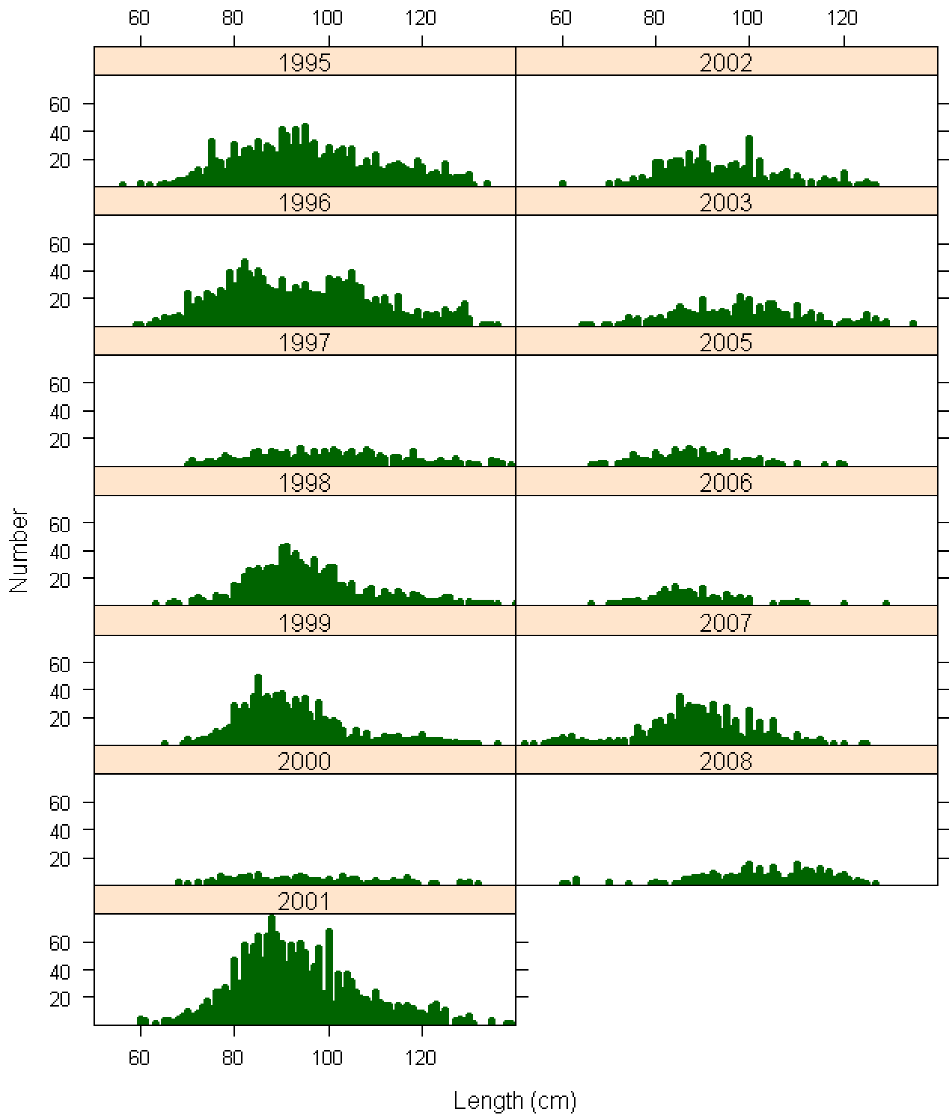


Figure 6.3.3 Blue ling in Vb (Faroes). Length distribution in the landings from Faroese otterboard trawlers >1000 HP (No length sampling was carried out in 2004).

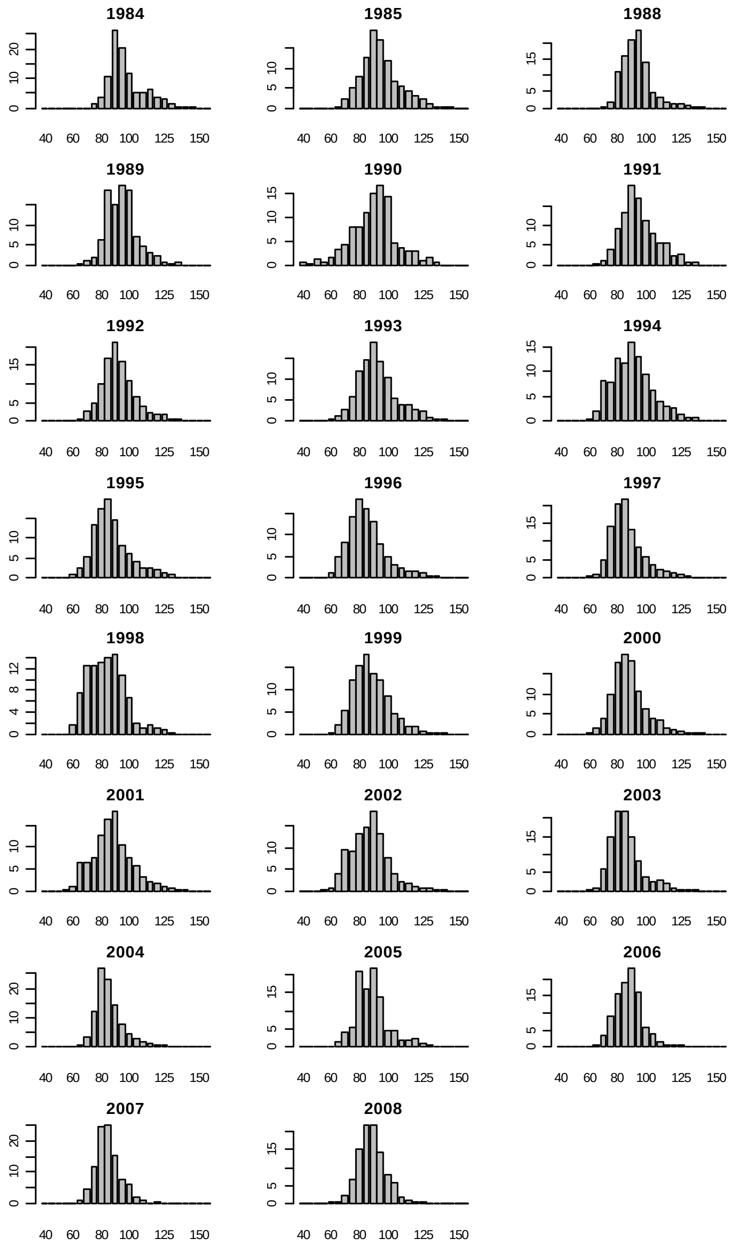


Figure 6.3.4. Length distribution in the landings of blue ling from French otter fishing in VIa.

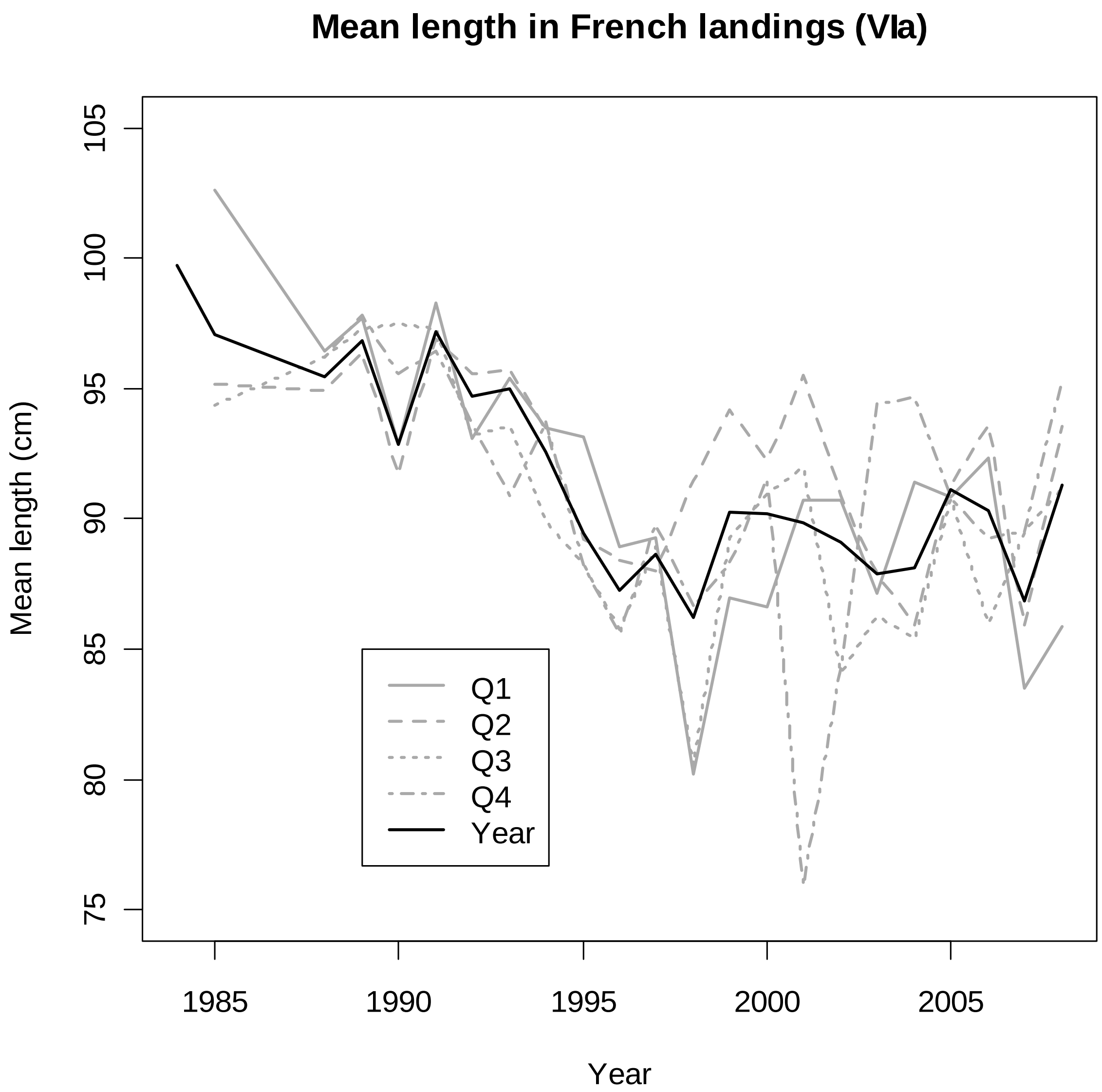


Figure 6.3.5. Mean length in French trawl landings from Via.

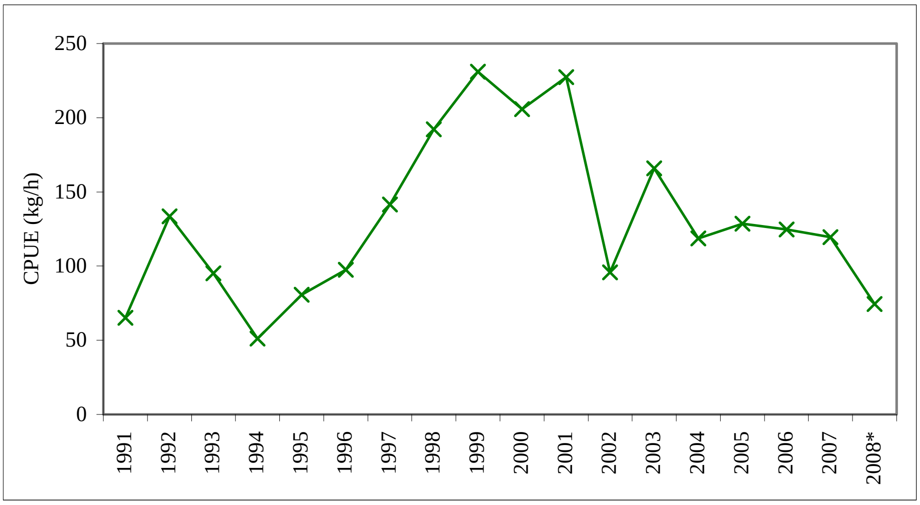


Figure 6.3.6. Blue ling cpue in Vb from Faroese otter trawlers >1000 HP (data for 2008 are provisional).

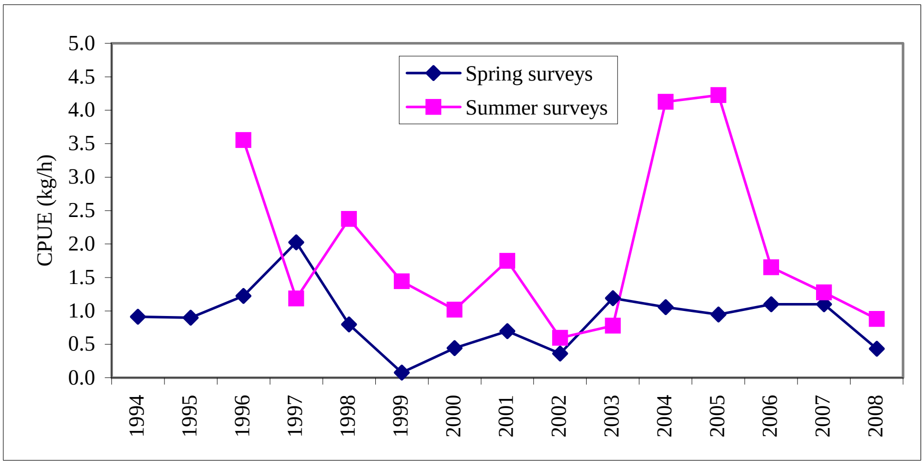
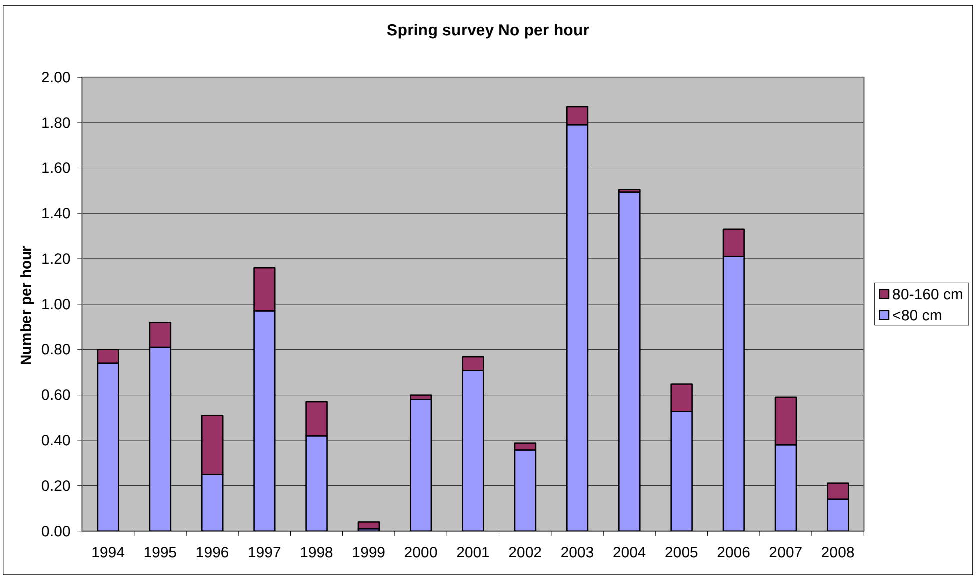


Figure 6.3.7. Blue ling cpue series from Faroese trawl surveys in Vb.



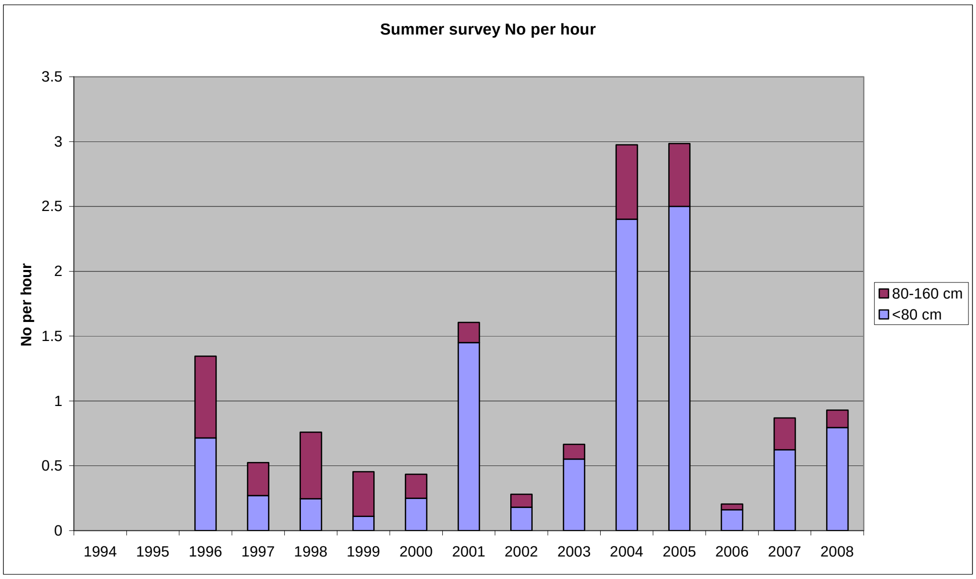


Figure 6.3.8. Number of juvenile (< 80 cm) and adult (>80 cm) blue ling caught in the spring (top) and summer (bottom) Faroese surveys.

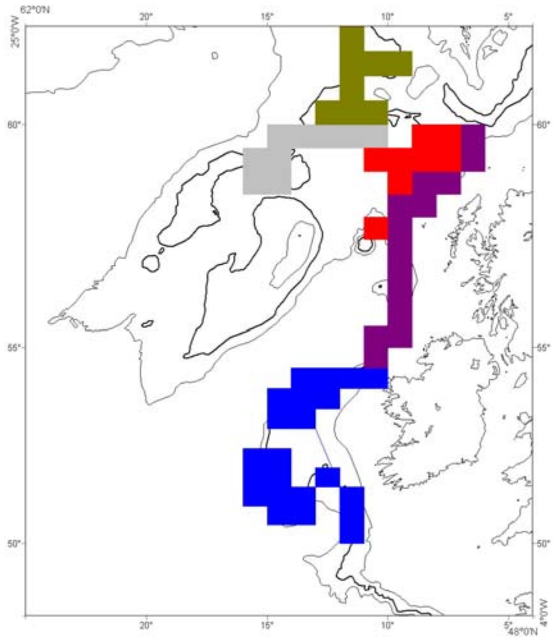


Figure 6.3.9. Areas used to calculate French lpues for blue ling: .green: new grounds in Vb (new5); grey: new grounds in VI (new6); red: others in VI (other6); purple: edge in VI (edge6); blue: all grounds in VII (ref7). Depth contours are 200, 1000 and 2000 m.

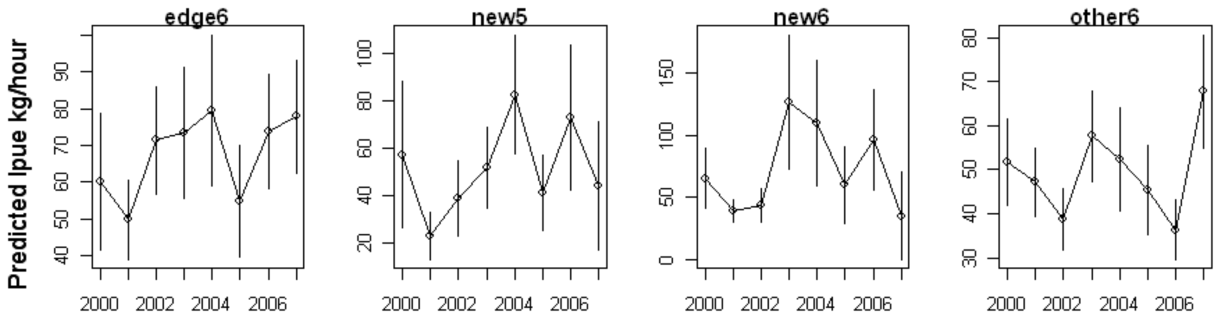


Figure 6. 3.10. Trends in lpue of positive tows (by area, see Figure 3.1.1). All tow where roundnose grenadier, black scabbardfish and deep-water sharks make more than 50% of the total catch. Predictions are made for an engine power of 1850 kw, 300 minutes fishing time and 700 depth.

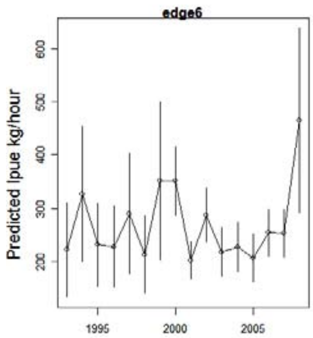


Figure 6.3.11. Estimated lpue of positive tows per dataset for area Edge 6 (see Figure 3.1.1). Estimates are standardized for an engine power of 1850 kw, 300 minutes fishing time and 700 depth.

6.4 Blue ling (*MOLVA DYPTERYGIA*) in I, II, IIIa, IV, VIII, IX, X, XII

6.4.1 The fishery

Blue ling has been an important bycatch in trawl fisheries for mixed deep-water species on Hatton Bank (Division XIIb). In other areas blue ling is taken in small quantities.

6.4.2 Landings trends

Landings data are demonstrated in Table 6.4.0a–f. Both historically as well as in recent years, around 90% or more of the total landings in other areas were taken in Areas II, IV and XII combined. In Area II reported landings decreased all through the available time-series from 1988 until 1994. Since then the landings in area II have varied between 150–400 tonnes, 15% of the mean for the years 1988–1993, and 7% of the 1988 level. In Area IV a reduction in landings appears from mid 1990s to a stable level in the last six years at 17% of pre 1995 level. In Area XII landings have been very variable throughout the time-series and the only apparent trend is a dramatic reduction during the years from 2002 to 2006. There were not reported any catches in area XII in 2007 and 2008.

6.4.3 ICES advice

The latest advice is from ICES in May 2008.

There should be no directed fisheries for blue ling and measures should be implemented to minimize the bycatch of this species in mixed fisheries. Blue ling is susceptible to sequential depletion of spawning aggregations and therefore closed areas to protect spawning aggregations should be maintained and expanded where appropriate.

6.4.4 Management

In 2009, the quota to Norway in the EC zone is 150 tonnes of blue ling.

6.4.5 Data availability

6.4.5.1 Landings and discards

Landings data are demonstrated in Table 6.4.1.

6.4.5.2 Length compositions

No length data are available.

6.4.5.3 Age compositions

No age data are available.

6.4.5.4 Weight-at-age

No weight-at-age data are available.

6.4.5.5 Maturity and natural mortality

No data were available.

6.4.5.6 Catch, effort and research vessel data

No data are available.

6.4.6 Data analyses

No data analyses were carried out.

6.4.7 Comments on assessment

Not applicable.

6.4.8 Management considerations

No new advice was required for this stock in 2009.

Table 6.4.0a Blue ling (*Molva dypterygia*). Working group estimates of landings (tonnes) in Subarea I.

Year	Iceland	Norway	Germany	Total
1988				
1989				
1990				
1991				
1992				
1993				
1994		3		**3**
1995		5		**5**
1996				**0**
1997		1		**1**
1998		1		**1**
1999				**0**
2000		1		**1**
2000		3		**3**
2001		1		**1**
2002		1		**1**
2003				**0**
2004		1		**1**
2005		1		**1**
2006				**0**
2007				**0**
2008*				**0**

***Preliminary.**

Table 6.4.0b Blue ling (*Molva dypterygia*). Working group estimates of landings (tonnes) in Divisions IIa and b.

Year	Faroes	France	Germany	Greenland	Norway	E & W	Scotland	Sweden	Russia	Total
1988	77	37	5		3416	2				**3537**
1989	126	42	5		1883	2				**2058**
1990	228	48	4		1128	4				**1412**
1991	47	23	1		1408					**1479**
1992	28	19		3	987	2				**1039**
1993		12	2	3	1003					**1020**
1994		9	2		399	9				**419**
1995	0	12	2	2	342	1				**359**
1996	0	8	1		254	2	2			**267**
1997	0	10	1		280					**291**
1998	0	3			272		3			**278**
1999	0	1	1		287		2			**291**
2000		2	4		240	1	2			**249**
2001	8	7			190	1	2			**208**
2002	1	1			129	1	17			**149**
2003	30				115		1	1		**147**
2004	28	1			144				1	**174**
2005	47	3			144	1			2	**197**
2006	49	4			149					**202**
2007	102	3			154		3			**262**
2008*	102	9			208		10			**329**

***Preliminary.**

Table 6.4.0c Blue ling (*Molva dypterygia*). Working group estimates of landings (tonnes) in Subarea III.

Year	Denmark	Norway	Sweden	Total
1988	10	11	1	**22**
1989	7	15	1	**23**
1990	8	12	1	**21**
1991	9	9	3	**21**
1992	29	8	1	**38**
1993	16	6	1	**23**
1994	14	4		**18**
1995	16	4		**20**
1996	9	3		**12**
1997	14	5	2	**21**
1998	4	2		**6**
1999	5	1		**6**
2000	13	1		**14**
2001	20	4		**24**
2002	8	1		**9**
2003	18	1		**19**
2004	18	1		**19**
2005	48	1		**49**
2006	42			**42**
2007				**0**
2008*		2		**2**

Table 6.4.0d Blue ling (*Molva dypterygia*). Working group estimates of landings (tonnes) in Division Iva.

Year	Denmark	Faroes	France (IV)	Germany	Norway	E & W	Scotland	Ireland	Total
1988	1	13	223	6	116	2	2		**363**
1989	1		244	4	196	12			**457**
1990			321	8	162	4			**495**
1991	1	31	369	7	178	2	32		**620**
1992	1		236	9	263	8	36		**553**
1993	2	101	76	2	186	1	44		**412**
1994			144	3	241	14	19		**421**
1995		2	73		201	8	193		**477**
1996		0	52	4	67	4	52		**179**
1997		0	36		61	0	172		**269**
1998		1	31		55	2	191		**280**
1999	2		21		94	25	120	2	**264**
2000	2		15	1	53	10	46	2	**129**
2001	7		9		75	7	145	9	**252**
2002	6		11		58	4	292	5	**376**
2003	8		8		49	2	25		**92**
2004	7		17		45		14		**83**
2005	6		7		51		2		**66**
2006	6		6		82				**94**
2007	5		2		55				**62**
2008*	2		9		63				**74**

Table 6.4.0e Blue ling (*Molva dypterygia*). Working group estimates of landings (tonnes) in Subarea XII.

Year	Faroes	France	Germany	Spain	E & W	Scotland	Norway	Iceland	Poland	Lithuania	Russia	Total
1988		263										**263**
1989		70										**70**
1990		5										**5**
1991		1147										**1147**
1992		971										**971**
1993	654	2591	90									**3335**
1994	382	345	25									**752**
1995	514	47			12							**573**
1996	445	60		264		19						**788**
1997	1	1		411	4							**417**
1998	36	26		375	1							**438**
1999	156	17		943	8	43		186				**1353**
2000	89	23		406	18	23	21	14				**594**
2001	6	26		415	32	91	103	2				**675**
2002	19			1234	8		9					**1270**
2003		7		971		2	40		12	37		**1069**
2004		27		610							7	**644**
2005		10		636						8		**654**
2006		61									4	**65**
2007	1											**1**
2008*												**0**

Table 6.4.0f Blue ling. Total landings by Subarea/Division (landings from Areas VIII, IX and X given in previous reports are now considered to represent *Molva macropthalma*).

Year	I	II	III	IV	XII	Total
1988		3537	22	363	263	4185
1989		2058	23	459	70	2610
1990		1412	21	501	5	1939
1991		1479	21	627	1147	3274
1992		1039	38	554	971	2602
1993		1020	23	415	3335	4793
1994	3	419	18	424	752	1616
1995	5	359	20	483	573	1440
1996	0	267	12	190	788	1257
1997	1	291	21	270	417	1000
1998	1	278	6	286	438	1009
1999	0	291	6	265	1353	1915
2000	1	249	14	130	594	988
2001	3	208	24	252	675	1162
2002	1	149	9	377	1270	1806
2003	1	147	19	101	1069	1337
2004	0	174	19	83	644	920
2005	1	171	49	70	0	291
2006	0	202	42	94	65	403
2007	0	263	0	62	1	326
2008*	0	329	2	74	0	405

***Preliminary.**

7 Tusk (Brosme brosme)

7.1 Stock description and management units

In 2007, WGDEEP examined the available evidence of stock discrimination in this species. Based on the genetic investigation, the group suggests the following stock units:

- Tusk in Va and XIV
- Tusk on the Mid Atlantic Ridge
- Tusk on Rockall (VIb)
- Tusk in I,II

all other areas (IVa,Vb, VIa, VII,…) be assessed as one combined stock, until further evidence of multiple stocks become available in these areas purposes.

Catches data for tusk in 2006 and 2007 aggregated at the level of statistical rectangle were provided to the Working Group by France, Ireland, the UK (England and Wales and Scotland) and Iceland. These are shown in Figures 7.1.1 and 7.1.2.

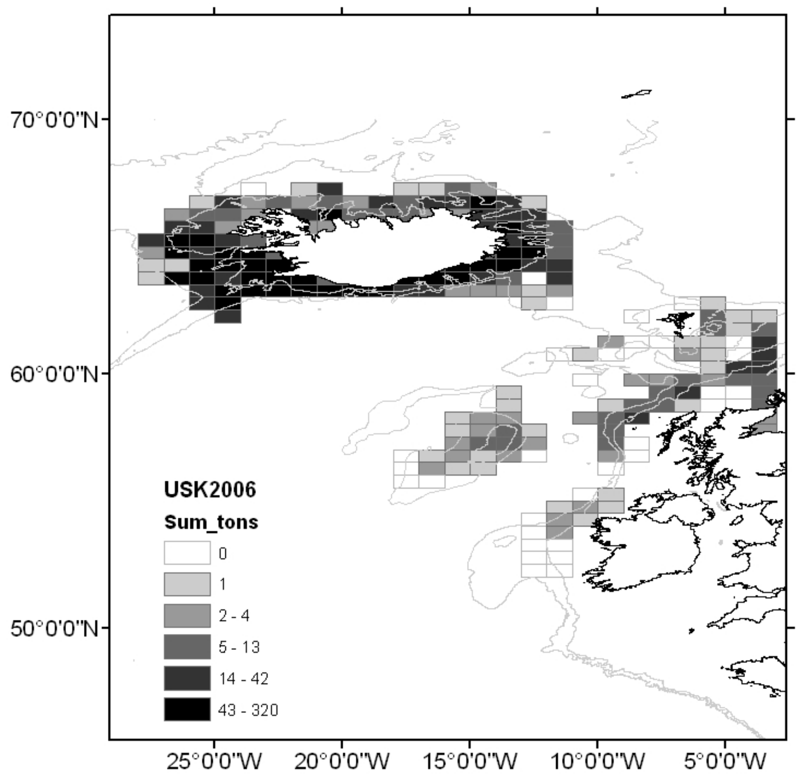


Figure 7.1.1. Catches of tusk by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2006.

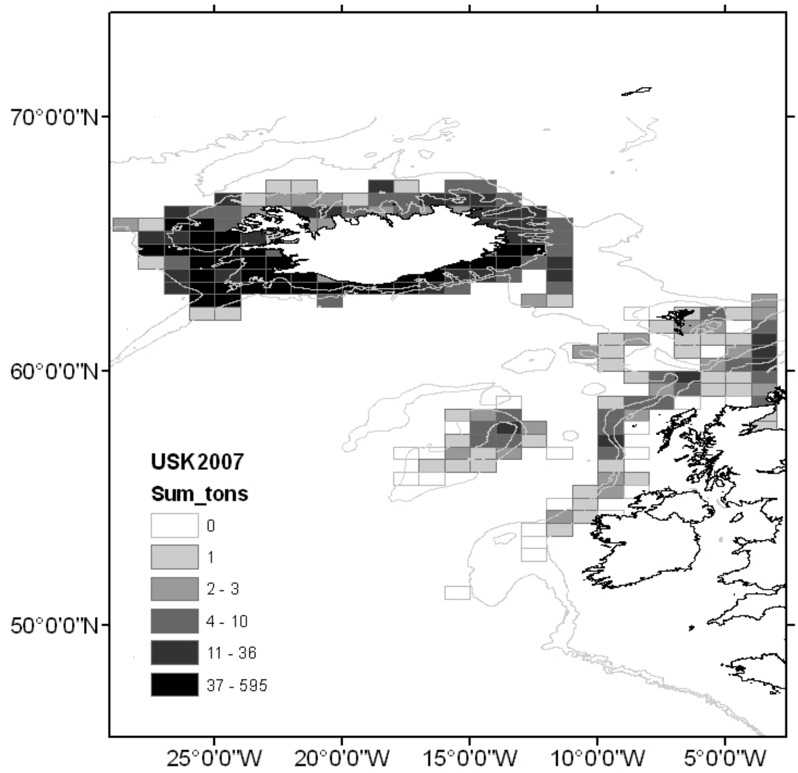


Figure 7.1.2. Catches of tusk by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

7.2 Tusk (*Brosme Brosme*) in Division Va and Subarea XIV

7.2.1 The fishery

Tusk in Va is primarily a bycatch in the longline fishery, conducted in order of importance by Icelandic, Faroese and Norwegian boats. The Icelandic longline fleet mainly targets cod, haddock and other demersal species. In some years there are direct fishery for tusk along the south and southwest coast of Iceland. In recent years, over 550–590 Icelandic vessels have been reporting catches of tusk, from less than 0.1 t to over 330 t per year. Most of the landings from Va (over 95%) come from longliners, but only partly from aimed fisheries. 50% of the Icelandic ling catches in 2007 were taken within the depth range of 100–300 m, with 80% of the catches taken at depth less than 400 m.

The fishing grounds in 1996, 2000, 2006, and 2007 as recorded in logbooks, are shown in Figure 7.2.1a and for 2008 in Figure 7.2.1b. In recent years, Icelandic vessels have, on average caught 75% of the tusk The Faroese (catch 960 t in 2008) and Norwegian fisheries (280 t in 2008) are from longline fisheries primarily targeting ling.

7.2.1.1 Landings trends

In late 1980s directed effort towards tusk started and the landings increased to 8700 and 8000 tonnes in 1991 and 1992, respectively. Since then, the landings varied between 4500 and 7300 tones, highest in 1999 and lowest in 2001. Total landings in 2008 were about 8200 tonnes. The total landings between 2001 and 2005 were rather stable at around 5000 tonnes, as a consequence of TAC restrictions and closure of juvenile areas. Landings by country in Va are given in Table 7.2.1a and in XIV in Table 7.2.1b.

7.2.1.2 ICES advice

The latest advice from ICES ACOM in May 200b states: *Surveys indicate that the overall biomass is increasing but consists mostly of small individuals. ICES reiterates the earlier advice to constrain catches to 5000 t (average 2001–2004) to allow the juveniles to recruit to the adult stock. ICES also recommends collecting information that can be used to evaluate a long term sustainable level of exploitation.*

7.2.1.3 Management

The Icelandic Ministry of Fisheries is responsible for management of the Icelandic fisheries and implementation of the legislation. The Ministry issues regulations for commercial fishing for each fishing year (1 September–31 August), including an allocation of the TAC for each of the stocks subject to such limitations. For tusk, the national TAC for the quota year 1 September 2008–31 August 2009 was set to 5500 tonnes. In addition vessels from EU, Norway and Faroe Island have rights to catch deep-sea species in Icelandic waters, but the amount of tusk is decided in bilateral agreements. The average catch of vessels from EU, Norway and Faroe Island has been around 1500 tonnes since 2000

In addition to above mentioned management measures there are areas that are closed for fishing where juvenile tusk has been observed in recent years along the south and southeast coast of Iceland. In addition, if length measurements taken by observers demonstrate that the number of tusk smaller than 55 cm in catches exceeds 25% of the tusk catch, and if tusk is more than 30% of the catches in given set, then an immediate closure of that area will take place for 2 weeks.

7.2.2 Data available

7.2.2.1 Landings and discards

Landings by EU and Icelandic vessels are given by the Icelandic Directorate of Fisheries. Catches are only landed in authorized ports where all catches are weighed and recorded. Landings of Norwegian and Faroese vessels are given by the Icelandic Coast Guard. Discard is banned in the Icelandic demersal fishery and there is no information available on possible discard of tusk.

7.2.2.2 Length compositions

Length distribution of tusk in the commercial landings of the Icelandic fleet in Va from 1996–2008 are shown in Figure 7.2.3. Detailed overview of sampling from commercial catches and surveys was given in the 2007 WGDEEP report. The sampling intensity in 2008 was similar as in recent years.

7.2.2.3 Age compositions

No new data available. Otoliths have been collected randomly from the catch since 1980s, but no age readings have been done since 1998. Age readings from 1980s and 1990s demonstrate that tusk is slow growing fish that can reach more than 20 years of age.

7.2.2.4 Weight-at-age

No data available.

7.2.2.5 Maturity and natural mortality

No new data available. Earlier observations indicates that tusk becomes mature-at-age of about 8–10 years or at around the length of 56 cm (Figure 7.2.4). The mean length-at-maturity is close to the mean length of tusk in the commercial catches (Figure 7.2.3). This means that a large proportion of the tusk is caught as immature.

No estimates of natural mortality are available for tusk in Va and XIV.

7.2.2.6 Catch, effort and research vessel data

Icelandic survey data

The Icelandic spring Groundfish survey (see Pálsson *et al.*, 1989) which has been conducted annually in March since 1985, gives trends on fishable biomass of many exploited stocks on Icelandic fishing grounds. Total of more than 550 stations are taken annually in the survey at depths down to 500 meters, including the most important distribution area of the tusk fisheries (Figure 7.2.7). Figure 7.2.5 shows both recruitment index and the trend in the fishable biomass (> 40 cm) of tusk. Survey length distributions are shown on Figures 7.2.6.

The indices of total biomass and of fishable biomass (40 cm and bigger) of tusk increased gradually from 2001, when it was below 50% of the 1985 value, to 2007 but decreased slightly in 2008 (Figure 7.2.5 a, b). In 2007, the biomass indices were around 85% of the mean in 1985–1989. The recruitment index (tusk less than 40 cm) was in 2008 was at its second highest value, 2007 being the highest observed value in the time-series (Figure 7.2.5d).

Survey indices from the Icelandic autumn survey are also shown in Figure 7.2.5. The autumn survey has been conducted since 1996 aiming at both continental shelf and deep-sea species such as redfish and Greenland halibut, covering depths down to

1200 m with 381 stations. The results of the shorter autumn survey demonstrate similar trends as the spring survey (Figure 7.2.5). Although the recruitment index (< 40 cm fish) is much lower in autumn than in the spring survey, the relative trends are the same. The difference in the absolute term is most likely as a consequence of lower catchability (because of gear differences) of smaller tusk in the fall survey.

The geographical distribution of tusk in the spring and autumn surveys (Figures 7.2.7 and 7.2.8) has not changed markedly over the period.

Catch per unit of effort and effort data from the commercial fleets

Figure 7.2.9 shows cpue of tusk in the Icelandic longline fishery (lcpue). The lcpue is calculated using all longline data where catches of the species was registered, but also for sets where tusk constituted to more than 10% and 30% of the catch, respectively. The trends, based on these different criteria are slightly conflicting and the cause of the difference has not been explored.

There is an increase in the exploitation ration in recent years (Catch/Survey biomass) (Figure 7.2.10).

7.2.3 Data analyses

No age-based assessments were possible as a consequence of lack of age-structured data however a Gadget model of tusk in Va was presented at the meeting.

Exploratory stock assessment on Tusk in Va using Gadget

An exploratory stock assessment of tusk in Va using the Gadget model was presented at the meeting. Gadget (**G**lobally applicable **A**rea **D**isaggregated **G**eneral **E**cosystem **T**oolbox, see www.hafro.is/gadget) is an age- and length based cohort model, where all the selection curves depend on the length of the fish and information on age is not a prerequisite but can be utilized if available. The commercial catch is modelled as one fleet with a fixed selection pattern described by a logistic function and total catch in tonnes specified for each time period.

Data used and model settings

Data used for tuning are:

- Length disaggregated survey indices (10 cm increments) from the Icelandic groundfish survey in March 1985–2008.
- Length distribution from the Icelandic commercial catch since 1979. The sampling effort was though relatively limited until the 1990s.
- Landings data divided into 4 month periods per year (quarters).
- Age-length keys and mean length-at-age from the Icelandic commercial fishery.

Model parameters were estimated using data from 1979 to 2008 and forecast carried out to 2016. Four time-steps are used each year. Natural mortality is set to 0.1 for all age groups. The ages used were 1 to 20 years, where the oldest age is treated as a plus group (fish 20 years and older). Recruitment was set at age 1.

Estimated parameters are:

- Number of fish when the simulation starts (8 age groups).
- Recruitment each year (30 year classes).
- Length-at-recruitment (mean length and SD).

- Parameters in the growth equation; (2 parameters of the growth function used in the model).
- Parameter β that models the transition from one length class to the next.
- Selection pattern of the commercial fleet (L50 and slope).

Model settings used in the Gadget model for tusk in Va are described in more detail in working document 16 (WGDEEP2009, WD16).

Results

The results are presented in Figure 7.2.11. Given the available data, the growth curve predicted by Gadget seems reasonable. Recruitment of the 1998, 1999 and 2001 to 2004 cohorts was high but the 2000 and 2005 cohorts are estimated as fairly small. Total biomass has been increasing since 2000 as a consequence of the good recruitment from 1998 whereas harvestable biomass (biomass available to the fishery according to the estimated selection curve) demonstrates only a slight increase and SSB demonstrates little change. The reason for this is the slow growth of tusk, i.e. it is not available to the fishery until it reaches approximately 10 years of age. Fishing mortality has increased in recent years.

Five different catch options were evaluated in the forecast for 2009 to 2016, 4 kt, 6 kt, 8 kt, 10 kt and 12 kt (Figure 7.2.12). In the forecasts recruitment is assumed to be half of the 2005 cohort (3.5 million) which is a very pessimistic outlook. On the other hand as the species is slow growing the assumptions on recruitment do not greatly affect the forecasts over the period studied. At least not for SSB, harvestable biomass and fishing mortality.

It is predicted that SSB will increase for catch levels of 8 kt and less, harvestable biomass will increase for catches of 6 kt and less. On the other hand total-stock biomass will decrease as it is most influenced by assumption of low recruitment. Fishing mortality will decrease for all catch options of 8 kt and less (Figure 7.2.12).

7.2.4 Comments on the assessment

The residuals from the Gadget model are shown in Figure 7.2.13. There is a block of positive residuals at the beginning of the period then a fairly large block of negative residuals for intermediate length groups. The reason for this may be that the model is constrained by the initial values and a way to fix this is to extend the simulation further back in time. It is interesting that Gadget does not follow the increase in the smaller length groups seen in the survey. That means that the estimated recruitment in the model is lower than would be expected from the survey. In Figure 7.2.14 the survey indices are plotted against the estimated number in stock by length groups. The fit is reasonable for length groups below 50 cm but in length groups 50–59 and 60–69 there is a split in the relationship where survey data points from the start of the time-series are above model values and the end of the series is below. This is simply the same phenomena as is seen in Figure 7.2.13.

It is not possible to apply an age-based assessment method on tusk in Va due to lack of time-series of age-structured data. The group considered the Gadget approach promising and encouraged further exploration of model settings and testing of various plausible scenarios such as different natural mortality regimes. Obvious venue for such an exercise would be at a benchmark workshop.

Previously the group has pointed out that material to run age based assessment has been collected in Va, but otoliths have not been age read yet. Age determination of tusk is problematic and consideration must be given to whether age structured models are appropriate to this species. If so, steps will have to be taken to work up historical otolith samples and validate age estimation methods.

7.2.5 Management considerations

No advice was required for this stock in 2009.

Table 7.2.1a. Tusk. Catches in Va since 1973. Source: STATLANT database.

YEAR	FAROE	GERMANY	ICELAND	NORWAY	UK	TOTAL
1973	3363	576	2366	911	391	7607
1974	3172	375	1857	893	230	6527
1975	2445	384	1673	975	254	5731
1976	2397	334	2935	1352	94	7112
1977	2818	212	3122	1796	0	7948
1978	2168	0	3352	812	0	6332
1979	2050	0	3558	845	0	6453
1980	2873	0	3089	928	0	6890
1981	2624	0	2827	1025	0	6476
1982	2410	0	2804	666	0	5880
1983	4046	0	3469	772	0	8287
1984	2008	0	3430	254	0	5692
1985	1885	0	3068	111	0	5064
1986	2811	0	2549	21	0	5381
1987	2638	0	2984	19	0	5641
1988	3757	0	3078	20	0	6855
1989	3908	0	3131	10	0	7049
1990	2475	0	4813	0	0	7288
1991	2286	0	6439	0	0	8725
1992	1567	0	6437	0	0	8004
1993	1329	0	4746	0	0	6075
1994	1212	0	4612	0	0	5824
1995	979	1	5245	0	0	6225
1996	872	1	5226	3	0	6102
1997	575	0	4819	0	0	5394
1998	1052	1	4118	0	0	5171
1999	1035	2	5794	391	2	7224
2000	0	0	4714	374	2	5090
2001	1125	1	3392	285	5	4808
2002	1269	0	3840	372	2	5483
2003	1163	1	4028	373	2	5567
2004	1478	1	3126	214	2	4821
2005	1157	3	3539	303	41	5043
2006	1239	2	5054	299	2	6596
2007	1250	0	5984	300	1	7535
2008 [1)]	959		6932	284		8175

[1)] Provisional figures.

Table 7.2.1b. Tusk. Catches in XIV since 1973. Source: STATLANT database.

Year	Faroe	Germany	Iceland	Norway	Russia	Spain	UK	Total
1973	16	9	0	0	0	0	2	27
1974	259	2	15	0	0	0	1	277
1975	29	17	13	138	0	0	0	197
1976	0	5	89	47	0	0	1	142
1977	167	16	0	40	0	0	1	224
1978	0	47	0	38	0	0	0	85
1979	0	27	0	0	0	0	0	27
1980	0	13	0	0	0	0	0	13
1981	110	10	0	0	0	0	0	120
1982	0	10	0	0	0	0	0	10
1983	74	11	0	0	0	0	0	85
1984	0	5	0	58	0	0	0	63
1985	0	4	0	0	0	0	0	4
1986	33	2	0	0	0	0	0	35
1987	13	2	0	0	0	0	0	15
1988	19	2	0	0	0	0	0	21
1989	13	1	0	0	0	0	0	14
1990	0	2	0	7	0	0	0	9
1991	0	2	0	68	0	0	1	71
1992	0	0	3	120	0	0	0	123
1993	0	0	1	39	0	0	0	40
1994	0	0	0	16	0	0	0	16
1995	0	0	0	30	0	0	0	30
1996	0	0	0	157	0	0	0	157
1997	0	0	10	9	0	0	0	19
1998	0	0	0	12	0	0	0	12
1999	0	0	0	8	0	0	0	8
2000	0	0	11	11	0	3	0	25
2001	3	0	20	69	0	0	0	92
2002	4	0	86	30	0	0	0	120
2003	0	0	2	88	0	0	0	90
2004	0	0	0	40	0	0	0	40
2005	7	0	0	41	8	0	0	56
2006	3	0	0	19	51	0	0	73
2007	0	0	0	40	6	0	0	46
2008 1)	0.2	0	0	7	0	0	0	7.2

1) Provisional figures.

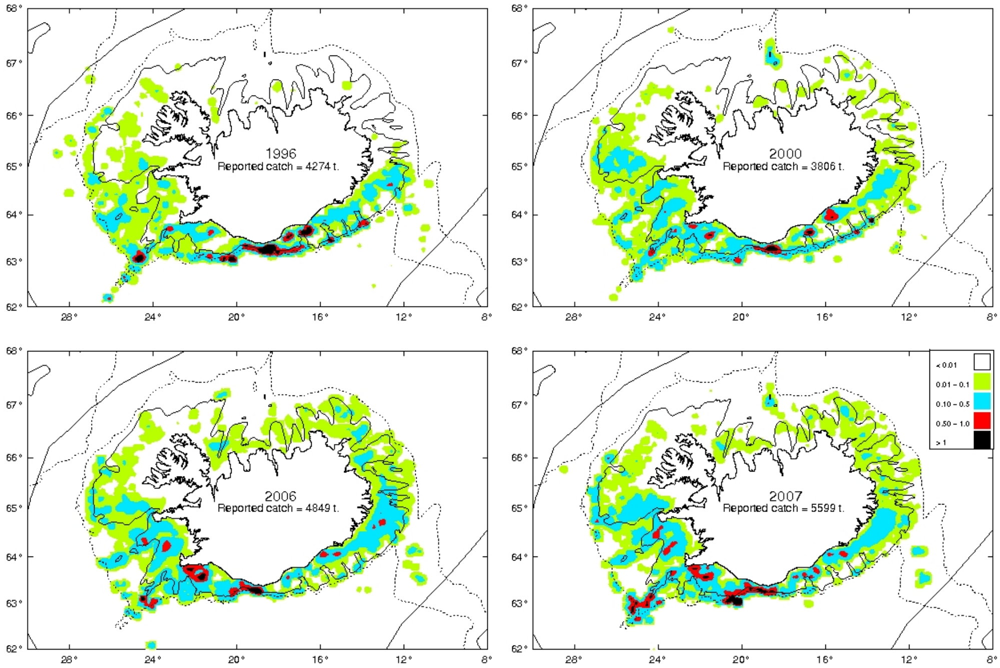


Figure 7.2.1a. Geographical distribution (tones/square mile) of the Icelandic tusk fishery in 1996, 2000, 2006 and 2007 as reported in the logbooks. All gear types combined.

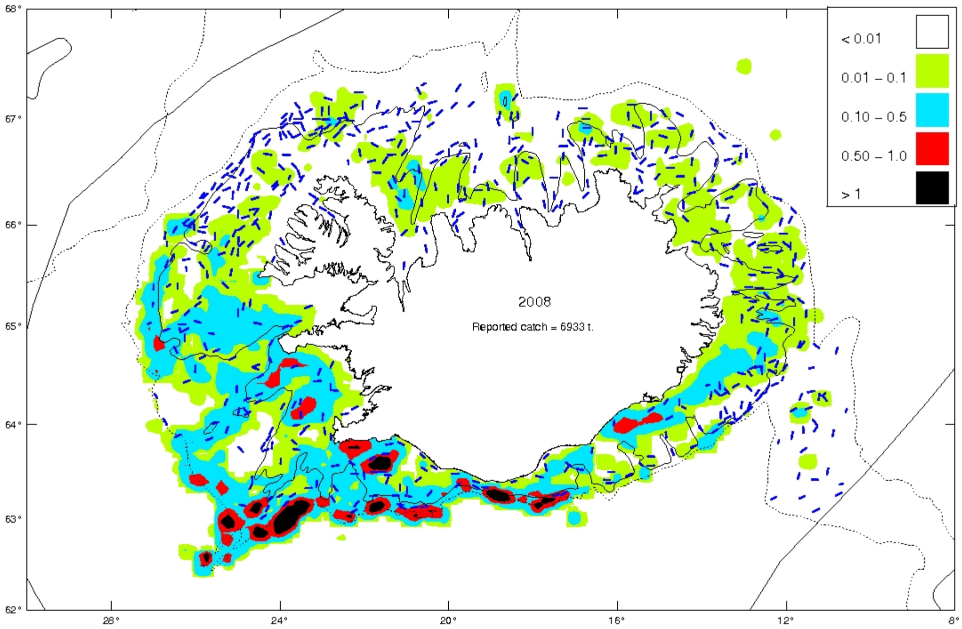


Figure 7.2.1b. Location of the spring groundfish survey stations (blue lines) and geographical distribution (tones/square mile) of the Icelandic tusk fishery in 2008 as reported in the logbooks. All gear types combined.

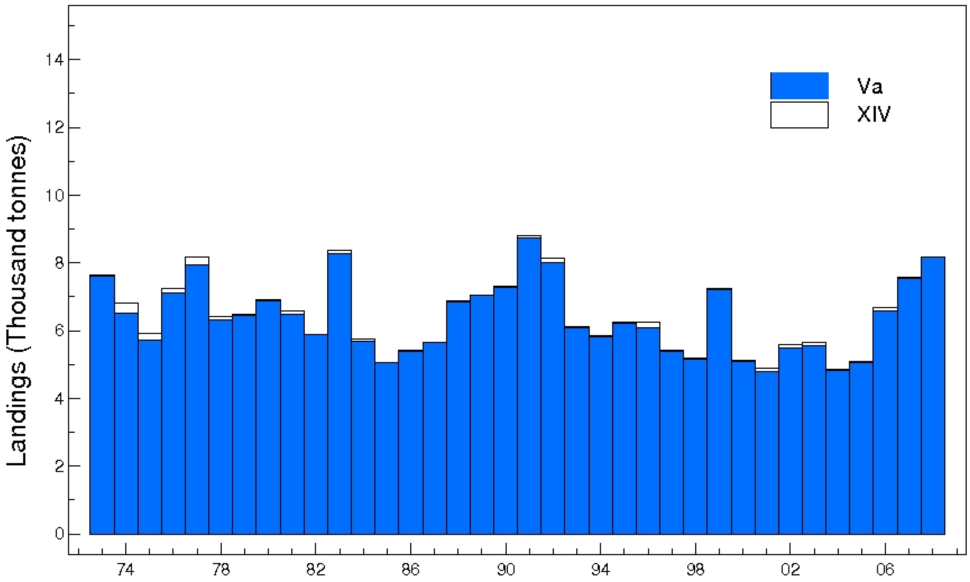


Figure 7.2.2. Estimated total landings of tusk in Va and XIV from 1973–2008.

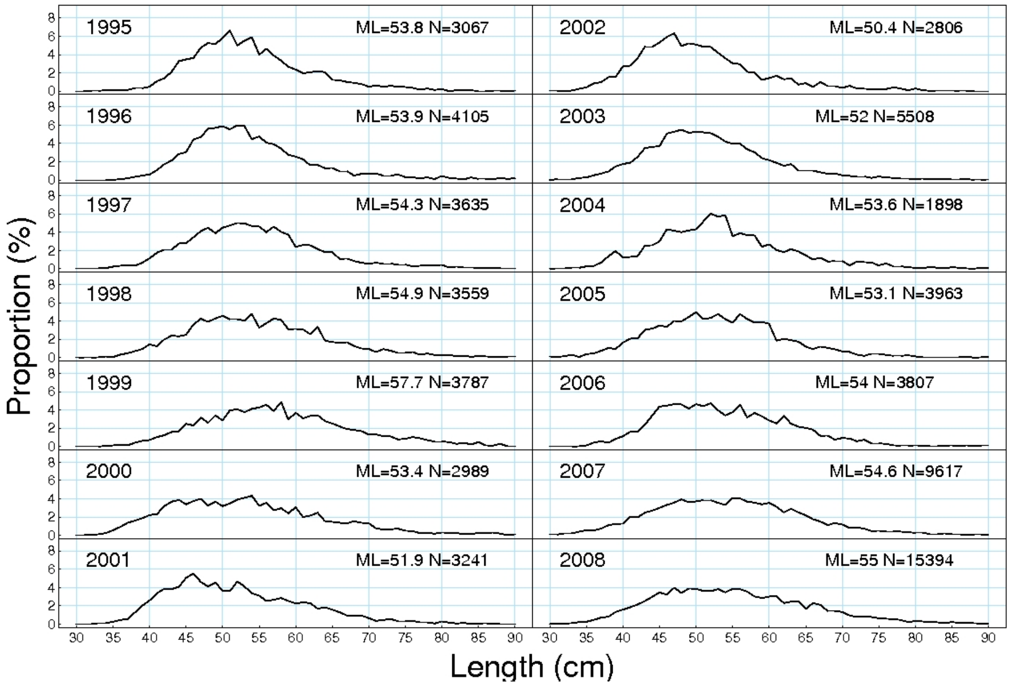


Figure 7.2.3. Length distribution of tusk in the commercial landings of the Icelandic fleet in Va 1996–2008. The number of measured fish (N) and mean length (ML) is also given.

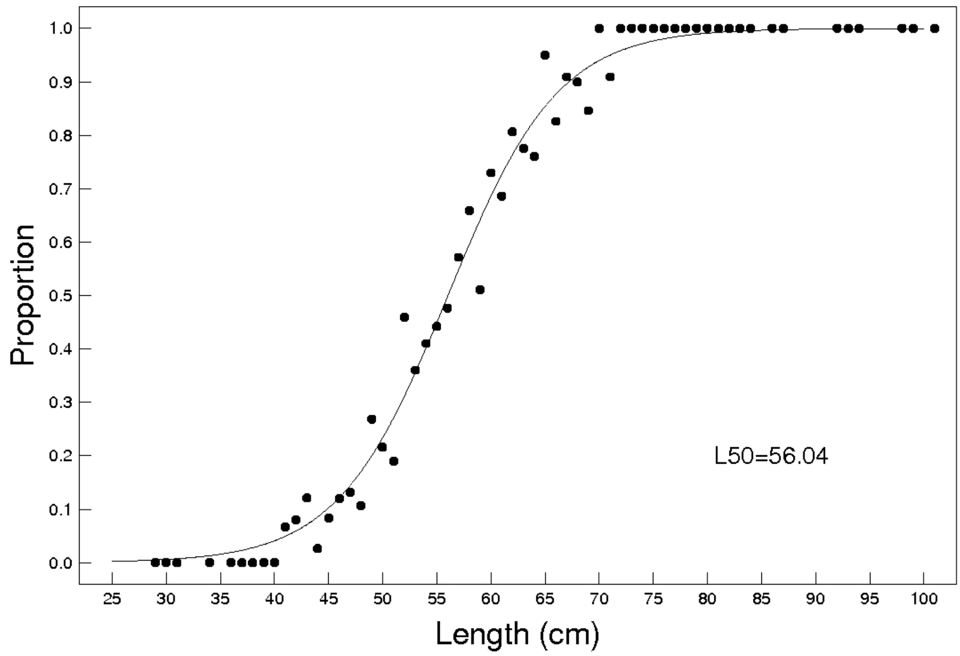


Figure 7.2.4. Tusk maturity. The figure shows average maturity at given length in the Icelandic catches. The fitted curve is also shown and the constants in the equation.

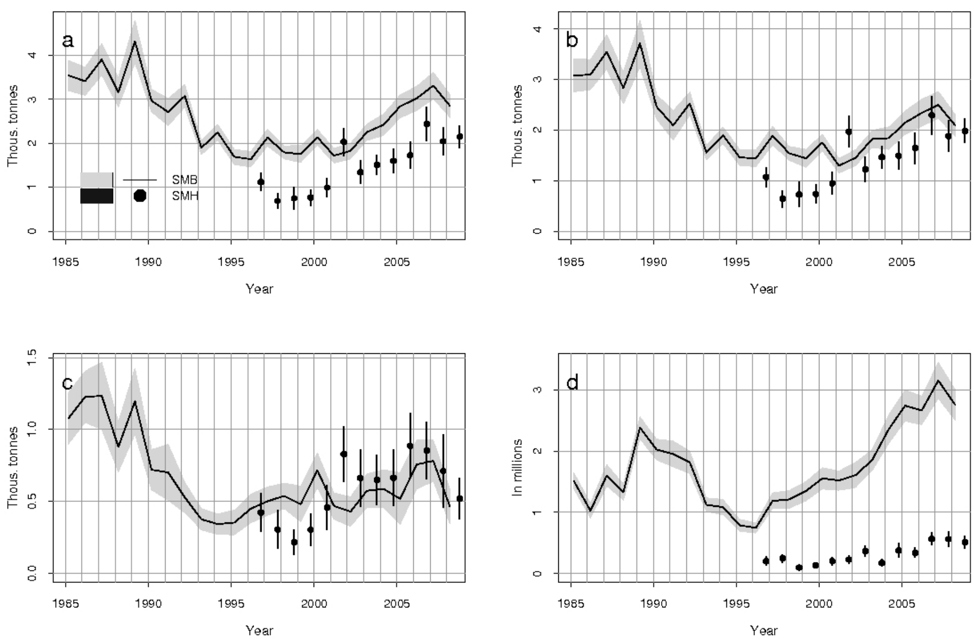


Figure 7.2.5. Abundance indices for tusk in the groundfish survey in March 1985–2008 (SMB, line, shaded area) and October 1996–2008 (SMH, points, vertical lines). a) Total biomass index, b) Biomass of 40 cm and larger, c) Biomass 55 cm and larger, d) Abundance of < 40 cm. The shaded area and the vertical bar show ±1 standard error of the estimate.

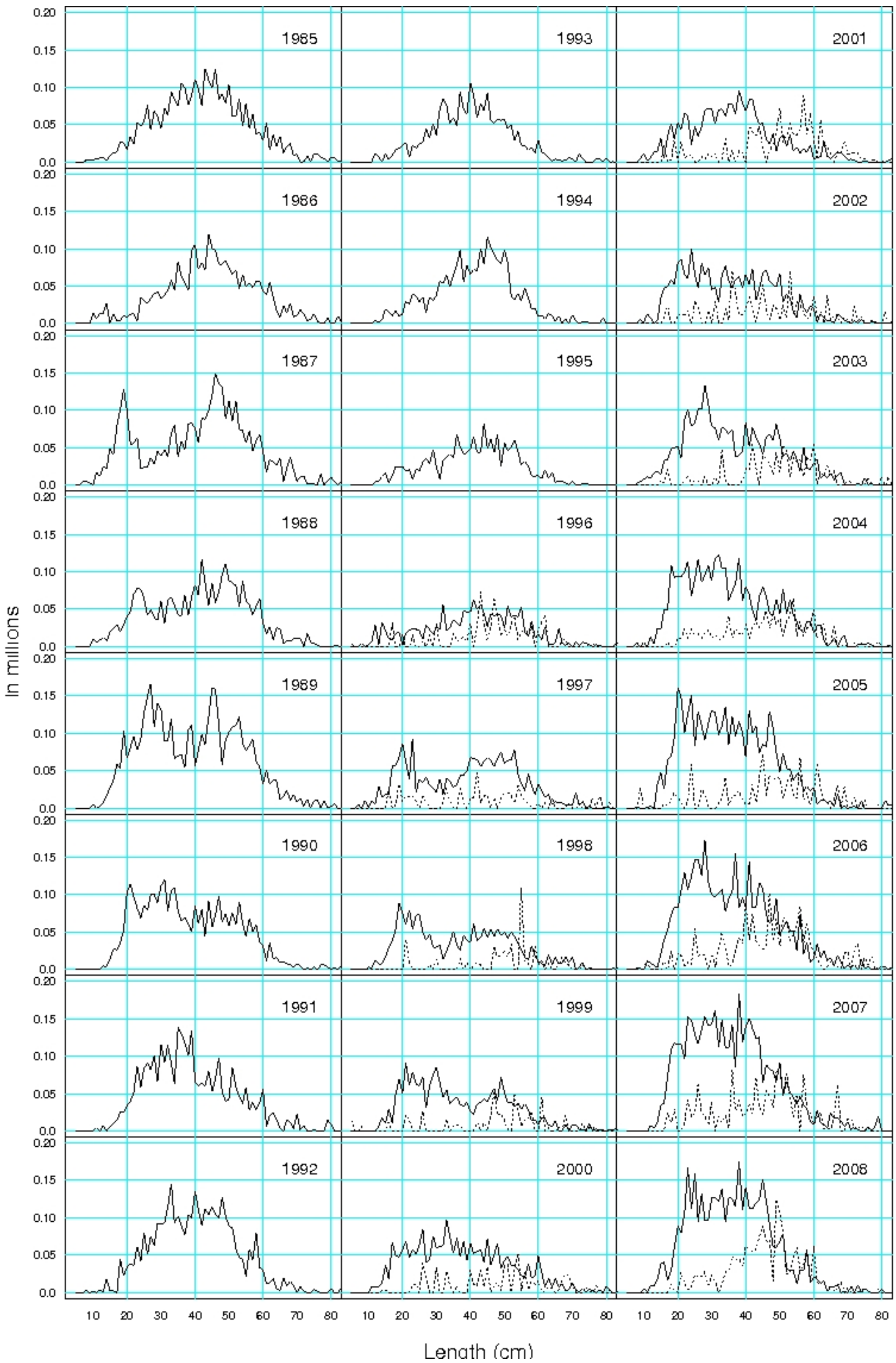


Figure 7.2.6. Length distributions of tusk in the Icelandic groundfish survey in March 1985–2007 (SMB, solid line) and in October 1996–2008 (SMH, dotted line).

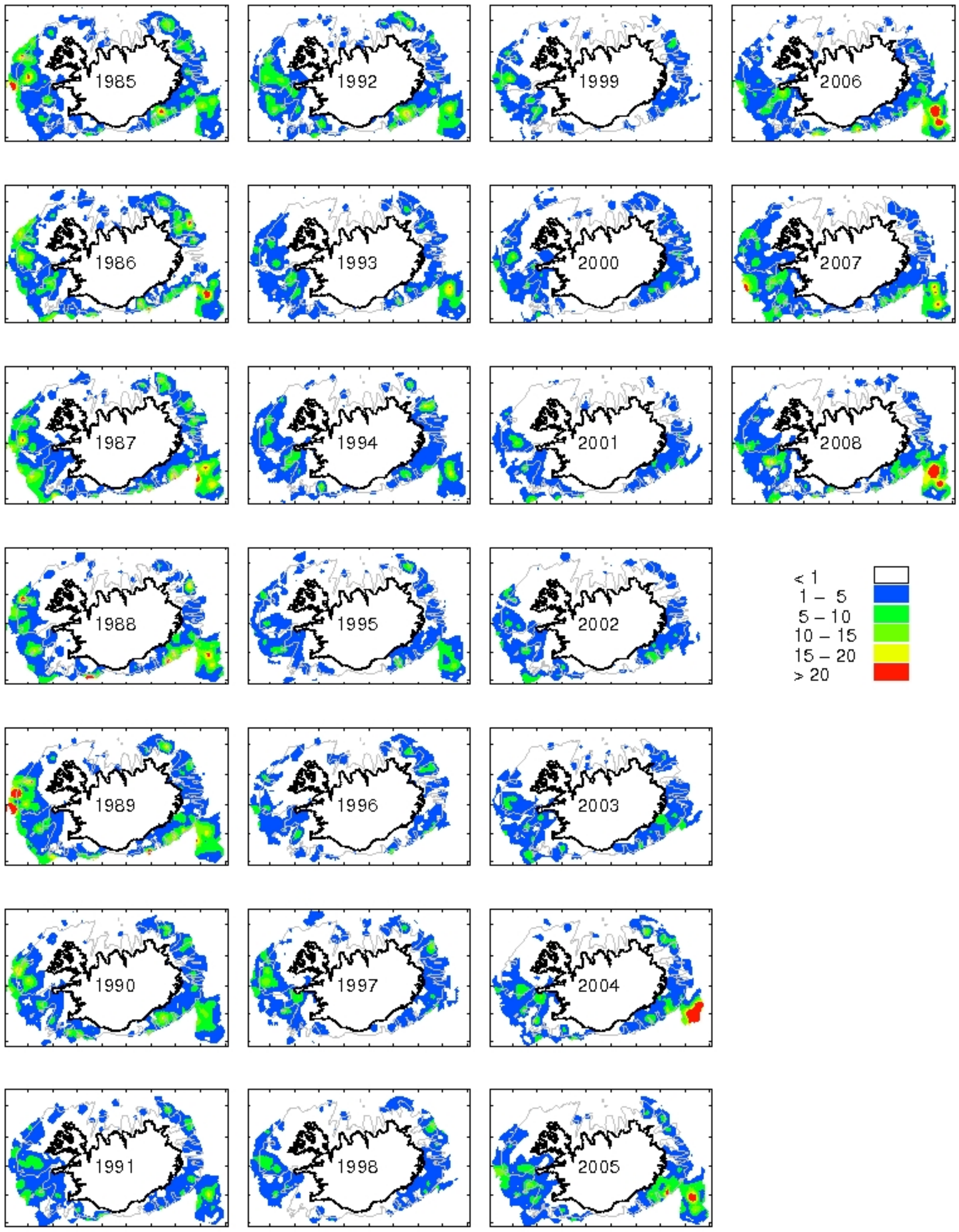


Figure 7.2.7. Distribution of tusk (kg per standardized tow) in the groundfish survey in March 1985–2008.

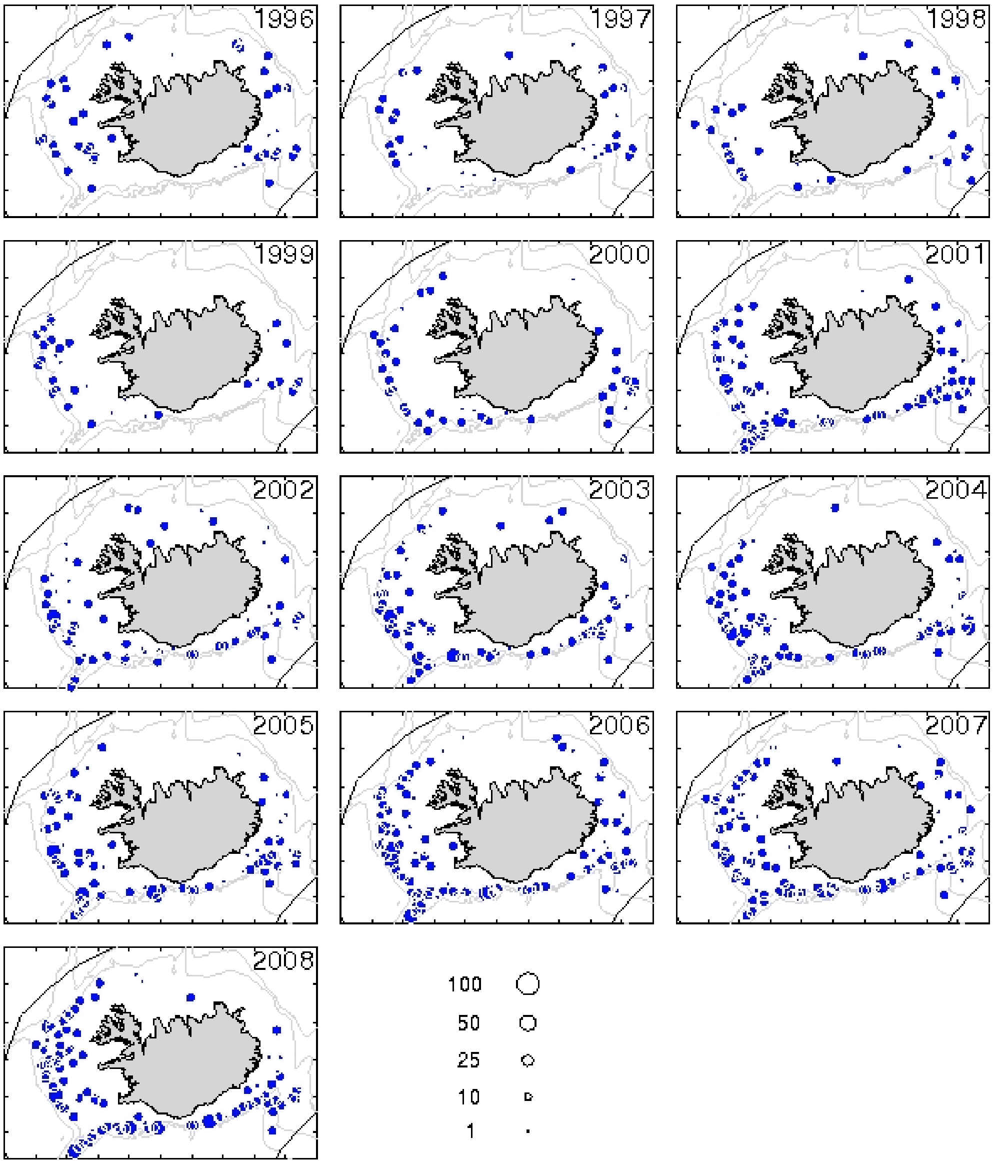


Figure 7.2.8. Distribution of tusk in the groundfish survey in October 1996–2008. The sizes of the circles indicate kg/station.

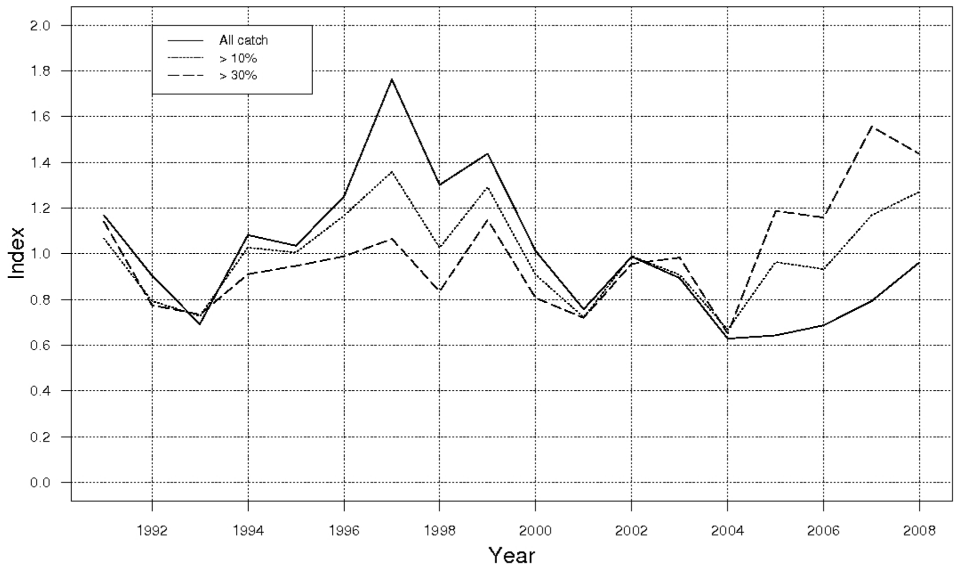


Figure 7.2.9. Index of raw cpue (sum(yield)/sum(effort)) of tusk from the Icelandic longline fishery based on logbooks 1991–2007. The criteria for the calculations were all sets where tusk was reported in the logbooks and where tusk composed at least 10% and 30% of the total catch in each set.

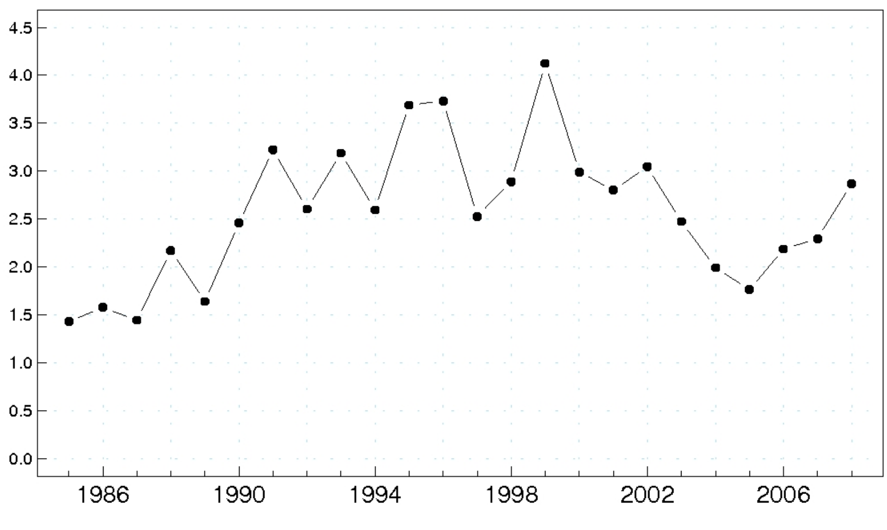


Figure 7.2.10. Tusk in Va. Estimates of trends in relative fishing mortality (Yield/Survey biomass).

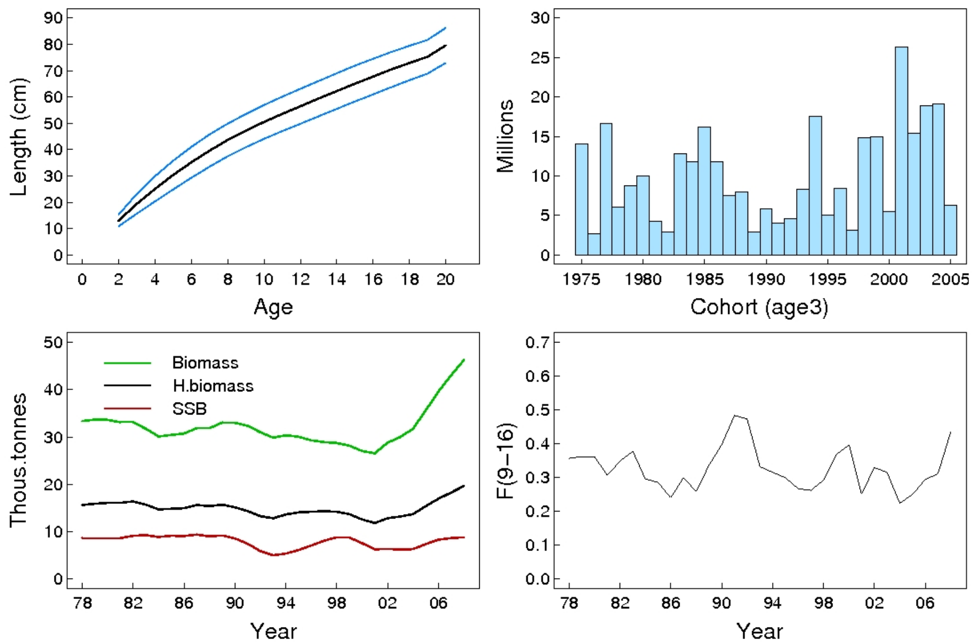


Figure 7.2.11. Results from the Gadget model for tusk using data from Va. From left to right, top to bottom: Estimated mean growth (±1 Std) predicted by the model. Recruitment of the 1975–2005 cohorts at age 3. Changes in total biomass, harvestable biomass (available biomass to the fishery) and spawning-stock biomass from 1978 to 2008. Trends in fishing mortality ($F_{9\text{-}16}$) from 1978 to 2008.

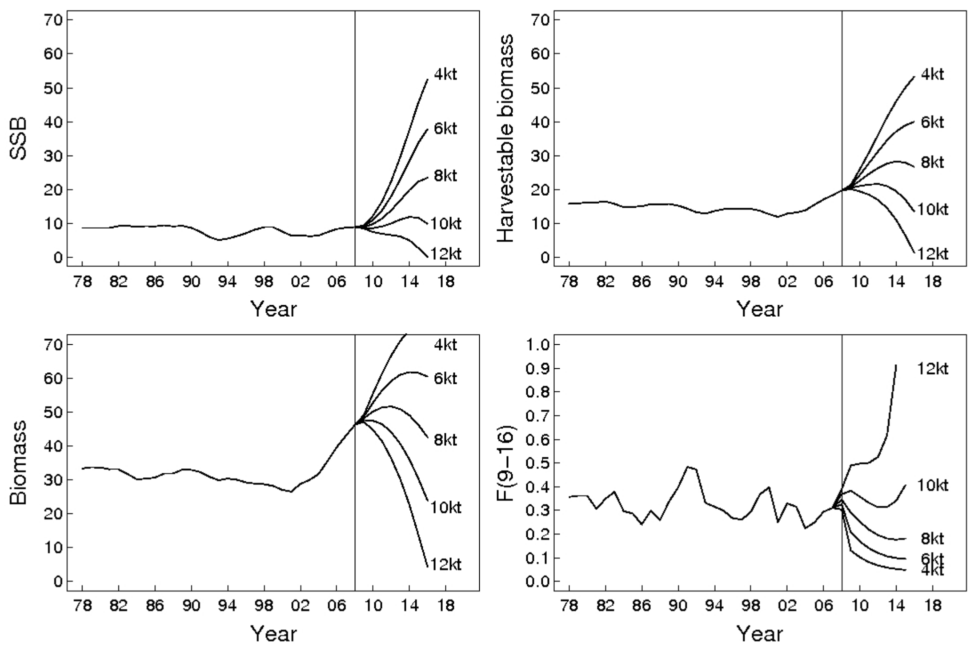


Figure 7.2.12. Prognosis from the Gadget model for tusk using data Va assuming future recruitment to be half of the 2005 cohort. From left to right, top to bottom: Changes in total biomass, harvestable biomass (available biomass to the fishery) and spawning-stock biomass from 1978 to 2016. Trends in fishing mortality ($F_{9\text{-}16}$) from 1978 to 2015.

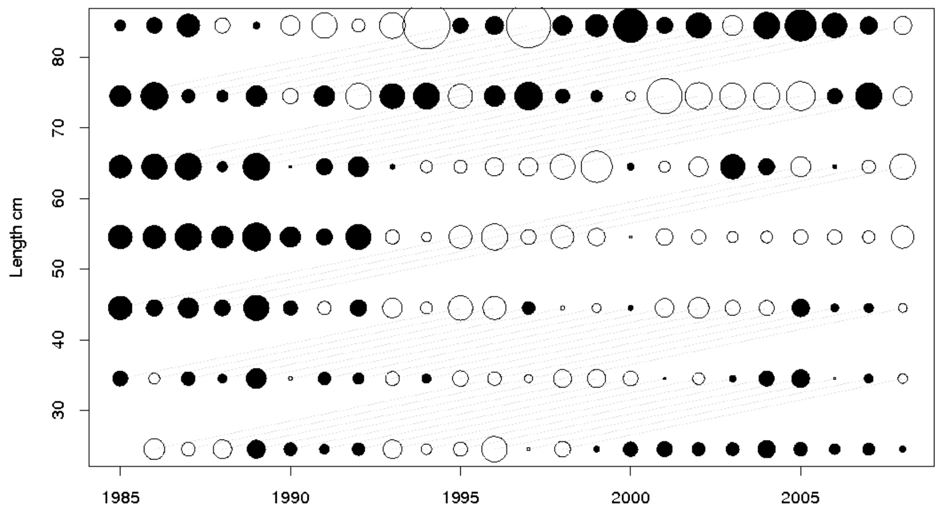


Figure 7.2.13. Residuals from the fit between model and survey indices. The shaded circles indicate positive trends (Model predictions below what the survey indicates). Largest residuals correspond to log(obs/mod)=1.

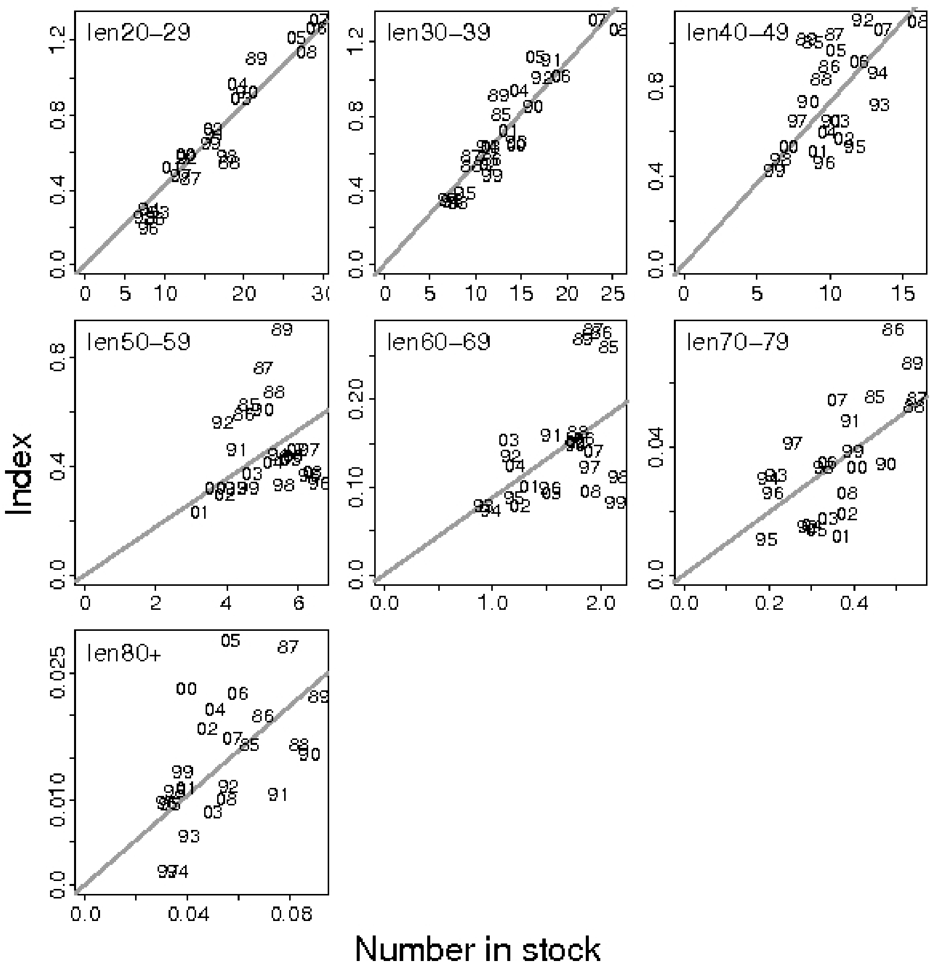


Figure 7.2.14.Survey indices for each length group plotted against the estimated number in the stock from the model. The line shown is fitted on original scale but the model is on log scale.

7.3 Tusk (*Brosme Brosme*) in Subareas I and II

7.3.1 The fishery

Tusk has been caught, primarily as a bycatch in the ling and cod fisheries, in these subareas for centuries, and the historical development is described by e.g. Bergstad and Hareide, 1996, including the post-World War II increase caused by a series of technical advances. Currently the major fisheries in Subareas I and II are the Norwegian longline and gillnet fisheries, but there are also bycatches by other gears, i.e. trawls and handlines. Of the Norwegian landings, usually around 85% is taken by longlines, 10% by gillnets and the remainder by a variety of other gears. Other nations catch ling as a bycatch in trawl and longline fisheries.

Russian landings (67 tonnes) from Sub-Divisions IIa and IIb in 2008 were mainly taken as bycatch in longline fisheries. In Subarea I, 7 t were caught (Vinnichenko and Mitina, WD9 2009).

7.3.1.1 Landings trends

Landing statistics by nation in the period 1988–2008 are given in Table 7.3.0a–d. Compared with the pre-2000 landings, recent landings were about halved. The preliminary landings for 2008 are 11 913 tonnes which is an increase compared with previous years.

7.3.1.2 ICES advice

The advice statement from 2008 was: Cpue in Areas I and II has been at a reduced level. ICES reiterates the advice to constrain catches to 5000 t and to collect information that can be used to evaluate a long-term sustainable level of exploitation.

7.3.1.3 Management

There is no species-specific management of the tusk fishery in Subareas I and II, but the exploitation is influenced by regulations aimed at other groundfish species, e.g. cod and haddock (see Section 4.2.1). There is no quota set for the Norwegian fishery. The quota for the EC in Areas I and II in the Norwegian zone for bycatch species such as ling and tusk is in 2009 set to 5000 tons. There is no minimum landing size in the Norwegian EEZ.

There is no species-specific management of the tusk fishery in Subareas I and II, but the exploitation is influenced by regulations aimed at other groundfish species, e.g. cod and haddock (see Section 4.2.1).

The EU TAC (for community vessels fishing in community waters and waters not under the sovereignty or jurisdiction of third countries in I, II and XIV): was set at 23 tonnes in 2008, increased to 24 tonnes in 2009.

7.3.2 Data available

7.3.2.1 Landings and discards

Landings were available for all relevant fleets. New discard data were not available, but within the Norwegian EEZ discarding is prohibited and assumed to be minor.

7.3.2.2 Length compositions

Length compositions/mean lengths from 1988 to present based on data from the Norwegian longliners are presented in Bergstad and Hareide, 1996 and Helle *et al.*, WD 2009. In this period, when the tusk have been fully or heavily exploited, the estimated mean length has varied around 50 cm without any clear trend.

7.3.2.3 Age compositions

No new age compositions were available.

7.3.2.4 Weight-at-age

No new data were presented.

7.3.2.5 Maturity and natural mortality

No new data were presented.

7.3.2.6 Catch, effort and research vessel data

Catch and effort data for Norwegian longliners were presented (Figure 7.3.1) No research vessel data were available.

The extensive Norwegian longliner cpue data based on private skipper's logbooks presented in the 1996 report of SGDEEP were not updated after 1994. In the 1998 report (Table 6.5 of ICES 1998), effort data were given for the period 1974–1996 based on official statistics.

In order to resume the cpue-series Norway has adopted two approaches:

> *Official logbooks from longliners.* Entering of data from official logbooks in an electronic database was begun in 2001 and data are now available for the period 2000–2007. (Because the WGDEEP meeting is relatively early this year, the logbook data, the reference fleet data and associated estimates are not yet available for 2008).Vessels were selected that had a total landed catch of ling, tusk and blue ling exceeding 8 tonnes in a given year. The logbooks contain records of the daily catch, date, position, and number of hooks used per day.
>
> *Reference fleet information*. Since 2001 special agreements were made with selected vessels, "the reference fleet", providing data for the species composition of the catch (in weight), and number of hooks used per day (Helle *et al*., WD? 2009). There are currently four longline vessels contributing data.

An analyses based on these two sources of data was presented in a WD by Helle and Pennington, WD6, 2007.

7.3.3 Data analyses

No assessment was required for this stock in 2009.

7.3.4 Comments on the assessment

No assessment was required for this stock in 2009.

7.3.5 Management considerations

No advice was required for this stock in 2009.

Table 7.3.0a. Tusk I. WG estimates of landings.

Year	Norway	Russia	Faroes	Iceland	Ireland	Total
1996	587					587
1997	665					665
1998	805					805
1999	907					907
2000	738	43	1	16		798
2001	595	6		13		614
2002	791	8	n/a	0		799
2003	571	5			5	581
2004	620	2			1	623
2005	562					562
2006	442	4				446
2007	355	2				357
2008*	628	7				635

***Preliminary**

Table 7.3.0b. Tusk IIa. WG estimates of landings.

Year	Faroes	France	Germany	Greenland	Norway	E & W	Scotland	Russia	Ireland	Total
1988	115	32	13	-	14241	2	-			14403
1989	75	55	10	-	19206	4	-			19350
1990	153	63	13	-	18387	12	+			18628
1991	38	32	6	-	18227	3	+			18306
1992	33	21	2	-	15908	10	-			15974
1993	-	23	2	11	17545	3	+			17584
1994	281	14	2	-	12266	3	-			12566
1995	77	16	3	20	11271	1				11388
1996	0	12	5		12029	1				12047
1997	1	21	1		8642	2	+			8667
1998		9	1		14463	1	1	-		14475
1999		7	+		16213		2	28		16250
2000		8	1		13120	3	2	58		13192
2001	11	15	+		11200	1	3	66	5	11301
2002		3			11303	1	4	39	5	11355
2003	6	2			7284		3	21		7316
2004	12	2			6607		1	61	1	6684
2005	29	6			6249			37	3	6324
2006	33	9			9246	1		51	11	9351
2007	54	7			9856	0	5	85	12	10019
2008*	51	6			10848	1	3	56	0	10965

***Preliminary**

Table 7.3.0c. Tusk IIb. WG estimates of landings.

Year	Norway	E & W	Russia	Ireland	Total
1988		-			0
1989		-			0
1990		-			0
1991		-			0
1992		-			0
1993		1			1
1994		-			0
1995	229	-			229
1996	161				161
1997	92	2			94
1998	73	+	-		73
1999	26		4		26
2000	15	-	3		18
2001	141	-	5		146
2002	30	-	7		37
2003	43				43
2004	114		5		119
2005	148		16		164
2006	168		23		191
2007	350		17	1	368
2008*	271		11	0	313

Table 7.3.0d. Tusk I and II. WG estimates of total landings by Subareas or Divisions.

Year	I	IIa	IIb	All areas
1988		14403	0	14403
1989		19350	0	19350
1990		18628	0	18628
1991		18306	0	18306
1992		15974	0	15974
1993		17584	1	17585
1994		12566	0	12566
1995		11388	229	11617
1996	587	12047	161	12795
1997	665	8667	94	9426
1998	805	14475	73	15353
1999	907	16250	26	17183
2000	798	13192	18	14008
2001	614	11301	146	12061
2002	799	11355	37	12191
2003	581	7316	43	7940
2004	623	6684	119	7426
2005	562	6324	164	7050
2006	446	9351	191	9988
2007	357	10019	368	10744
2008*	635	10965	313	11913

***Preliminary**

Table 7.3.1. Summary statistics for the Norwegian longliner fleet during the period 1995–2008 (vessels exceeding 21m). This list only includes vessels that landed 8 tonnes or more of ling, blue ling and tusk in a given year.

Year	Number of longliners
1995	65
1996	66
1997	65
1998	67
1999	71
2000	72
2001	65
2002	58
2003	52
2004	43
2005	39
2006	35
2007	38
2008	36

Table 7.3.2. Estimated number of days that the Norwegian longliner fleet (selected using criteria described in the text) operated in Subareas I and II and caught tusk in the period 2000–2007.

Tusk	2000	2001	2002	2003	2004	2005	2006	2007
I	3	1	5	5	6	5	1	5
IIa	34	57	66	58	60	69	67	89
IIb	1		2		1	2	1	3

Table 7.3.3. Estimated number of hooks that the Norwegian longliners set per day in Subarea I and II in the period 2000–2006. n= the total number of days with hook information contained in the logbooks.

All	2000		2001		2002		2003		2004		2005		2006		2007	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
I	31688	353	33325	163	35432	263	35045	376	32431	433	32671	316	33182	187	34380	318
IIa	31439	1916	30703	2196	33431	2031	34766	1839	33475	1389	32861	1248	35140	1252	35207	2103
IIb	35409	71	34638	315	34756	45	34776	67	31859	217	35082	207	39298	57	37881	328

Table 7.3.4. Estimated total number of hooks (in thousands) the Norwegian longliner fleet used in Subareas I and II for the years 2000–2007 in the fishery for tusk, ling and blue ling.

All	2000	2001	2002	2003	2004	2005	2006	2007
I	20534	10831	20551	21868	27891	29306	12775,07	19081
IIa	117708	127724	143486	131972	107957	103808	89783	131569
IIb	5099	20263	4032	5425	15069	19155	4126	29434

Table 7.3.5. Estimated mean cpue ([kg/hook]x1000) of tusk in Subarea I and II based on logbook data. Standard error (se) and number of catches sampled (n) is also given.

All vessels submitting logbooks:

	2000			2001			2002			2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
I	21,6	189	2,1	18,8	53	3,2	4,2	115	2,0	11,9	141	1,7	3,8	122	2,2	3,5	73	3,7	7,8	18	9,5	7,95	108	2,7
IIA	59,5	1678	0,7	52,5	1959	0,5	47	1809	0,5	40,1	1473	0,5	36,1	1096	0,8	49,5	1060	1,0	56,3	1145	1,2	53,1	1853	0,7
IIB	4,1	8	10,4	10,8	17	5,6				5,3	5	9,0	2,2	20	5,6	2,7	12	9,2	5,62	6	16,4	2,85	19	6,4

Reference vessels:

Tusk	2001			2003			2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
I				2,1	43	6,35	1,13	77	3,26	2,39	44	4,96	1,83	51	5,44	4,41	60	7	24,7	16	10,7
IIA	22,1	46	3,6	41,4	208	2,89	35,1	296	1,66	32,6	431	1,58	63,4	349	2,09	61,8	498	2,43	75,1	447	2,03
IIB										8,74	2	23,3	0,55	4	19,4	4,69	45	8,08	3,06	68	5,21

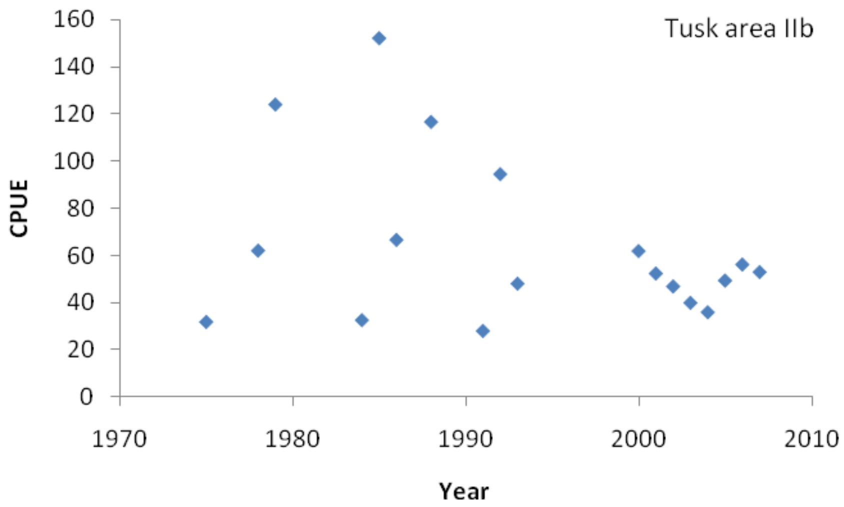


Figure 7.3.1. Estimates of cpue (kg/1000 hooks) of tusk based on skipper's logbooks (pre-2000) and official logbooks (post 2000). Combination of data from Bergstad and Hareide, 1996 and Helle *et al.*, WD8 2008. Note interruption in time-series in the period 1993–2000.

7.4 Tusk (*Brosme Brosme*) on the Mid-Atlantic Ridge (Division XIIa1)

7.4.1 The fishery

Tusk is a bycatch species in the gillnet and longline fisheries in Subarea/Division XII. No catches were reported in 2008 and in 2006 and 2007 only Russia reported catches of tusk. During the period 1996 to 2004 Norway also had a fishery in this area.

7.4.1.1 Landings trends

Landing statistics by nation in the period 1988–2008 are in Table 7.4.0.

It should be noted that catches in XIIb, Hatton Bank, may have been included in these data.

The reported catches are generally very low in this area.

7.4.1.2 ICES advice

The advice statement from 2008 was: *Fisheries on tusk should be accompanied by programmes to collect data on both target and bycatch fisheries. Fisheries should not be allowed to expand unless there is information that can be used to evaluate a long-term sustainable level of exploitation.*

7.4.1.3 Management

NEAFC recommends that in 2009 the effort in areas beyond national jurisdiction shall not exceed 65 per cent of the highest level for deep-water fishing in previous years.

7.4.2 Data available

7.4.2.1 Landings and discards

Landings were available for all the relevant fleets. New discard data were not available.

7.4.2.2 Length compositions

No length compositions were available.

7.4.2.3 Age compositions

No age compositions were available.

7.4.2.4 Weight-at-age

No data were available.

7.4.2.5 Maturity and natural mortality

No data were available.

7.4.2.6 Catch, effort and research vessel data

No data were available.

7.4.3 Data analyses

No assessment was required for this stock in 2009.

7.4.4 Comments on the assessment

No assessment was required for this stock in 2009.

7.4.5 Management considerations

No advice was required for this stock in 2009.

Table 7.4.0. Tusk XII. WG estimate of landings. It should be noted that catches in XIIb, Hatton Bank, may be included in these data.

TUSK XII							
Year	Faroes	France	Iceland	Norway	Scotland	Russia	Total
1988		1					1
1989		1					1
1990		0					0
1991		1					1
1992		1					1
1993		12	+				12
1994		1	+				1
1995	8	-	10				18
1996	7	-	9	142			158
1997	11	-	+	19			30
1998		1		-			1
1999		1		+	1		1
2000				5	+		5
2001		1		51	+		52
2002				27			27
2003				83			83
2004	2	2		7		5	16
2005	2	1					3
2006		0				64	64
2007		0				19	19
2008*							0

***Preliminary**

Table 7.4.0 (continued).Tusk, total landings by Subareas or Division.

Year	XII	All areas
1988	1	1
1989	1	1
1990	0	0
1991	1	1
1992	1	1
1993	12	12
1994	1	1
1995	18	18
1996	158	158
1997	30	30
1998	1	1
1999	1	1
2000	5	5
2001	52	52
2002	27	27
2003	83	83
2004	16	16
2005	3	3
2006	64	64
2007	19	19
2008	0	0

***Preliminary**

7.5 Tusk (*Brosme Brosme*) in VIb

7.5.1 The fishery

Tusk is a bycatch species in the trawl, gillnet and longline fisheries in Subarea VIb. Norway has traditionally landed the largest percentage of the total catch. Longliners catch about 90% of the Norwegian landings. Since the 12th of January 2007 parts of the Rockall bank has been closed to fishing with bottom trawls, gillnets and longlines. The areas closed are traditional areas fished by the Norwegian longline fleet.

7.5.1.1 Landings trends

Landing statistics by nation in the period 1988–2008 are in Table 7.5.0.

For Subarea VIb catches declined considerably in 2007 and 2008 compared with previous years.

7.5.1.2 ICES advice

ICES advice in 20088 was*: Cpue in Rockall does not indicate any clear trends. Therefore, recent levels of catches do not appear to have had a negative impact. ICES recommends that catches should be constrained to 530 t (average 2003–2007) and to collect information that can be used to evaluate a long-term sustainable level of exploitation.*

7.5.1.3 Management

There are no management measures that apply specifically to this area.

Norway, which also has a licensing scheme, could in 2007 catch 3350 tonnes and in 2008 catch 3400 tonnes in EU waters (Subareas V, VI and VIII). In 2009 the Norwegian quota in the EC zone is 3350 tonnes.

EU TACs cover Subarea V, VI, VII and is set at 435 tonnes in 2009.

NEAFC recommend in 2009 that the effort shall not exceed 65 per cent of the highest level put into deep-fishing in previous years.

7.5.2 Data available

7.5.2.1 Landings and discards

Landings were available for all relevant fleets. New discard data were not available.

7.5.2.2 Length compositions

Length compositions and mean lengths from 1988 to the present, based on Norwegian longliner data, are in Bergstad and Hareide, 1996, Helle and Pennington, WD8, 2008 and Helle *et al.*, WD2 2009.

7.5.2.3 Age compositions

No new age compositions were available.

7.5.2.4 Weight-at-age

No new data were presented.

7.5.2.5 Maturity and natural mortality

No new data were presented.

7.5.2.6 Catch, effort and research vessel data

The extensive Norwegian longliner cpue series, based on private skipper's logbooks, presented in the 1996 report was not updated after 1994. In the 1998 report (Table 6.5 of ICES 1998), effort data were given for the period 1974–1996 based on official statistics.

In order to resume the cpue-series Norway has adopted two approaches:

> *Official logbooks from longliners.* Entering of data from official logbooks into an electronic database was begun in 2001 and data are now available for the period 2000–2006. Vessels were selected that had a total landed catch of ling, tusk and blue ling exceeding 8 tonnes in a given year. The logbooks contain records of the daily catch, date, position, and number of hooks used per day.
>
> *Reference fleet information*. Since 2001 special agreements were made with selected vessels, "the reference fleet", providing data on the species composition of the catch (in weight), and number of hooks used per day Helle *et al.*, WD 2, 2009. There are currently four longline vessels contributing data.

An analyses based on these two sources of data is in Helle *et al.*, WD 2, 2009.

7.5.3 Data analyses

No assessment was required for this stock in 2009.

7.5.4 Comments on the assessment

No assessment was required for this stock in 2009.

7.5.5 Management considerations

No advice was required for this stock in 2009.

Table 7.5.0. Tusk VIb. WG estimate of landings.

Year	Faroes	France	Germany	Ireland	Iceland	Norway	E & W	N.I.	Scot.	Russia	Total
1988	217		-	-		601	8	-	34		860
1989	41	1	-	-		1537	2	-	12		1593
1990	6	3	-	-		738	2	+	19		768
1991	-	7	+	5		1068	3	-	25		1108
1992	63	2	+	5		763	3	1	30		867
1993	12	3	+	32		899	3	+	54		1003
1994	70	1	+	30		1673	6	-	66		1846
1995	79	1	+	33		1415	1		35		1564
1996	0	1		30		836	3		69		939
1997	1	1		23		359	2		90		476
1998		1		24	18	630	9		233		915
1999				26	-	591	5		331		953
2000		2		22		1933	14		372	1	2344
2001	1	1		31		476	10		157	6	681
2002		8		3		515	8		88		622
2003		7		18		452	11		72	1	561
2004		9		1		508	4		45	60	627
2005		5		9		503	5		33	137	692
2006	10	1		16		431	2		25	2	487
2007	4	0		8		231	1		30	25	299
2008*	41	0		2		190	0		14	44	291

***Preliminary**

Table 7.5.0 (continued).

Tusk, total landings in Subarea VIb.

Year	VIb	All areas
1988	860	860
1989	1593	1593
1990	768	768
1991	1108	1108
1992	867	867
1993	1003	1003
1994	1846	1846
1995	1564	1564
1996	939	939
1997	476	476
1998	915	915
1999	953	953
2000	2344	2344
2001	681	681
2002	622	622
2003	561	561
2004	627	627
2005	692	692
2006	487	487
2007	299	299
2008*	291	291

***Preliminary**

Table 7.5.1. Estimated number of days that the Norwegian longliner fleet (selected using criteria described in the text, Section 6) operated in Subarea VIb in the period 2000–2007. Data from 2008 was not available to the Working Group.

TUSK	2000	2001	2002	2003	2004	2005	2006	2007
VIb	4	6	8	5	5	8	7	6

Table 7.5.2. Estimated number of hooks that the Norwegian longliners set per day in Subarea VIb in the period 2000–2007. n= the total number of days with hook information contained in the log-books. Data from 2008 was not available to the Working Group.

ALL	2000		2001		2002		2003		2004		2005		2006		2007	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
VIb	30471	227	30340	140	31557	149	31325	97	31559	111	35949	137	32273	139	36400	145

Table 7.5.3. Estimated total number of hooks (in thousands) the Norwegian longliner fleet used in Subarea VIb for the years 2000–2007 in the fishery for ling, tusk and blue ling. Data from 2008 was not available to the Working Group.

ALL	2000	2001	2002	2003	2004	2005	2006	2007
VIb	21939	11833	14642	9773	6785	11216	7907	8081

Table 7.5.4. Estimated mean cpue ([kg/hook]x1000) based on logbook data along with its standard error (*se*) and number of catches sampled for tusk in SubareaVIb.

	2000			2001			2002			2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
VIB	76,8	222	2,0	50,6	132	2,0	55,2	149	1,7	44,9	94	2,1	62,7	111	2,4	72,5	136	2,7	41,2	138	3,4	26,1	135	2,4

Table 7.5.5. Estimated mean cpue ([kg/hook]x1000) based on data from the reference fleet, along with its standard error (*se*) and number of catches sampled for tusk in Subarea VIb.

	2002			2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
VIb	36,7	29	7,34	31,19	61	3,66							34,01	26	10,64	9,7	22	9,16

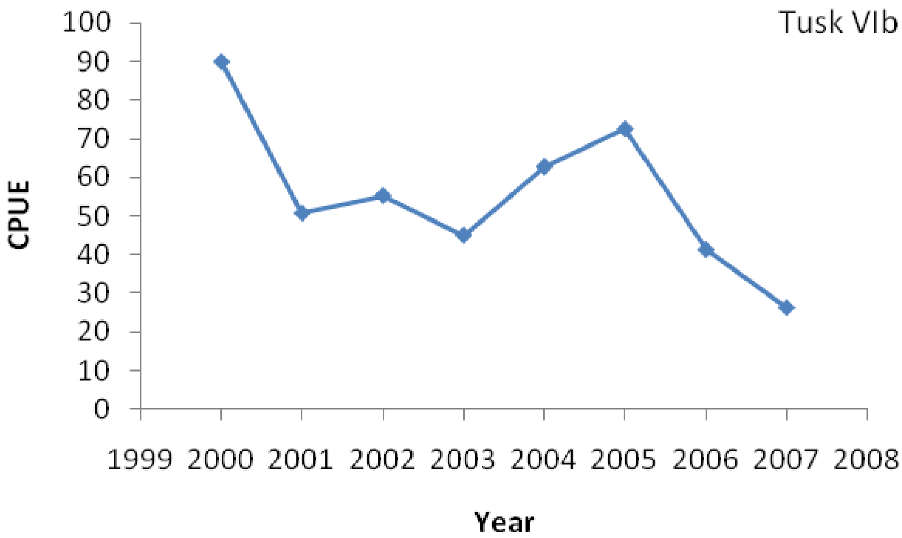


Figure 7.5.1. Estimated mean cpue([kg/hook]x1000) based on data from the logbooks for tusk in ICES Subarea VIb for the years 2000–2007. Data from 2008 was not available to the Working Group meeting.

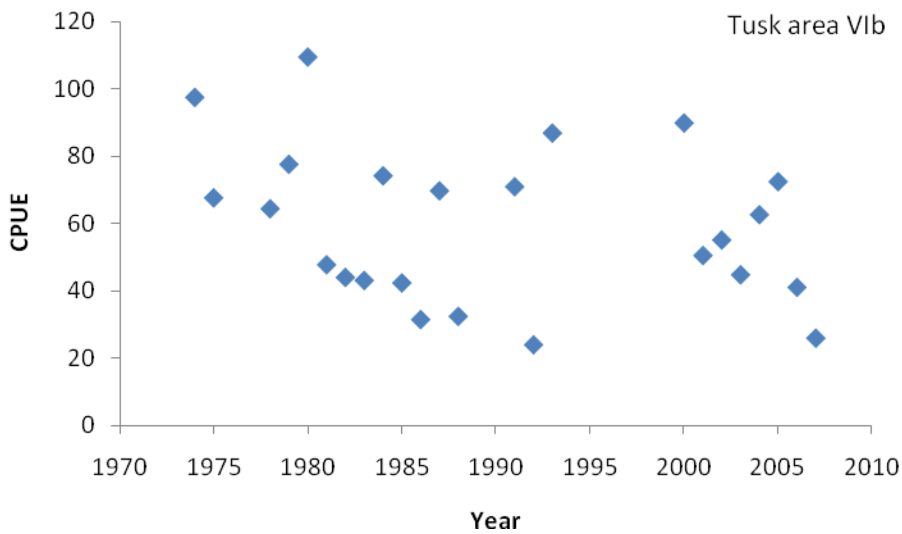


Figure 7.5.2. Estimates of cpue (kg/1000 hooks) of tusk based on skipper's logbooks (pre-2000) and official logbooks (post 2000) in Subarea VIb. Combination of data from Bergstad and Hareide, 1996 and WD by Helle *et al.*, 2009. Note gap in time-series between 1993 and 2000, and the differences in cpue scale between areas. Data from 2008 was not available to the Working Group meeting.

7.6 Tusk (*Brosme Brosme*) in other areas (IIIa, IVa, Vb, VIa, VII, VIII, IX and other areas of XII)

7.6.1 The fishery

Tusk is a bycatch species in trawl, gillnet and longline fisheries in these Subareas/Divisions. Norway has traditionally landed a dominant portion of the total, and around 90% of the Norwegian landings are taken by longliners.

7.6.1.1 Landings trends

Landing statistics by nation in the period 1988–2008 are given in Table 7.6.0.

For all Subareas/Divisions the catches have been at a stable level during the last four years.

Before this period the catches in Division IVa declined from about 4000 tons at the beginning of the 1990s to about 1500 tons/year in 2004. From 2005 to 2008 the catches have stabilized at about 2000 tons

7.6.1.2 ICES advice

ICES advice in 2008 was: *Cpue in these areas has been at a reduced level. ICES recommends to constrain catches to 5000 t (30% reduction) and to collect information that can be used to evaluate a long-term sustainable level of exploitation*.

7.6.1.3 Management

There is a licensing scheme and effort limitation in Vb. The minimum landing length for tusk in division Vb is 40 cm. Norway has a bilaterally agreed quota in Vb and the quota for 2009 is 1847 tons. Norway also has a licensing scheme in EU waters and could in 2007 and 2008 catch 3400 and 3350 tons respectively. In 2009 the Norwegian quotas in the EC zone is 3350 tons. The quota for the EC in the Norwegian zone (Area IV) is set at 170 tons.

EU TACs for areas partially covered in this section are in 2009:

Subarea III: 28 tonnes

Subarea IV: 231 tonnes

Subarea V, VI, VII: 435 tonnes

NEAFC recommends that in 2009 the effort in areas beyond national jurisdiction shall not exceed 65 per cent of the highest level for deep-water fishing in previous years.

7.6.2 Data available

7.6.2.1 Landings and discards

Landings were available for all relevant fleets. New discard data were not available.

7.6.2.2 Length compositions

Length compositions/mean lengths from 1988 to present based on data from the Norwegian longliners are presented in Bergstad and Hareide, 1996 and Helle *et al.*, WD2, 2009. In this period, when the tusk was fully or heavily exploited, the mean length has varied around 50 cm without any clear trend.

Length distributions from Faroese longliners in Vb were presented for the period 1995–2008. No trend in the composition can be seen in this series (Figure 7.6.6).

7.6.2.3 Age compositions

No new age compositions were available.

7.6.2.4 Weight-at-age

No new data were presented.

7.6.2.5 Maturity and natural mortality

No new data were presented.

7.6.2.6 Catch, effort and research vessel data

Catch and effort data for Norwegian and Faroese longliners and Danish trawlers were presented. Abundance indices and length frequency data from the Faroese groundfish surveys were presented.

The extensive Norwegian longliner cpue series based on private skippers' logbooks presented in the 1996 report were not updated after 1994. In the 1998 report (Table 6.5 of ICES C.M. 1998/ACFM:12), effort data were given for the period 1974–1996 based on official statistics.

In order to resume the cpue-series Norway has adopted two approaches:

> *Official logbooks from longliners;* Entering of data from official logbooks in an electronic database was begun in 2001 and data are now available for the period 2000–2007. Vessels were selected that had a total landed catch of ling, tusk and blue ling exceeding 8 tons in a given year. The logbooks contain records of the daily catch, date, position, and number of hooks used per day.
>
> *Reference fleet information*; Since 2001 special agreements were made with selected vessels, "the reference fleet", providing data for the species composition of the catch (in weight), and number of hooks used per day (Helle *et al.*, WD 2009). There are currently four longline vessels contributing data.

An analyses based on these two sources of data is presented in Helle and Pennington, WD8, 2008.

A cpue series for Danish trawlers fishing in IVa was available for the period 1992–2008.

Data from Faroese summer and autumn surveys were available for the period 1994 onwards. A cpue series for the Faroese longliners (>100 GRT) for the period 1987–2008 was also available.

7.6.3 Data analyses

No assessment was required for this stock in 2009.

7.6.4 Comments on the assessment

No assessment was required for this stock in 2009.

7.6.5 Management considerations

No advice was required for this stock in 2009.

Table 7.6.0. Tusk IIIa, IV, Vb, VI, VII, VIII, IX. WG estimate of landings.

TUSK IIIa

Year	Denmark	Norway	Sweden	Total
1988	8	51	2	61
1989	18	71	4	93
1990	9	45	6	60
1991	14	43	27	84
1992	24	46	15	85
1993	19	48	12	79
1994	6	33	12	51
1995	4	33	5	42
1996	6	32	6	44
1997	3	25	3	31
1998	2	19		21
1999	4	25		29
2000	8	23	5	36
2001	10	41	6	57
2002	17	29	4	50
2003	15	32	4	51
2004	18	21	6	45
2005	9	30	5	44
2006	4	21	4	29
2007	1	19	1	21
2008*	0	43	1	44

***Preliminary**

TUSK IVa

YEAR	DENMARK	FAROES	FRANCE	GERMANY	NORWAY	SWEDEN(1)	E & W	N.I.	SCOTLAND	IRELAND	TOTAL
1988	83	1	201	62	3,998	-	12	-	72		4,429
1989	86	1	148	53	6,050	+	18	+	62		6,418
1990	136	1	144	48	3,838	1	29	-	57		4,254
1991	142	12	212	47	4,008	1	26	-	89		4,537
1992	169	-	119	42	4,435	2	34	-	131		4,932
1993	102	4	82	29	4,768	+	9	-	147		5,141
1994	82	4	86	27	3,001	+	24	-	151		3,375
1995	81	6	68	24	2,988		10		171		3,348
1996	120	8	49	47	2,970		11		164		3,369
1997	189	0	47	19	1,763	+	16		238	-	2,272
1998	114	3	38	12	2,943		11		266	-	3,387
1999	165	7	44	10	1,983		12		213	1	2,435
2000	208	+	32	10	2,651	2	12		343	1	3,259
2001	258		30	8	2443	1	11		343	1	3095
2002	199		21		2438	1	8		294		2961
2003	217		19	6	1560		4		191		1997
2004	137	+	14	3	1370	+	2		140		1666
2005	123	17	11	4	1561	1	2		107		1826
2006	155	8	14	3	1854		5		120		2159
2007	95	0	22	4	1975	1	6		74	3	2180
2008*	57	0	15	2	1975		3		75	1	2128

(1) Includes IVb 1988-1993

***Preliminary.**

Table 7.6.0 (continued).

Tusk IVb

Year	Denmark	France	Norway	Germany	E & W	Scotland	Ireland	Total
1988		n.a.		-	-			
1989		3		-	1			4
1990		5		-	-			5
1991		2		-	-			2
1992	10	1		-	1			12
1993	13	1		-	-			14
1994	4	1		-	2			7
1995	4	-	5	1	3	2		15
1996	4	-	21	4	3	1		33
1997	6	1	24	2	2	3		38
1998	4	0	55	1	3	3		66
1999	8	-	21	1	1	3		34
2000	8		106	+	-	2		116
2001	6		45(1)	1	1	3		56
2002	6		61	1	1	2		71
2003	2		5	1				8
2004	2		19	1		1		23
2005	2		4	1				7
2006	2		30					32
2007	1		6				8	15
2008*			69				2	71

(1) Includes IVc.

***Preliminary.**

TUSK Vb1

YEAR	DENMARK	FAROES(4)	FRANCE	GERMANY	NORWAY	E & W	SCOTLAND (1)	RUSSIA	TOTAL
1988	+	2827	81	8	1143	-			4059
1989	-	1828	64	2	1828	-			3722
1990	-	3065	66	26	2045	-			5202
1991	-	3829	19	1	1321	-			5170
1992	-	2796	11	2	1590	-			4399
1993	-	1647	9	2	1202	2			2862
1994	-	2649	8	1 (2)	747	2			3407
1995		3059	16	1 (2)	270	1			3347
1996		1636	8	1	1083				2728
1997		1849	11	+	869		13		2742
1998		1272	20	-	753	1	27		2073
1999		1956	27	1	1522		11(3)		3517
2000		1150	12	1	1191	1	11(3)		2367
2001		1916	16	1	1572	1	20		3526
2002		1033	10		1642	1	36		2722
2003		1200	11		1504	1	17		2733
2004		1705	13		1798	1	19		3536
2005		1838	12		1398		24		3272
2006		2736	21		778		24	1	3559
2007		2291	28		1108	2	2	37	3431
2008*		2810	16		816		13	109	3655

1)Included in Vb_2 until 1996.

(2)Includes Vb_2.

(3)Reported as Vb.

(4) 2000–2003 Vb1 and Vb2 combined.

***Preliminary**

Table 7.6.0 (continued).

TUSK Vb2

YEAR	FAROE	NORWAY	E & W	SCOTLAND [1]	TOTAL
1988	545	1061	-	+	1606
1989	163	1237	-	+	1400
1990	128	851	-	+	979
1991	375	721	-	+	1096
1992	541	450	-	1	992
1993	292	285	-	+	577
1994	445	462	+	2	909
1995	225	404	-2	2	631
1996	46	536			582
1997	157	420			577
1998	107	530			637
1999	132	315			447
2000		333			333
2001		469			469
2002		281			281
2003		559			559
2004		107			107
2005		360			360
2006		317			317
2007		344			344
2008*		61			61

(1)Includes Vb1.

(2)See Vb_1.

(3)Included in Vb_1.

***Preliminary**

TUSK VIa

YEAR	DENMARK	FAROES	FRANCE (1)	GERMANY	IRELAND	NORWAY	E & W	N.I.	SCOT.	SPAIN	TOTAL
1988	-	-	766	1	-	1310	30	-	13		2120
1989	+	6	694	3	2	1583	3	-	6		2297
1990	-	9	723	+	-	1506	7	+	11		2256
1991	-	5	514	+	-	998	9	+	17		1543
1992	-	-	532	+	-	1124	5	-	21		1682
1993	-	-	400	4	3	783	2	+	31		1223
1994	+		345	6	1	865	5	-	40		1262
1995		0	332	+	33	990	1		79		1435
1996		0	368	1	5	890	1		126		1391
1997		0	359	+	3	750	1		137	11	1261
1998			395	+		715	-		163	8	1281
1999			193	+	3	113	1		182	47	539
2000			267	+	20	1327	8		231	158	2011
2001			211	+	31	1201	8		279	37	1767
2002			137		8	636	5		274	64	1124
2003			112		4	905	3		104	13	1141
2004		1	140		22	470			93	17	743
2005		10	204		7	702			96	16	1035
2006		5	239		10	674	16		115	15	1074
2007		39	261		3	703	9		70	0	1085
2008*		30	307		1	964	0		38	0	1340

Not allocated by divisions before 1993.

***Preliminary**

Table 7.6.0 (continued).

TUSK VIIa

Year	France	E & W	Scotland	Total
1988	n.a.	-	+	+
1989	2	-	+	2
1990	4	+	+	4
1991	1	-	1	2
1992	1	+	2	3
1993	-	+	+	+
1994	-	-	+	+
1995	-	-	1	1
1996	-	-		
1997	-	-	1	1
1998	-	-	1	1
1999	-	-	+	+
2000		-	+	+
2001		-	1	1
2002	n/a	-	-	-
2003		-	-	-
2004				
2005				
2006				
2007				
2008*				

***Preliminary**

TUSK VIIb,c

YEAR	FRANCE	IRELAND	NORWAY	E & W	N.I.	SCOTLAND	TOTAL
1988	n.a.	-	12	5	-	+	17
1989	17	-	91	-	-	-	108
1990	11	3	138	1	-	2	155
1991	11	7	30	2	1	1	52
1992	6	8	167	33	1	3	218
1993	6	15	70	17	+	12	120
1994	5	9	63	9	-	8	94
1995	3	20	18	6		1	48
1996	4	11	38	4		1	58
1997	4	8	61	1		1	75
1998	3		28	-		2	33
1999	-	16	130	-		1	147
2000	3	58	88	12		3	164
2001	4	54	177	4		25	263
2002	1	31	30	1		3	66
2003	1	19		1			21
2004	2	19					21
2005	4	18				1	23
2006	4	23	63			0	90
2007	2	4	7				13
2008*	2	2	0				4

***Preliminary**

Table 7.6.0 (continued).

TUSK VIIg–k

Year	France	Germany	Ireland	Norway	E & W	Scotland	Spain	Total
1988	n.a.		-	-	5	-		5
1989	3		-	82	1	-		86
1990	6		-	27	0	+		33
1991	4		-	-	8	2		14
1992	9		-	-	38	-		47
1993	5		17	-	7	3		32
1994	4		12	-	12	3		31
1995	3		8	-	18	8		37
1996	3		20	-	3	3		29
1997	4	4	11	-		+	0	19
1998	2	3	4	-		1	0	10
1999	2	1	-	-		+	6	8
2000	2		5	-	-	+	6	13
2001	3		-	9	-	+	2	14
2002	1				1		3	5
2003	1		1				1	3
2004	1						0	1
2005	1						1	2
2006	1		1				1	3
2007	1						1	1
2008*	0						0	0

***Preliminary**

TUSK VIIIa

Year	E & W	France	Total
1988	1	n.a.	1
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	-	-	-
1994	-	-	-
1995	-	-	-
1996	-	-	-
1997	+	+	+
1998	-	1	1
1999	-	-	0
2000	-		-
2001	-		-
2002	-	+	+
2003	-	-	-
2004		1	
2005			
2006			
2007			
2008*			

***Preliminary**

Table 7.6.0 (continued).

Tusk, total landings by Subareas or Division.

Year	III	IVa	IVb	Vb1	Vb2	VIa	VIIa	VIIb,c	VIIg–k	VIIIa	All areas
1988	61	4429		4059	1606	2120		17	5	1	12298
1989	93	6418	4	3722	1400	2297	2	108	86		14130
1990	60	4254	5	5202	979	2256	4	155	33		12948
1991	84	4537	2	5170	1096	1543	2	52	14		12500
1992	85	4932	12	4399	992	1682	3	218	47		12370
1993	79	5141	14	2862	577	1223		120	32		10048
1994	51	3375	7	3407	909	1262		94	31		9136
1995	42	3348	15	3347	631	1435	1	48	37		8904
1996	44	3369	33	2728	582	1391		58	29		8234
1997	31	2272	38	2742	577	1261	1	75	19		7016
1998	21	3387	66	2073	637	1281	1	33	10	1	7510
1999	29	2435	34	3517	447	539		147	8	0	7156
2000	36	3259	116	2367	333	2011		164	13		8299
2001	57	3095	56	3526	469	1767	1	263	14		9248
2002	50	2961	71	2722	281	1124		66	5		7280
2003	51	1997	8	2733	559	1141		21	3		6513
2004	45	1666	23	3536	107	743		21	1		6142
2005	44	1826	7	3272	360	1035		23	2		6569
2006	29	2159	32	3559	317	1074		90	3		7263
2007	21	2180	15	3431	344	1085		13	1		7090
2008*	44	2128	71	3655	61	1340		4	0		7303

***Preliminary**

Table 7.6.1. Estimated number of days that the Norwegian longliner fleet (selected using criteria described in the text, Section 6) operated in Subareas III to IX (not Va,VIb) in the period 2000–2006.

Tusk	2000	2001	2002	2003	2004	2005	2006	2007
IVa	18	22	28	19	21	25	37	26
IVb	1			2				
Vb	11	18	20	25	34	21	11	15
VIa	12	14	12	12	14	23	13	10
VIb	4	6	8	5	5	8	7	6
VIIc	2	1			1	0		0

Table 7.6.2. Estimated number of hooks that the Norwegian longliners set per day in Subarea IIIa–VIIc for the period 2000–2007. n= the total number of days with hook information contained in the logbooks.

All	2000		2001		2002		2003		2004		2005		2006		2007	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
IIIa	30250	4					33037	27							35000	8
IVa	29378	685	30553	727	32291	667	33484	510	30934	439	34039	331	34561	673	33414	587
IVb	30263	38	33500	10	33867	15	32559	34							38086	58
Vb	24594	411	26760	613	25939	475	29513	515	31804	693	29885	374	27943	159	30681	355
VIa	22763	435	24419	447	21484	186	29421	302	25636	308	24807	369	22504	248	25958	249
VIIc	29600	80	33108	37					25250	28	33429	7			31071	14

Table 7.6.3. Estimated total number of hooks (in thousands) the Norwegian longliner fleet used in Subareas IIIa–VIIc for the years 2000–2007 in the fishery for ling, tusk and blue ling.

All	2000	2001	2002	2003	2004	2005	2006	2007
IIIa	218			1718				
IVa	50765	43691	54313	36565	29264	33188	45966	33381
IVb	4358			1693				4228
Vb	23020	31309	30089	38367	46497	24476	10758	17028
VIa	19667	22221	14953	18359	15433	24187	10239	9604
VIIc	4262	2152			1086	521		1150

Table 7.6.4. Estimated mean cpue ([kg/hook]x1000) based on logbook data along with its standard error (*se*) and number of catches sampled for tusk.

Tusk

	2000			2001			2002			2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
IVA	35,7	664	1,2	32,6	721	0,8	25	649	0,9	29,8	496	0,9	49,3	437	1,2	36,4	329	1,8	44,6	664	1,6	51,2	583	1,2
IVB	18,1	17	7,2	16,5	2	12,4				7,22	13	5,6												
VB	56,8	405	1,5	50,2	608	1,0	50,1	473	1,0	53,7	514	0,9	59,3	693	0,9	66,5	374	1,7	98,9	159	3,2	64,7	353	1,5
VIA	48	430	1,4	40,7	444	1,1	45,9	186	1,6	36,1	300	1,2	50,3	307	1,4	59,1	368	2,7	106	247	2,6	66,1	249	2,4
VIIC	62,7	60	3,8	4,8	25	4,6							7,05	23	5,2	15,9	7	12,0				5,14	10	8,8

Table 7.6.5. Estimated mean cpue ([kg/hook]x1000) based on data from the reference fleet, along with its standard error (*se*) and number of catches sampled for tusk.

TUSK	2003			2004			2005			2006			2007		
Area	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se	cpue	n	se
IVA	73,7	40	4,52	13,7	83	3,61	21,8	99	3,9	37,5	90	5,72	10,7	59	5,6
VB	60,1	12	8,25	71,6	71	3,9	57,3	84	4,24	80,8	54	7,38	61,1	71	5,1
VIA	13,1	45	4,26										33,2	22	9,16

Table 7.6.6. Tusk in Vb (Faroes). Abundance index from spring and summer survey.

	Spring survey			Summer survey		
	Catch (kg)	Effort (h)	cpue (kg/h)	Catch (kg)	Effort (h)	cpue (kg/h)
1994	429	91	4.71			
1995	300	91	3.29			
1996	142	100	1.42	467	200	2.33
1997	331	98	3.38	311	200	1.56
1998	261	99	2.63	463	201	2.31
1999	143	100	1.43	157	199	0.79
2000	104	100	1.04	163	200	0.81
2001	198	100	1.98	331	200	1.66
2002	245	100	2.45	167	199	0.84
2003	302	100	3.02	123	200	0.62
2004	201	100	2.01	708	200	3.54
2005	210	100	2.10	968	200	4.84
2006	386	100	3.86	427	200	2.14
2007	391	100	3.91	391	199	1.97
2008	204	99	2.06	847	200	4.24

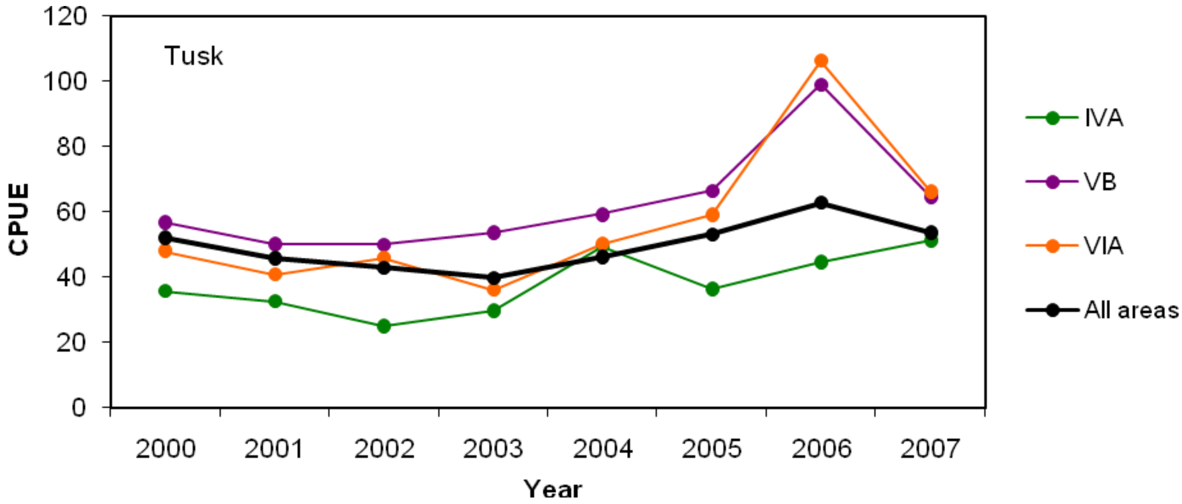


Figure 7.6.1. Estimated mean cpue([kg/hook]x1000) based on data from the Norwegian logbooks for tusk in each ICES Subarea III to IX (except Va, VIb) and all areas combined for the years 2000–2007. Data from 2008 was not available to the Working Group.

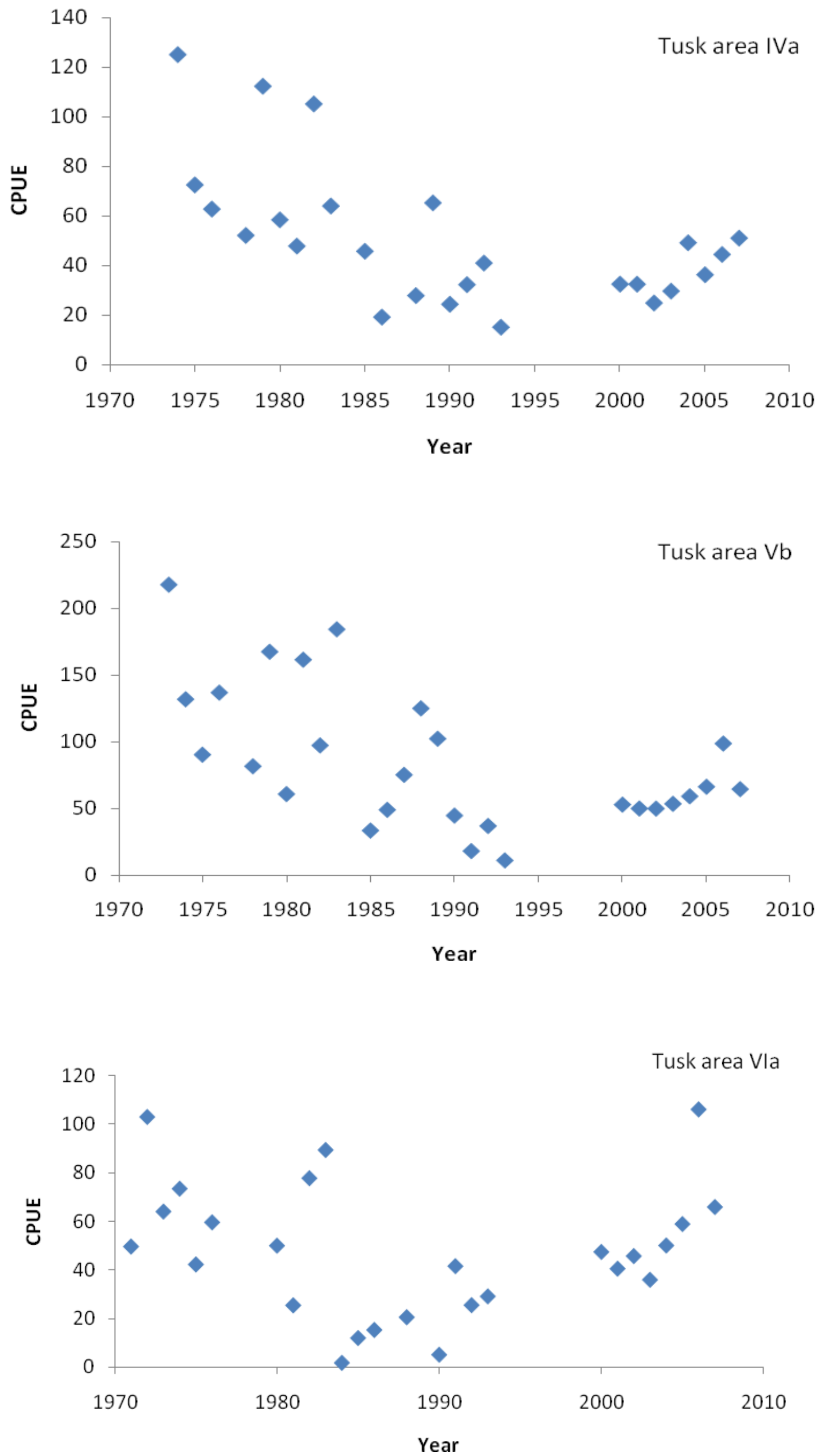


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Figure 7.6.2. Estimates of cpue (kg/1000 hooks) of tusk in Subareas IVa ,Vb and VIa based on skipper's logbooks (pre-2000) and official logbooks (post 2000). Combination of data from Bergstad and Hareide, 1996 and Helle *et al.*, WD2, 2009. Note gap in time-series between 1993 and 2000, and the differences in cpue scale between areas. Data from 2008 was not available to the Working Group.

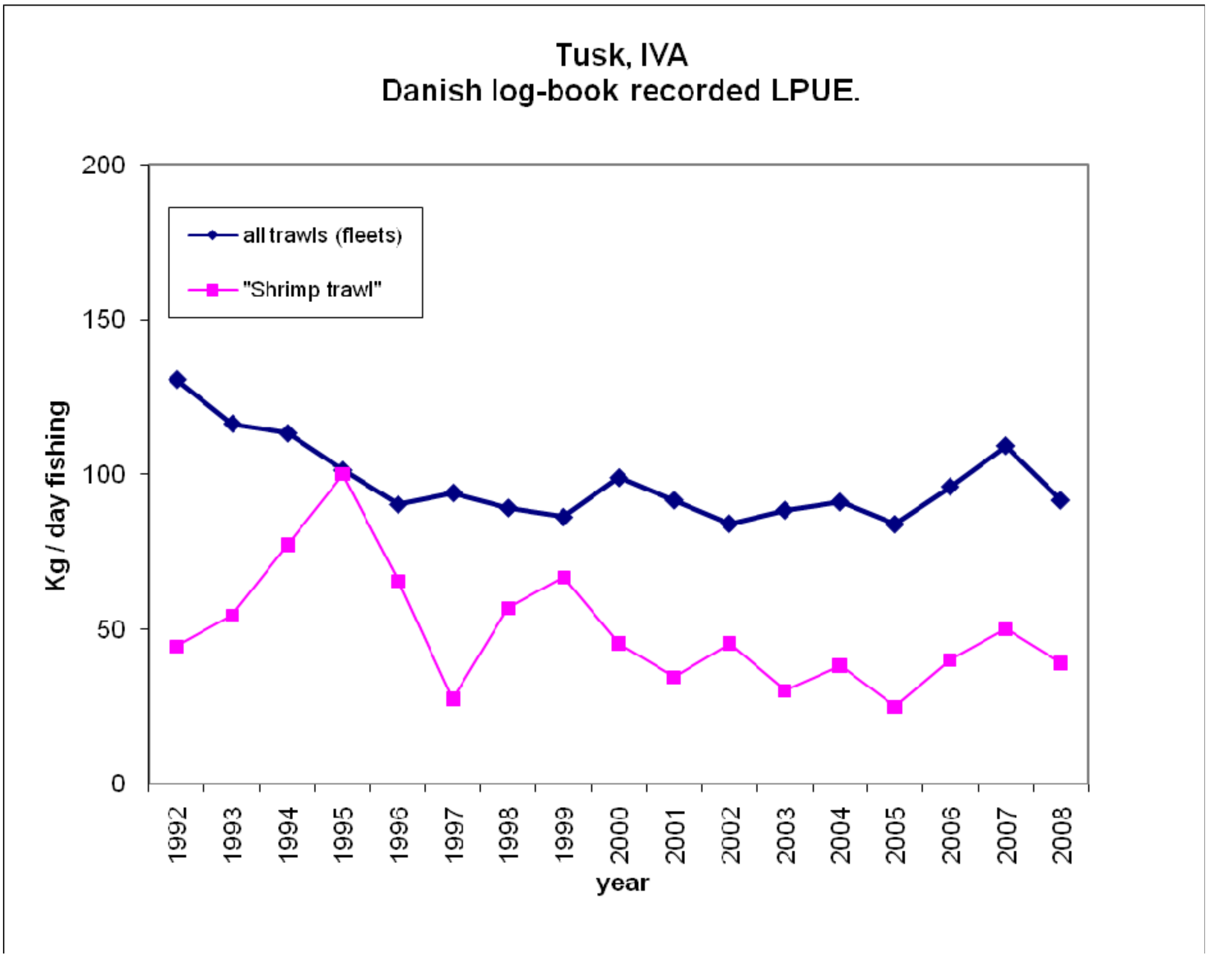


Figure 7.6.3. Tusk in IVa. Cpue of tusk for Danish. Based on logbook data.

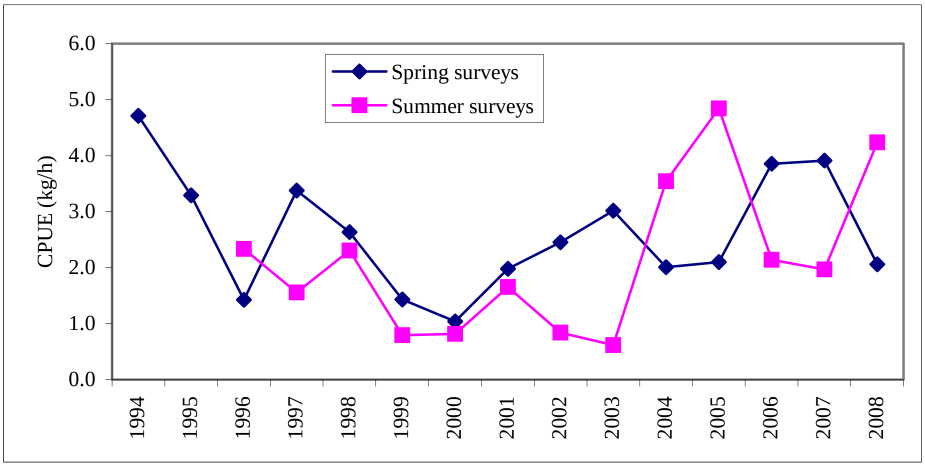


Figure 7.6.4. Tusk in Vb (Faroes). Cpue in spring and autumn bottom-trawl survey.

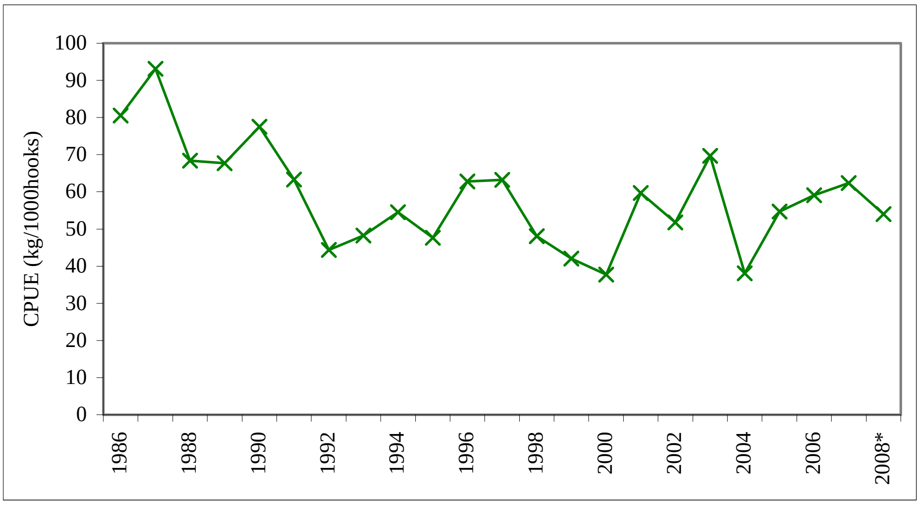


Figure 7.6.5. Tusk in Vb (Faroes). Cpue (kg/1000hooks) from longliners > 100 GRT.

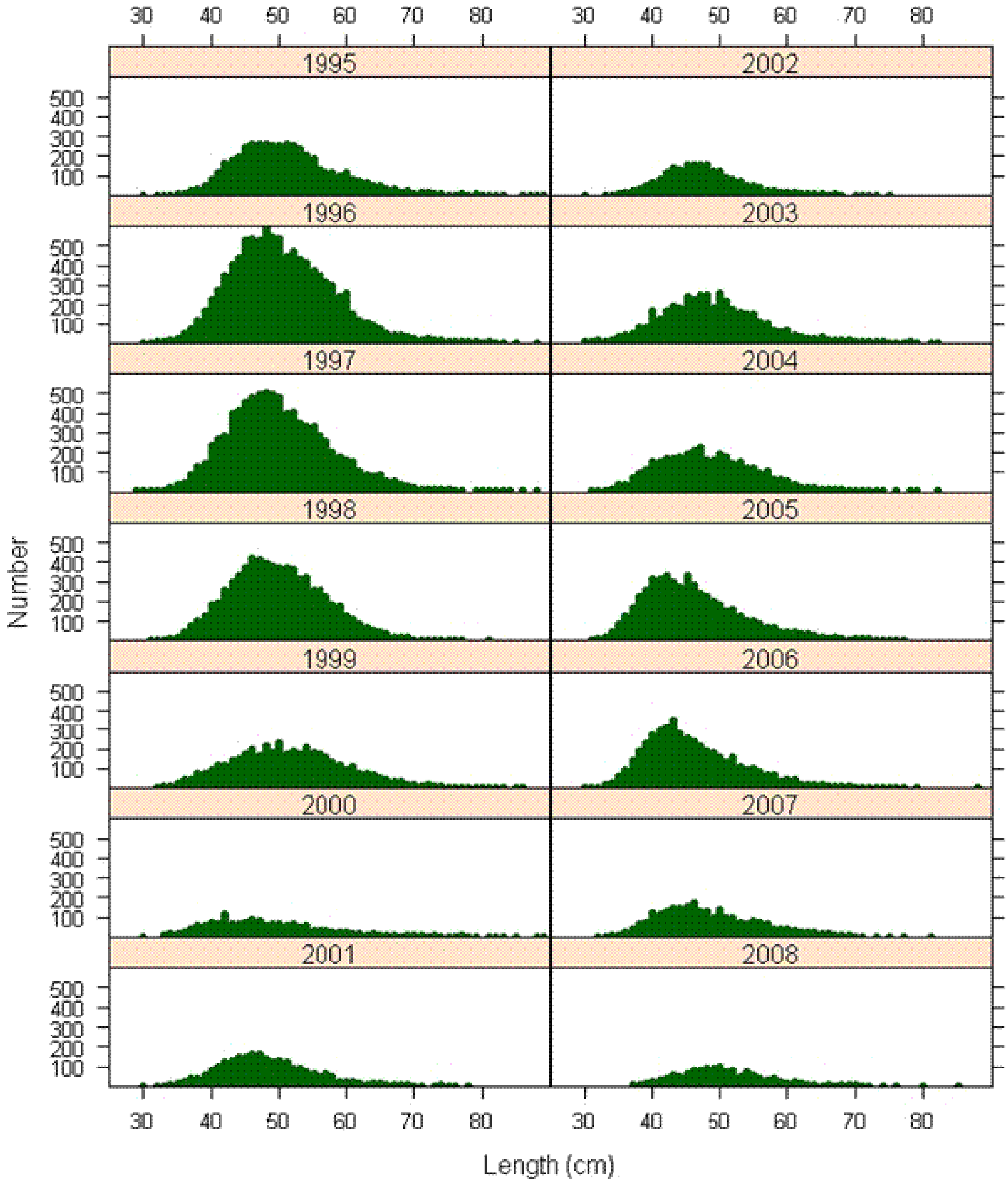


Figure 7.6.6. Tusk in Vb (Faroes). Length distribution from the Faroes groundfish survey.

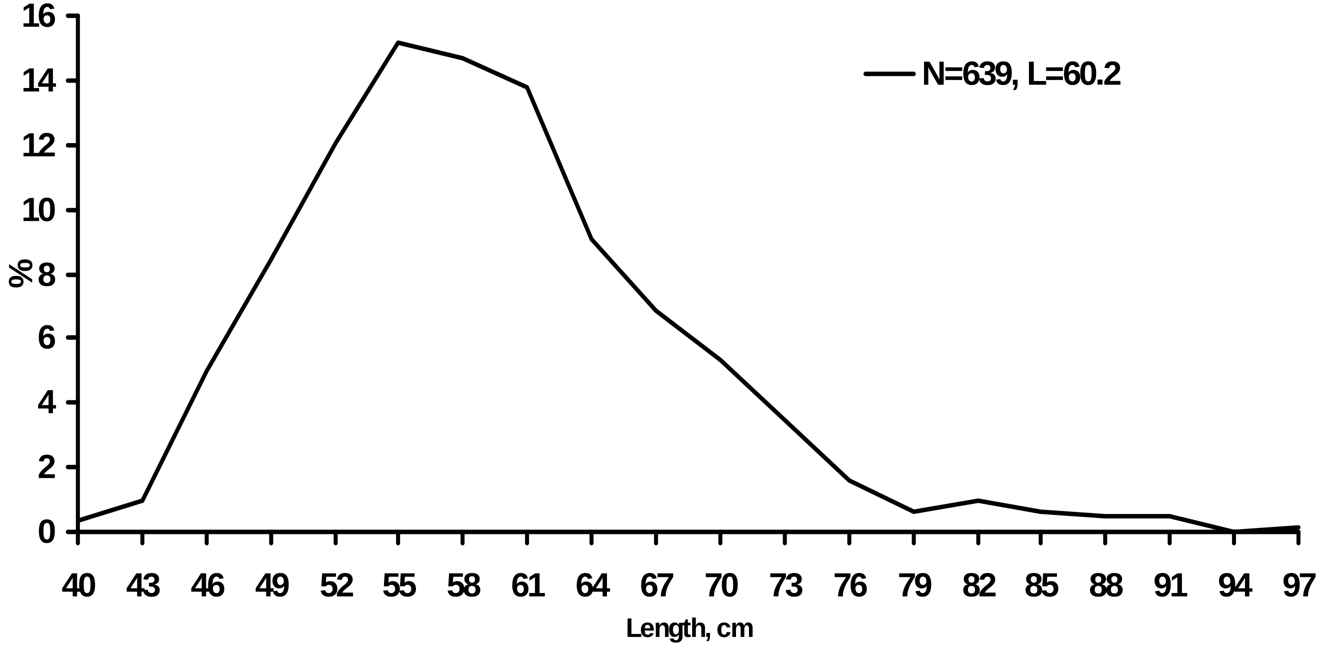


Figure 7.6.7. Length composition of tusk in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in June–July 2008.

8 Greater Silver Smelt

8.1 Stock description and management units

8.1.1 Current ICES structure

The current ICES structure for greater silver smelt is that ICES Subareas I, II, IV, VI, VII, VIII, IX, X, XII and XIV and Divisions IIIa and Vb, are treated as a single assessment unit. Only the greater argentine around Iceland (Division Va) is treated as a separate assessment unit.

The limited and hypothetical information on possible stocks was reported in the 1998 Study Group report (CM 1998/ACFM:12), quote: "*Icelandic life-history studies suggest that a separate stock might exist in Subarea Va. Irish investigations on stock discrimination in areas VI and VII are inconclusive. A study by Ronan et al. (1993), using morphometrics (box truss analysis) and meristic measurements, suggests that populations from the north of Subarea VI and the south of Subarea VII form either end of a shape cline with fish in intermediary populations exhibiting a mixture of northern and southern morphologies. Norwegian investigations in 1984–1987 in Divisions IIa, IIIa and IVa appear to show two separate populations in winter but in summer the species is widely distributed (Bergstad, 1993)*". No new information was presented to the Working Group.

For the purpose of an exploratory assessment, WGDEEP in 2009 has made an assumption that greater silver smelt around Faroe Island can be treated as a separate assessment unit. However, available information is not sufficient to suggest changes to current ICES interpretation of stock structure.

In order to evaluate the stock structure further, sampling for genetic studies from the whole distribution area of greater silver smelt is needed. It is therefore recommended that such work should be initiated as soon as possible.

Greater silver smelt in all areas is suggested for benchmarking.

8.2 Greater Silver Smelt (*Argentina Silus*) in Division Va

8.2.1 The fishery

Greater silver smelt has been caught in bottom trawls for years as bycatch in the redfish fishery. Only small amounts were reported prior to 1996 as most of the greater silver smelt was discarded. Since 1997, direct fishery for greater silver smelt has been ongoing and the landings have increased significantly (Table 8.2.1). Greater silver smelt is now taken both in a directed fishery with a small mesh size belly and codends (80 mm), but also still as a bycatch in the redfish fishery. The expansion of the fishery from 1996 to 2008 as reported in logbooks is shown in Figure 8.2.1.

Greater silver smelt is mostly fished along the south and southwest coast of Iceland, at depths between 500 and 800 m (Table 8.2.2).

8.2.2 Landings trends

Landings are displayed in Table 8.2.1. Since directed fishery started in 1996, the landings increased from 800 tonnes in 1996 to 13 000 tonnes in 1998. Landings since then have varied between around 3000 to 6000 tonnes with the exception of last year's catches which amounted to almost 9000 tonnes. The variations in the amount caught are mainly as a consequence of market situations.

8.2.3 ICES advice

The latest advice is from ICES ACOM in May 2008 states: As a consequence of its low productivity, greater silver smelt can only sustain low rates of exploitation. Fisheries on such species should always be accompanied by programmes to collect data on both target and bycatch fish. The target fishery should not be allowed to expand unless it can be demonstrated that it is sustainable.

8.2.4 Management

The Icelandic Ministry of Fisheries is responsible for management of the Icelandic fisheries and implementation of the legislation. The management on Greater silver smelt fisheries has been in the form of research licences that the Ministry of Fisheries has issued. The licences are issued for short time only.

8.2.5 Data available

8.2.5.1 Landings and discards

Landings by Icelandic vessels are given by the Icelandic Directorate of Fisheries. Discarding is banned in the Icelandic waters and currently there is no available information on greater silver smelt discards. It is however likely that unknown quantities of greater silver smelt were discarded prior to 1996.

8.2.5.2 Length compositions

The length distributions from the catches are shown in Figure 8.2.2. Mean length in the catches has decreased almost continuously from 1997 to 2008. That is from 45 cm down to 38 cm. The reasons for this may either be increased recruitment or depletion by the fishery (See 8.2.3).

8.2.5.3 Age compositions

No data available. Otoliths have been collected randomly from the catch since 1980s, but no age readings have been done since 1998. The group encouraged efforts to work up the material in order to facilitate age-based assessment for this stock.

8.2.5.4 Weight-at-age

No data available.

8.2.5.5 Maturity and natural mortality

No data available.

8.2.5.6 Catch, effort and research vessel data

Icelandic survey data

In the Icelandic groundfish survey which has been conducted annually in March since 1985 gives trends on fishable biomass of many exploited stocks on Icelandic fishing grounds. Total of more than 500 stations are taken annually in the survey at depths down to 500 meters. Therefore the survey area does not cover the most important distribution area of greater silver smelt (Figure 8.2.3). Survey length distributions of greater silver smelt are shown in Figure 8.2.4.

In addition, an autumn survey was commenced in 1996 covering 150 stations of the 550 stations that have been taken in spring survey (i.e. shallower than 500 m). From its commencement in 1996 to 1999 an additional 150 stations were taken in deeper waters off the west, north, east and southeast continental slopes off Iceland (primarily targeting Greenland halibut). In 2000, 74 stations were added to the survey, covering the continental slopes to the south of Iceland and the Reykjanes ridge. The station coverage of the autumn survey from the year 2000 is thought to represent a reasonable coverage of the distribution of the greater silver smelt fishery (Figure 8.2.5).

Time-series stratified abundance and biomass indices from the spring and autumn trawl surveys are shown in Figure 8.2.6.

Catch per unit of effort and effort data from the commercial fleets

Figure 8.2.7 shows catch per unit of effort and Figure 8.2.8 shows the effort of greater silver smelt in the Icelandic trawl fishery since 1996. The cpue is calculated using all data where catches of the species was more than 30, 50 and 70% of total registered catch in each haul. Cpue of greater silver smelt has been rather stable in the trawl fishery throughout the period.

8.2.6 Data analyses

No assessment was required for this stock in 2009.

8.2.7 Comments on the assessment

No assessment was required for this stock in 2009.

8.2.8 Management considerations

No advice was required for this stock in 2009.

Table 8.2.1. Greater silver smelt Va. WG estimates of landings.

YEAR	ICELAND	E&W	TOTAL
1988	206		206
1989	8		8
1990	112		112
1991	247		247
1992	657		657
1993	1255		1255
1994	613		613
1995	492		492
1996	808		808
1997	3367		3367
1998	13387		13387
1999	6681	23	6704
2000	5657		5657
2001	3043		3043
2002	4960		4960
2003	2686		2686
2004	3637		3637
2005	4481		4481
2006	4775		4775
2007	4226		4226
2008	8778		8778

Table 8.2.2. Greater silver smelt in Division Va. Cumulative catches by depth intervals from 1998–2008. The data are extracted from logbooks of the Icelandic trawler fleet. As an example, 33% of the catches in 1998 where taken at shallower water than 700 m as 68% of the catches in 2006 were taken shallower than that.

DEPTH	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
0–100	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
100–200	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
200–300	1%	1%	1%	1%	1%	3%	2%	2%	2%	2%	2%
300–400	2%	3%	7%	8%	4%	5%	4%	5%	7%	4%	6%
400–500	5%	6%	8%	17%	11%	10%	16%	10%	14%	12%	14%
500–600	11%	19%	13%	25%	23%	24%	38%	19%	32%	33%	28%
600–700	33%	52%	36%	46%	64%	57%	83%	65%	68%	62%	56%
700–800	65%	69%	60%	70%	88%	82%	94%	81%	84%	76%	73%
800–900	90%	93%	89%	97%	98%	99%	97%	97%	94%	90%	80%
900–1000	96%	98%	96%	98%	100%	100%	98%	99%	98%	97%	85%
>1000	97%	100%	97%	100%	100%	100%	100%	100%	100%	100%	100%

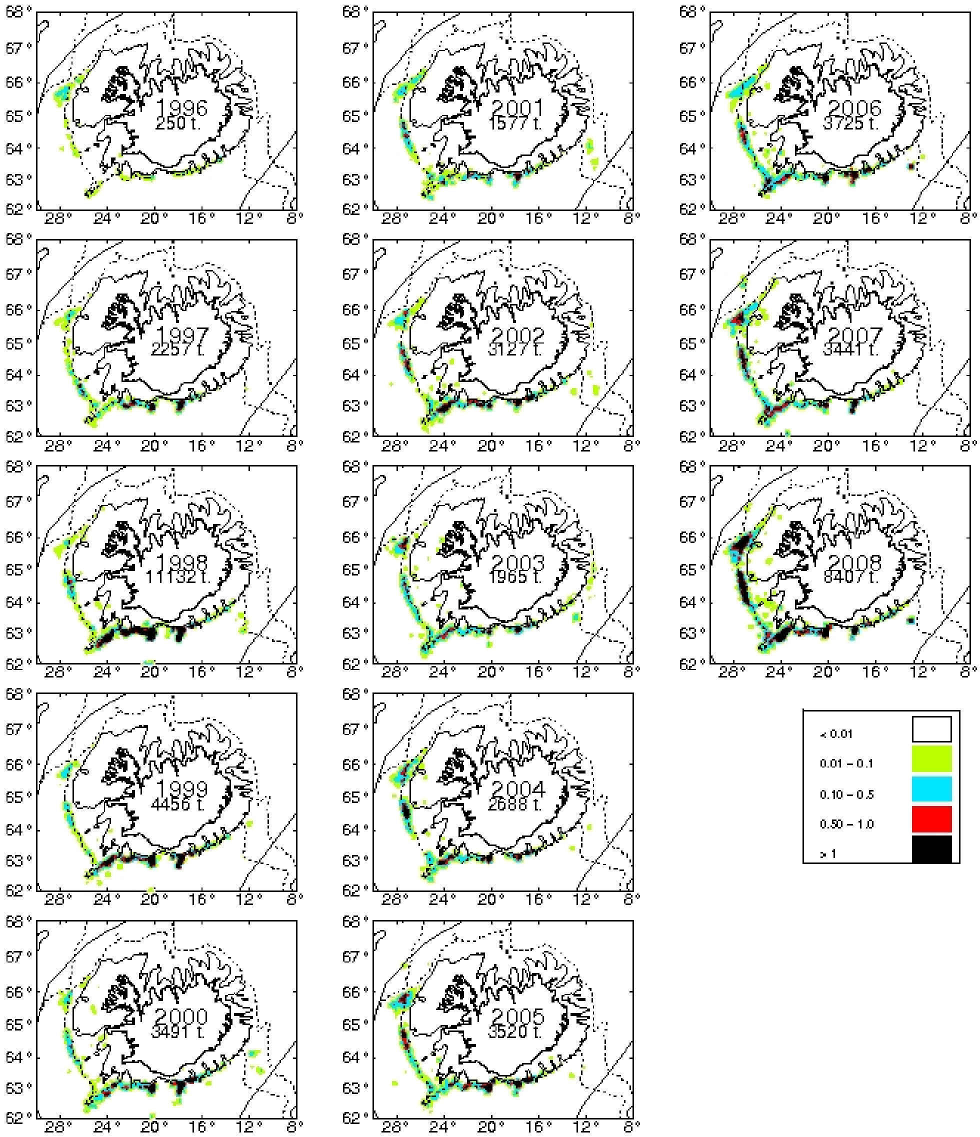


Figure 8.2.1. Greater silver smelt in Va. Geographical distribution (tonnes/square mile) of the Icelandic greater silver smelt fishery from 1996 to 2008 as reported in the logbooks. All gear types combined.

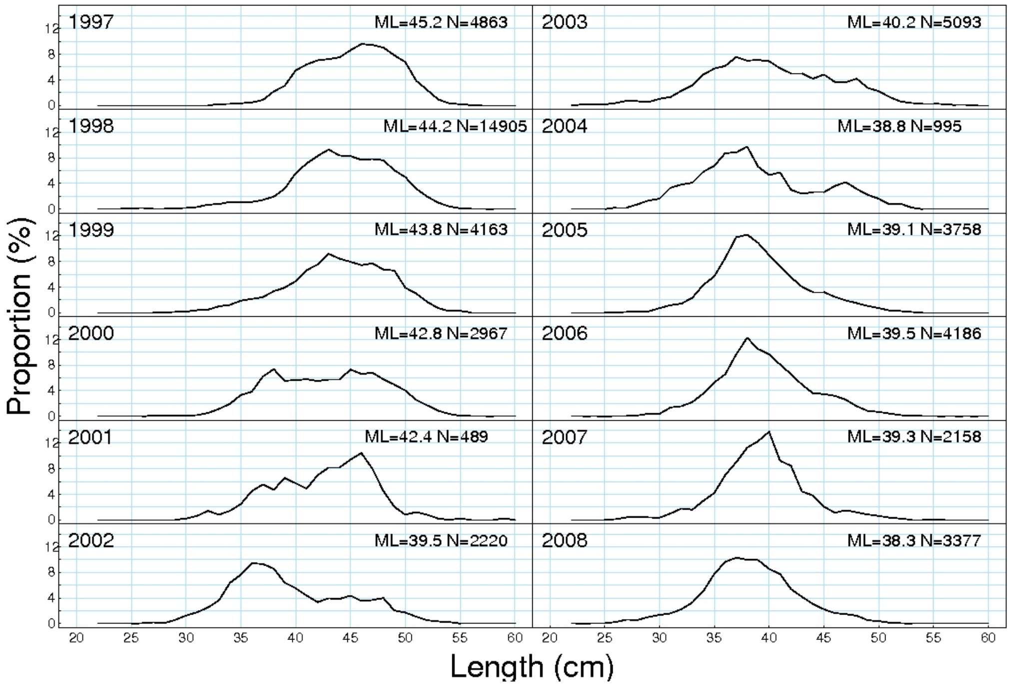


Figure 8.2.2. Length distribution of greater silver smelt in the Icelandic catches since 1997. The number of measured fish and mean length is also given.

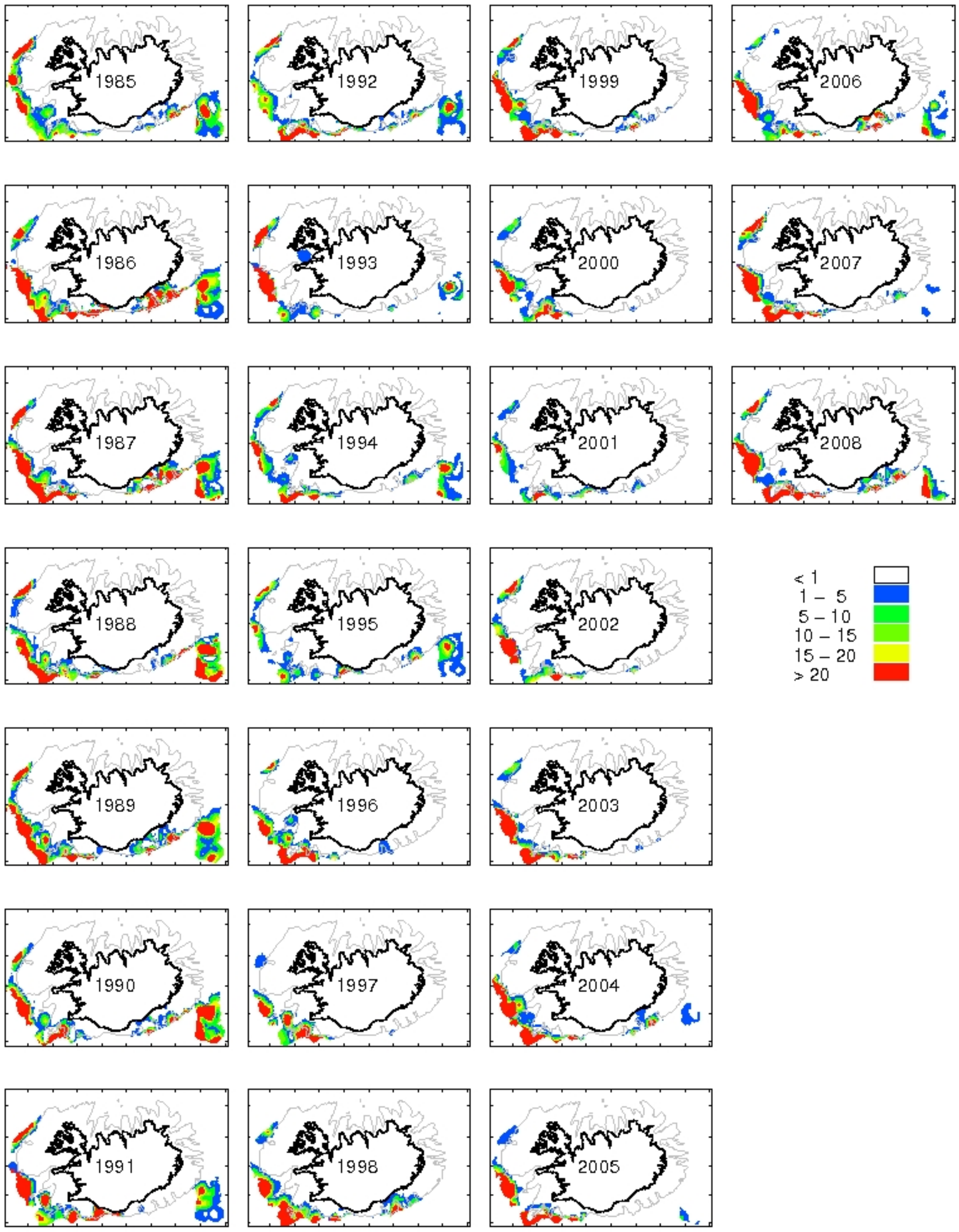


Figure 8.2.3. Distribution of Greater silver smelt (kg per standardized tow) in the groundfish survey in March 1985–2008.

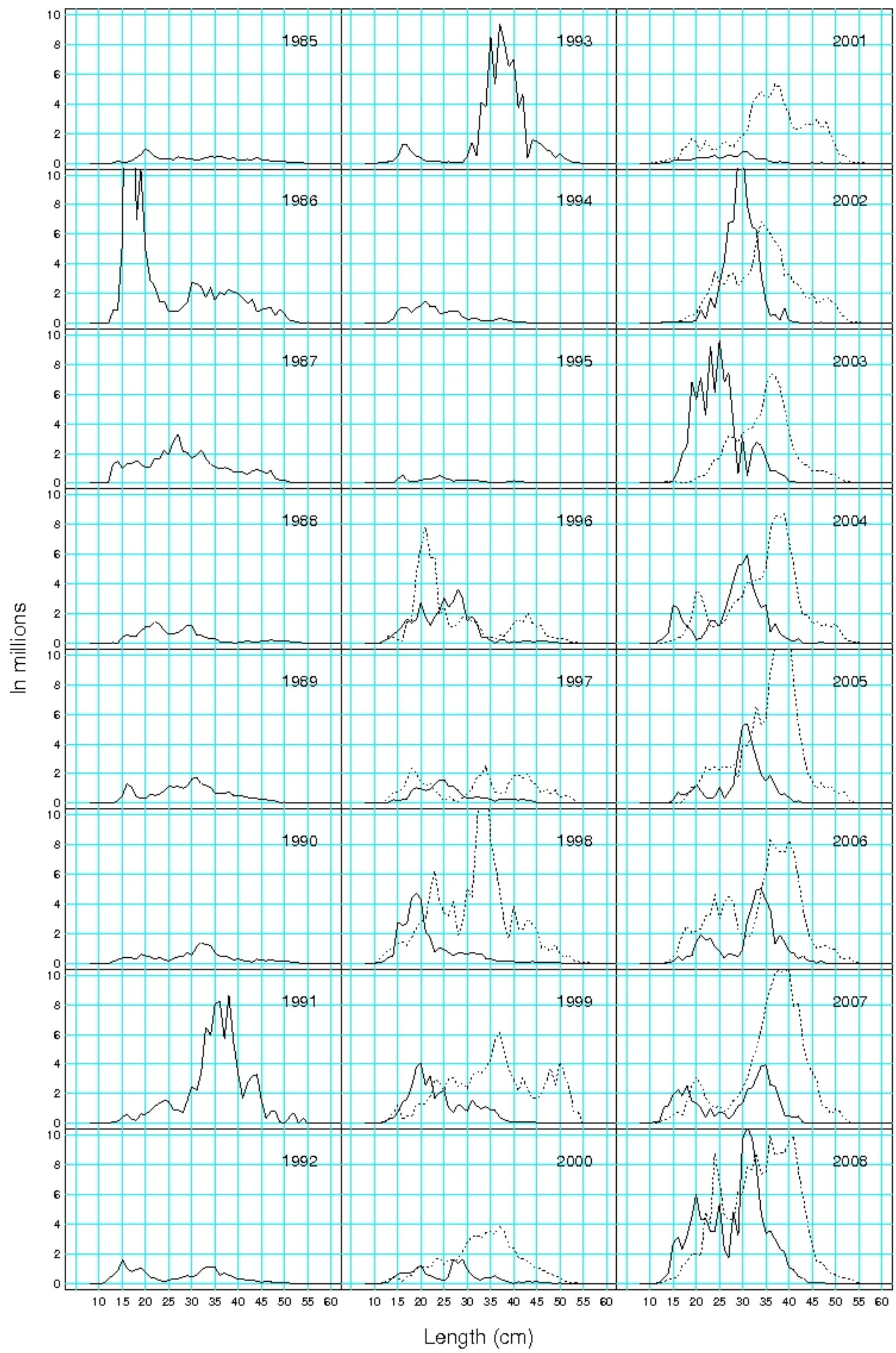


Figure 8.2.4. Greater silver smelt length distributions in the Icelandic groundfish survey in March 1985–2008 (solid line) and the groundfish survey in October 1995–2008 (dotted line).

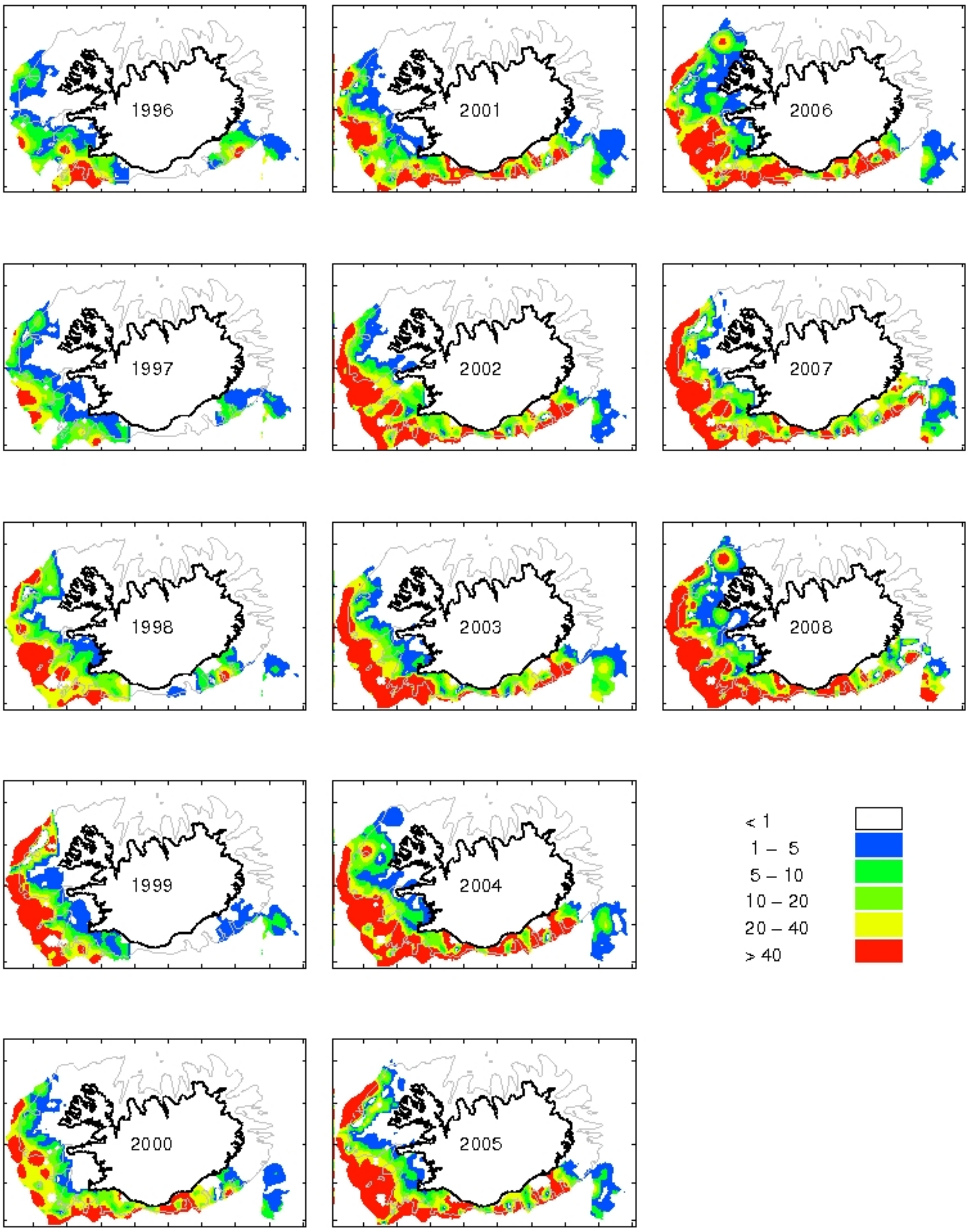


Figure 8.2.5. Distribution of Greater silver smelt (kg per standardized tow) in the groundfish survey in October 1996–2008. The sizes of the circles indicate number/station.

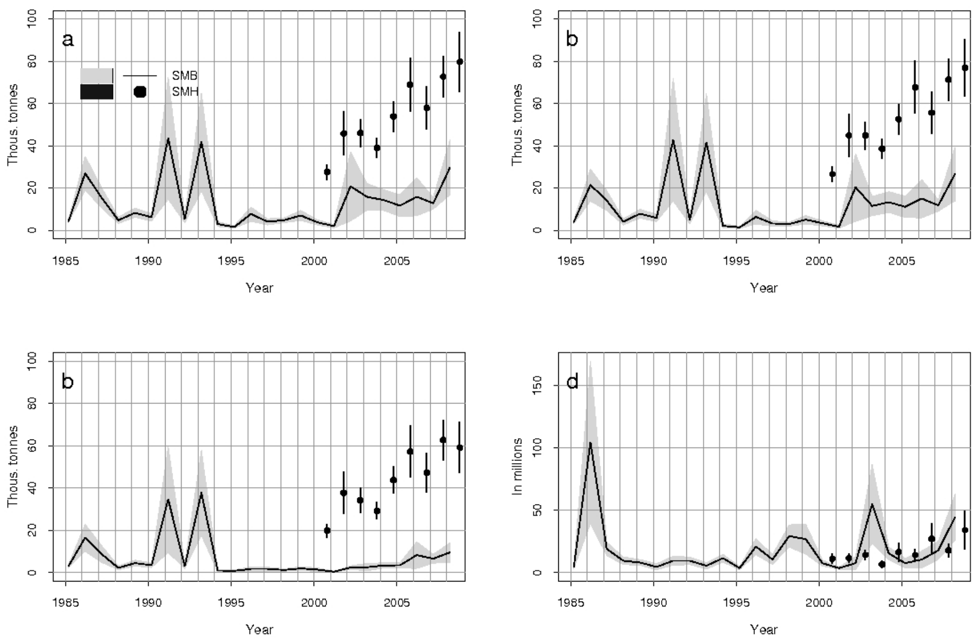


Figure 8.2.6. Biomass indices for greater silver smelt in the Icelandic groundfish survey in March 1985–2008 (SMB, line, shaded area) and October 1996–2008 (SMH, points, vertical lines). a) Total biomass index, b) Biomass of 25 cm and larger, c) Biomass 35 cm and larger, d) Abundance of < 25 cm. The shaded area and the vertical bar show ±1 standard error of the estimate.

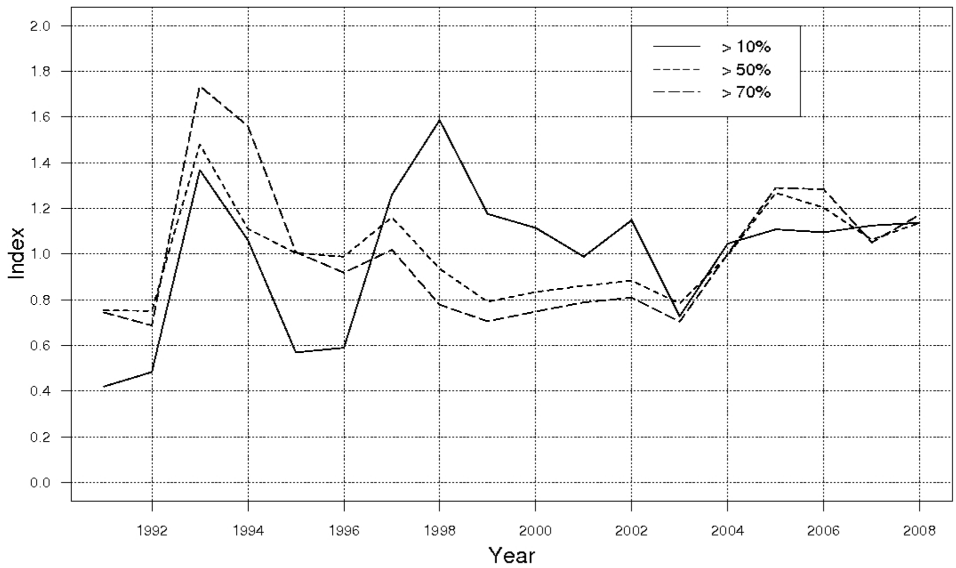


Figure 8.2.7. Index of raw cpue (sum(yield)/sum(effort)) of Greater silver smelt from the Icelandic bottom-trawl fishery 1991–2008. The criteria for the calculations were tows where Greater silver smelt composed at least 10%, 50% and 70% of the total catch.

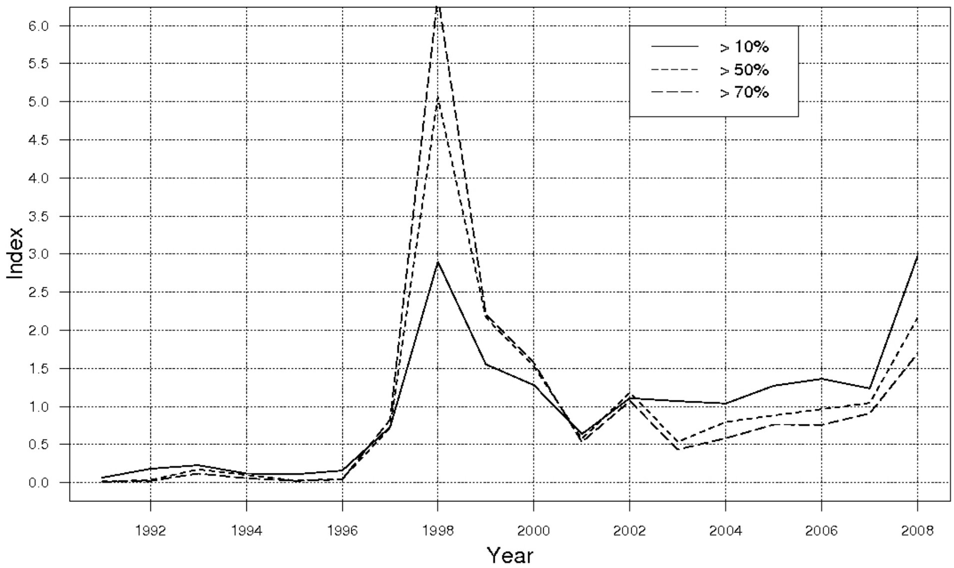


Figure 8.2.8. Index of fishing effort of greater silver smelt from the Icelandic bottom-trawl fishery 1991–2008. The criteria for the calculations were tows where Greater silver smelt composed at least 10%, 50% and 70% of the total catch.

8.3 Greater Silver Smelt (*Argentina Silus*) in I, II, IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV

8.3.1 The fishery

The present targeted fisheries for greater silver smelt are conducted with pelagic trawl operated very close to or at the seabed and depend on localization of aggregations.

In Subarea I and II the fishery for greater silver smelt is primarily prosecuted by licensed Norwegian trawlers that have this species as target. They operate specialised greater silver smelt "pelagic" trawls at the seabed (Hallfredsson and Svellingen, WD11, 2009) In 2004 an apparently exceptional Dutch fishery occurred. In recent years this fishery has normally ceased in late April as a result of rapidly declining catch rates (Bergstad *et al.*, WD7, 2008). This is a notable change, as April–May was regarded the best months in Subarea II in the early 1980s.

In the Skagerrak IIIa, the greater silver smelt has periodically been targeted by Norwegian, Danish and Swedish bottom trawlers. During the last 10 years it is primarily a few Danish vessels that have conducted targeted fisheries for roundnose grenadier and greater silver smelt. However, there is also a bycatch in the Norwegian and Danish small-mesh bottom-trawl fisheries along the Norwegian Deep (primarily in IVa) that land the catch for reduction. In area IV the Norwegian landings have increased from 11 tonnes in 2005 to over 3000 tonnes in 2006 and 2007, but 1550 tonnes are registered in 2008.

In the Faroes (Division Vb) especially two pairs of pairtrawlers have had a direct fishery for greater silver smelt, from early summer to autumn, for several years. In 2007 one more pair of trawlers was licensed. There is a minor bycatch of greater silver smelt in the pelagic fishery in Area Vb.

8.3.2 Landings trends

Table 8.3.1.1 lists the landings data for greater silver smelt (or argentine) *Argentina silus* by ICES Subareas/Divisions *Argentina sphyraena* may in some cases have been included in the landing figures (particularly in Subareas III and IV). This is because juveniles of the dominant species *Argentina silus* and the much smaller and less abundant *Argeninta sphyraena* may be difficult to separate in catches. Confusion arises because fleets tend to report all small specimens as *A. sphyraena* and big specimens as A. *silus*, and/or use the different names interchangeably depending on regional variations in vernacular names. Bergstad *et al.*, WD7, 2008 reported that not a single specimen of *A. sphyraena* was caught in a survey on greater silver smelt in Subarea II, III and IV in 2007, and concluded, that the amount of lesser silver smelt would be insignificant in this area.

Landings by Norway from Subareas I and II declined in the 1990s from peak levels of 10 000 to 11 000 t in the 1980s. Landings have been stable at 6–8 000 tonnes, but do reach high levels some years (e.g. 14357 tonnes in 2001). The last five years the landings have increased to around 15 000 tonnes, with the exception of 2006 when 21 700 tonnes were landed. It is thought that these fluctuations reflect variation in the market demands rather than changes in abundance of *A. silus*.

Landings in Subareas III and IV varied between 1000 and almost 4500 t. The Danish quota (part of EU TAC) for 2003 onwards was 1388 t, and the annual landings are below this level. As a consequence of the introduction of the sorting grid to the shrimp fishery the bycatch of fish is very low in the Danish, Norwegian and Swedish fishery for *Pandalus borealis*. The Norwegian bycatch in the industrial fishery for

Norway pout and blue whiting, based on sampling at fishmeal factories, is very variable. The annual estimated quantities of both greater and lesser silver smelt in 2002–2005, 2007 and 2008 are 926, 376, 786, 1348, 2172 and 868. The Norwegian landings in Subarea IV in the same period were less than 20 tonnes, but in 2006, 2007 and 2008 they were 3500, 3100 and 1550 respectively.

The landings of *A. silus* in Divisions Vb increased considerably from 1994–1998 as a direct fishery for the species started. After 1998 when 18 000 tonnes were landed, the landings were 6500 tonnes on average in 1999–2005. In 2006, 2007 and 2008 the landings have increased to 12 500, 14 100 and 14 600 tonnes respectively. The variations in the catches are largely as a consequence of market demands, and that a third pair of trawlers got licensed in 2007. Greater silver smelt is also taken as bycatch in the blue whiting fishery and in the deep-water fishery for e.g. red fish and blue ling. These bycatches are not recorded in the landings.

There has been a considerable decline in the landings of *A. silus* from Subareas VI and VII from a peak in the late 1980s to the mid 1990s, with the exception of the years 2000–2002, when the landings were between 14 000 and 19 000 tonnes. The landings have been restricted by TACs in this area. A main fleet producing catches of greater silver smelt is Dutch freezer trawlers operating in Vb, VI and VII, west and northwest of the Hebrides, from depths ranging from 600–700 m, and west of Ireland (Porcupine Bank) where smelt is a minor bycatch in the fishery directed at blue whiting (*Micromesistius poutassou*). The Dutch fleet apparently also operated in IIa in 2004. In 2004 the landings significantly exceeded the TAC for the Netherlands for V and VI.

Irish landings were very high in the late 1980s when an exploratory fishery was developed by large pelagic trawlers. However by the early 1990s landings had declined to a few hundred tonnes and directed fishing had ceased by 1993. There was some directed fishing for the species in subsequent years. In 2000 larger Irish pelagic trawlers began to direct effort at this species on the shelf edge of Subarea VIa. Landings reached over 4700 t in 2000 and were estimated at around 7500 t in 2001 and 2002. Figures for 2003 showed a very low landing of only 95 t. Because of a restrictive quota there was no Irish directed fishery for greater silver smelt. The landings by Scottish vessels also increased in 2000–2002 and between 65 and 75 % of these landings were outside the UK. The Scottish landings also dropped abruptly to a very low level in 2003. In some of the years where landings are very high, there is possibly some misreporting but no documentation of quantities is available.

The Russian bycatch statistic of greater silver smelt in the commercial blue whiting fishery in Division Vb demonstrates considerable catch decline during recent years.

8.3.3 ICES advice

ICES advised in 2008: As a consequence of its low productivity greater silver smelt can only sustain low rates of exploitation. Fisheries on such species should always be accompanied by programmes to collect data on both target and bycatch fish. The fishery should not be allowed to expand unless it can be demonstrated that it is sustainable.

8.3.4 Management

In IIa there is no TAC before 2007. In 2007, 2008 and 2008 a 12 000 t TAC was introduced as a precautionary measure to reduce an increased fishery. In addition there is a licensing system that regulates number of trawlers that can take part in the aimed fishery, equipment restriction and an area- and time restriction.

There is no species-specific management of greater silver smelt in Vb, only minimum landing size (28 cm) and a licensing system. At present licenses are issued to three pairs of pairtrawlers.

The EU introduced TAC management in 2003, and for each year quotas were set for greater silver smelt. EU TACs as valid for community vessels fishing in community waters and waters not under the sovereignty or jurisdiction of third countries are in the table below.

	2003/2004	2005	2006	2007	2008	2009
Subarea III, IV	1566	1331	1331	1331	1331	1331
Subarea V,VI, VII	6247*	5310	5310	5310	5311	5311

of which 4281 was allocated to the Netherlands in 2009.

8.3.5 Data available

8.3.5.1 Landings and discards

Argentina silus can be a very significant discard of the trawl fisheries of the continental slope of Subareas VI and VII particularly at depths 300–700m (e.g. Girard and Biseau, WD 2004). No new information was provided.

8.3.5.2 Length compositions

Length distributions were presented from a Norwegian survey in 2008 on greater silver smelt and from surveys targeting Greenland halibut 2003–2005 and beaked redfish 2008 in Subarea IIa (Figure 8.3.2.1) (Hallfredsson and Svellingen, WD11, 2009). The Greenland halibut surveys and the beaked redfish surveys cover the continental slope, but not the Norwegian continental shelf part of the distribution area and were conducted with commercial bottom trawl. According to these surveys the length distribution seems to be relatively stable the later years with mean length around 40 cm and no obvious seasonal variation. The aimed survey in 2008 was carried out for examination of acoustical properties of greater silver smelt and the trawling was by specialised greater silver smelt trawl on registrations at the fishing grounds. Thus the length distributions from this survey were presented station vice and are closer to reflect lengths in the fisheries rather than being representative for the area (Figure 8.3.2.2). The mean length in the hauls was generally lower than the distributions in the bottom-trawl surveys indicate.

The average length in Faroese commercial catches has decreased since 1994–2000 but seem to have stabilized since then (Figure 8.3.2.3) (Ofstad and í Homrum, WD14, 2009). This is probably a natural reaction as a consequence of new fishery. Length distributions were available for two Faroese surveys in Vb (1994 onwards). There was no obvious trend in either series. The bathymetric distribution of greater silver smelt from Faroese surveys is clearly size-related with larger individuals dominating in the deeper areas (Figure 8.3.2.4), as was the case for on Porcupine bank survey data presented in last year's WGDEEP report.

Length measurements from Russian trawl fisheries and research surveys from a number of areas for 2008 were presented (Vinnichenko *et al.*, WD 17, 2009). In April several tonnes of greater silver smelt individuals 13–34 cm long (mean length=21.5 cm) were taken by bottom trawl on the Fugløy Bank (at 180 m depth) in Area II.

Figure 8.3.2.5 presents the comparison between length frequency distributions from the 2001–2008 Spanish bottom-trawl surveys on the Porcupine bank (Subarea VII).

There seem to be two main modes at about 22–23 and 26–27 cm throughout the time-series, and there is a consistent decrease in numbers caught (Velasco *et al.*, WD7, 2009).

8.3.5.3 Age compositions

The age distribution of greater silver smelt in the landings in area Vb demonstrate a decrease in mean age in 1994–2000 but seem to have stabilized since then (Figure 8.3.2.6). This could reflect a natural reaction for a virgin stock to an introduced fishery, but a clearer analysis is needed to investigate this reduction for the sustainability of the fishery.

Age distribution from a Norwegian survey in 2007 on greater silver smelt was presented in Bergstad *et al.*, WD7, 2008). Compared with age-distributions in the same areas in the 1980s and early 1990s, the Subarea II demonstrated a marked decline in 20+ specimens (7% in 2007 compared with up to 26% in the 1980s) In the age distribution from the fishing grounds in the greater silver smelt survey in 2008 the same trend is observed with very few old individuals (Figure 8.3.2.2) (Hallfredsson and Svellingen, WD11, 2009).

There is an additional time-series of age information available for Dutch landings from Subarea VI but these are not yet available to the Working Group. Age distribution for 2008 from these fisheries, are presented in Table 8.3.2.1.

8.3.5.4 Weight-at-age

New data provided from Division Vb are presented in Section 8.3.3.1.

8.3.5.5 Maturity and natural mortality

In Division Vb the 50% maturity in greater silver smelt was reached at lengths of 33 cm and 35 cm for females and males, respectively. This corresponds to an age approximately 6 years for females and 8 years for males. In weights it corresponded to 290 g for females and 340 g for males. Gonadosomatic index plots seem to manifest the visual classification of maturity (Figure 8.3.2.7). There is also established a greater silver smelt maturity key with pictures for Division Vb. Average length-at-age demonstrated that females grew more quickly than males from the age of about 7 years onwards (t-test, $p<0.05$), e.g. for 18 year old fish, the divergence amounted to 2.5 cm and approximately 200 g (Ofstad and í Homrum, WD14, 2009). This is in agreement with previous findings, e.g. in data on greater silver smelt maturity from Area Vb presented in Vinnichenko, WD9, 2007.

No new data were presented on natural mortality.

8.3.5.6 Catch, effort and research vessel data

Logbook catch and corresponding effort data for the Danish fleet in Division IIIa are available for the period 1992–2006 as demonstrated in the WGDEEP report 2008. The Danish fisheries are reduced and insignificant in 2007 and 2008.

Cpue indices for greater silver smelt were presented from two Faroese groundfish surveys for cod, haddock and saithe in Vb (1994 onwards, Figure 8.3.2.8). The distribution on the Faroe plateau is illustrated in Figure 8.3.2.9.

Logbooks from three pairs of pairtrawlers (>1000 HP) fishing greater silver smelt in Faroese waters (Area Vb) are available (Ofstad and í Homrum, 2009, WD14). Figure 8.3.2.10 shows cpue where catches of greater silver smelt contribute with more than 50% of total catch in each haul for these series.

Logbook data reveals that greater silver smelt is fished mostly in the area west of the Faroes and on the continental slope north and northwest of the Faroe Bank, at depths around 300–700 meters. To some extent, there is also being trawled on the Bill Bailey Bank and Lousy Bank and north of the Faroes (Figure 8.3.2.11).

Spanish research bottom-trawl surveys have been carried out in Subarea VII (Porcupine) since 2001. Figure 8.3.2.12 shows the catch rate of greater silver smelt and Figure 8.3.2.13 the geographical distribution. Blue whiting is the most abundant species in the survey area.

In April 2008 research survey was conducted in Norwegian waters with the intention to investigate acoustical target strength (TS) for greater silver smelt using an acoustical probe (Hallfredsson and Svellingen, WD11, 2009). On 7 out of 9 stations with the TS-probe, target strength estimations were achieved. The estimated mean TS varied from 35.8–39.5 dB and the estimated values of the B_{20} coefficient varied from 66.1 to 69.3. The results are in accordance to earlier findings and the preliminary recommended TS to length relation equation for greater silver smelt is TS=20logL+68.

8.3.6 Data analyses

No new data analyses have been carried out; however an exploratory assessment has been trialled for Division Vb. The current ICES structure for greater silver smelt is that ICES Subareas I, II, IV, VI, VII, VIII, IX, X, XII and XIV and Divisions IIIa and Vb, are treated as one stock. Only the greater argentine around Iceland (Division Va) is treated as a local stock. For the purpose of an exploratory assessment, WGDEEP in 2009 has made an assumption that greater silver smelt around Faroe Island can be treated as a separate assessment unit. However, available information is not sufficient to suggest changes to current ICES interpretation of stock structure.

8.3.6.1 Exploratory assessment of greater silver smelt in Division Vb

An analytical assessment exercise on greater silver smelt in Vb was attempted (Ofstad and í Homrum, WD14, 2009). The assessment series is from 1995–2008, only 13 years, but it covers the time period of the directed fishery for greater silver smelt in Division Vb. The age range in the analysis is from age 4 to 14+.

Catch-at-age is based on length, weight and otoliths samples from Faroese landings of pairtrawlers (>1000 HP), and landing statistic by fleet provided by the Faroese Authorities. Catch-at-age was calculated for the pairtrawler fleet for the period from May to September and raised to include foreign catches (Table 8.3.3.1). There are many year classes in the samples (Figure 8.3.2.6), because greater silver smelt is a long living species.

Mean weight-at-age of greater silver smelt in the Faroese landings have varied since the introduction of the fishery, but there are no obvious trends (Table 8.3.3.2 and Figure 8.3.3.1).

Maturity-at-age data were available from Faroese studies (see WD14, 2009), for 2006 and 2007, and the proportion mature for all years was set to be the average of these two years (Table 8.3.3.3 and Figure 8.3.3.2).

A separable analysis was run as (age 12 for unit selection, terminal F of 0.4 and S of 1) in order to test the catch dataset for outliers. The separable analysis demonstrated that the catch number-at-age data are noisy, with high residuals for young fish (Table 8.3.3.4 and Figure 8.3.3.3).

Although the quality of the input data can be questioned, a tentative XSA was performed. The XSA was calibrated with pairtrawlers as tuning series (Table 8.3.3.5). XSA runs were carried out for a range of natural mortality and the summary results of four of them are presented in Figure 8.3.3.4. The XSA settings were; catchability independent of stock size for ages < 7, catchability independent of age for ages ≥ 11, and time tapered weighting applied. In the first one were natural mortality set as 0.2 as usual for most stocks, second one had M=0.15 and the third M=0.1. The shrinkage of the SE of the mean was set at = 0.5 for the first three runs and 2.0 with natural mortality 0.15 for the fourth.

The diagnostics for XSA (M=0.15 and shrinkage=2.0) are in Table 8.3.3.6 and the outputs from these are presented in Tables 8.3.3.7–8.3.3.9. The tuning did not converge after 50 iterations. Log catchability residuals are noisy, especially for age 4 and year 1995 (Figure 8.3.3.5).

Retrospective analysis of the average fishing mortality from the XSA (M=0.15 and shrinkage=2.0) for age groups 6–11 are presented in Figure 8.3.3.6.

The recruitment, fishing mortalities, biomass and spawning biomass for 1995–2008 are presented in Figure 8.3.3.4 for four different XSA runs.

8.3.7 Comments on the assessment

The results are unreliable for a number of reasons and are presented here for illustrative purposes only.

The available time-series catch and tuning data is short, 14 years only, compared with the longevity of the species. Furthermore, the pair trawl fleet used for tuning accounts for around 60 to 80% of the total catch in the assessment and the same age structure is assumed in both the tuning fleet and the total catch data. A major concern is that greater silver smelt in Vb are only a component of what is considered may be a larger stock in Subareas/Divisions I, II, IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV. These factors are likely to have contributed to the absence of convergence.

This stock is suggested for benchmarking in 2010 and guidance is requested as to whether age structured assessment would be appropriate. It has earlier been discussed that maybe an acoustic survey combined with biological sampling would provide a more appropriate tuning fleet for greater silver smelt.

8.3.8 Management considerations

No advice is required for this management unit in 2009.

Under no circumstances should the inference be made that greater silver smelt in Vb should be treated as a separate stock for advisory or management purposes. The exercise carried out here is simply to trial an age based method (XSA) on what is a long lived bentho-pelagic species.

Table 8.3.1.1. Greater Silver Smelt I, II, IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV. WG estimates of landings in tonnes. *) landings in 2008 are preliminary.

Greater silver smelt (*Argentina silus*) I and II

Year	Germany	Netherlands	Norway	Poland	Russia/USSR	Scotland	France	Faroes	TOTAL
1988			11332	5	14				**11351**
1989			8367		23				**8390**
1990		5	9115						**9120**
1991			7741						**7741**
1992			8234						**8234**
1993			7913						**7913**
1994			6217			590			**6807**
1995	357		6418						**6775**
1996			6604						**6604**
1997			4463						**4463**
1998	40		8221						**8261**
1999			7145			18			**7163**
2000		3	6075		195	18	2		**6293**
2001			14357		7	5			**14369**
2002			7405			2			**7407**
2003		555	8345		7	2	4	4	**8917**
2004		4601	11557		4				**16162**
2005			17063		16			14	**17093**
2006			21681		4				**21685**
2007			13272		1				**13273**
2008*			11876						**11876**

Greater silver smelt (*Argentina silus*) III and IV

YEAR	DENMARK	FAROES	FRANCE	GERMANY	NETHERLANDS	NORWAY	SCOTLAND	SWEDEN	IRELAND	TOTAL
1988	1062			1		1655				**2718**
1989	1322				335	2128	1			**3786**
1990	737			13		1571				**2321**
1991	1421		1		3	1123	6			**2554**
1992	4449			1	70	698	101			**5319**
1993	2347				298	568	56			**3269**
1994	1480					4	24			**1508**
1995	1061					1	20			**1082**
1996	2695	370				213	22			**3300**
1997	1332			1		704	19	542		**2598**
1998	2716			128	277	434		427		**3982**
1999	3772		82		7	5	452		2	**4320**
2000	1806		270			32	78	273	12	**2471**
2001	1653		28			3	227	1011	3	**2925**
2002	1161					1	161	484	4	**1811**
2003	1119				42	6	20		1	**1188**
2004	1036			4	42	17	12		46	**1157**
2005	733			1	28	11			18	**791**
2006	548					3468				**4016**
2007	243					3100				**3343**
2008*	23	58				1548				**1629**

Table 8.3.1.1 (continued).

Greater silver smelt (*Argentina silus*) Vb

YEAR	FAROES	RUSSIA/USSR	UK (SCOT)	UK(EWN)	IRELAND	FRANCE	NETHERLANDS	NORWAY	TOTAL
1988	287								**287**
1989	111	116							**227**
1990	2885	3							**2888**
1991	59		1						**60**
1992	1439	4							**1443**
1993	1063								**1063**
1994	960								**960**
1995	5534	6752							**12286**
1996	9495		3						**9498**
1997	8433								**8433**
1998	17570								**17570**
1999	8186		15	23		5			**8214**
2000	3713	1185	247			64			**5209**
2001	9572	414	94		1				**10081**
2002	7058	264	144				5		**7471**
2003	6261	245	1				42		**6549**
2004	3441	702	42				2266		**6451**
2005	6939	59					11		**7009**
2006	12524	35							**12559**
2007	14085	8						32	**14093**
2008*	14576	19						3	**14595**

Greater silver smelt (*Argentina silus*) VI and VII

YEAR	FAROES	FRANCE	GERMANY	IRELAND	NETHERLANDS	NORWAY	E&W	SCOTLAND	N.I.	RUSSIA	SPAIN	TOTAL
1988				5454		4984						**10438**
1989	188			6103	3715	12184	198	3171				**25559**
1990	689		37	585	5871			112				**7294**
1991		7		453	4723			10	4			**5197**
1992		1		320	5118			467				**5906**
1993					1168			409				**1577**
1994			43	150	4137			1377				**5707**
1995	1597		357	6	4136			146				**6242**
1996			1394	295	3953			221				**5863**
1997			1496	1089	4695			20				**7300**
1998			463	405	4687							**5555**
1999		21	24	394	8025			387		5		**8856**
2000		17	482	4703	3636			4965		29	34	**13866**
2001		12	189	7494	3659			7620		76		**19050**
2002			150	7589	4020			4197		29		**15985**
2003			164	95	1933			89		163	7	**2451**
2004		147	652	46	3731			526		12	19	**5133**
2005	103	10	131	1	3465			75		4	19	**3808**
2006	53				1062							**1115**
2007	254				3866	3						**4122**
2008*	991				3040	3				1		**4035**

Table 8.3.1.1 (continued).

Greater silver smelt (*Argentina silus*) VIII

YEAR	NETHERLANDS	TOTAL
2002	191	**191**
2003	37	**37**
2004	23	**23**
2005	202	**202**
2006		
2007		
2008*		

Greater silver smelt (*Argentina silus*) XII

YEAR	FAROES	ICELAND	RUSSIA	NETHERLANDS	TOTAL
1988					
1989					
1990					
1991					
1992					
1993	6				**6**
1994					
1995					
1996	1				**1**
1997					
1998					
1999					
2000		2			**2**
2001					
2002					
2003					
2004			4		**4**
2005				322	**322**
2006					
2007					
2008*					

Table 8.3.1.1 (continued).

Greater silver smelt (*Argentina silus*) XIV

YEAR	NORWAY	ICELAND	TOTAL
1988			
1989			
1990	6		**6**
1991			
1992			
1993			
1994			
1995			
1996			
1997			
1998			
1999			
2000		217	**217**
2001	66		**66**
2002			
2003			
2004			
2005			
2007			
2008*			

Greater silver smelt (*Argentina silus*) (all areas)

Year	I + II	III + IV	Va	Vb	VI + VII	VIII	XII	XIV	Total
1988	11351	2718	206	287	10438				**25000**
1989	8390	3786	8	227	25559				**37970**
1990	9120	2321	112	2888	7294			6	**21741**
1991	7741	2554	247	60	5197				**15799**
1992	8234	5319	657	1443	5906				**21559**
1993	7913	3269	1255	1063	1577		6		**15083**
1994	6807	1508	613	960	5707				**15595**
1995	6775	1082	492	12286	6242				**26877**
1996	6604	3300	808	9498	5863		1		**26074**
1997	4463	2598	3367	8433	7300				**26161**
1998	8261	3982	13387	17570	5555				**48755**
1999	7163	4320	6704	8214	8856		2		**35259**
2000	6293	2471	5657	5209	13866			217	**33713**
2001	14369	2925	3043	10081	19050			66	**49534**
2002	7407	1811	4960	7471	15985	191			**37825**
2003	8917	1188	2683	6549	2451	37			**21825**
2004	16162	1157	3645	6451	5133	23	4		**32575**
2005	17093	791	4481	7009	3808	202	322		**33706**
2006	21685	4016	4775	12559	1115	0	0		**44150**
2007	13273	3343	4227	14093	4122				**39059**
2008*	11876	1629	8778	14595	4035				**40913**

Table 8.3.2.1. Age readings from the Netherland's fisheries in area VIa 2008, by sex and time period.

		MALE						FEMALE					
		Q1			Q2			Q1			Q2		
		numbers	weight	length	numbers	weight	length	numbers	weight	length	numbers	weight	length
Age	Yearclass	('000)	(kg)	(cm)	('000)	(kg)	(cm)	('000)	(kg)	(cm)	('000)	(kg)	(cm)
0	2008												
1	2007												
2	2006												
3	2005												
4	2004				19.4	0.266	33.5						
5	2003	69.3	0.245	33	58.1	0.276	34.17				38.8	0.327	35.5
6	2002	34.7	0.265	33.5	155	0.321	35.5	34.7	0.337	35.5	135.6	0.345	36.21
7	2001	138.6	0.305	34.75	251.9	0.308	35.35	69.3	0.384	36	232.5	0.37	37
8	2000	242.6	0.304	34.93	658.8	0.333	36.09	69.3	0.439	37.5	542.5	0.397	37.75
9	1999	173.3	0.335	36.1	465	0.346	36.25	69.3	0.388	37	697.5	0.4	38.17
10	1998	242.6	0.325	35.64	658.8	0.364	36.74	242.6	0.397	37.21	736.3	0.433	38.87
11	1997	138.6	0.325	35.25	213.1	0.4	38.14	34.7	0.275	.34.50	426.3	0.432	38.73
12	1996	69.3	0.341	35.5	387.5	0.401	38.2	69.3	0.406	.37.5	155	0.479	40.38
13	1995				38.8	0.383	38.5	34.7	0.476	.39.5	77.5	0.518	41.5
14	1994				19.4	0.513	40.5				58.1	0.497	40.5
15 +	1993				96.9	0.479	40.5				135.6	0.564	42.21
Sample weight (kg)				17.1			126.3			17.1			126.3
Number of samples				2			22			2			22
Number of age readings				32			156			18			167

Table 8.3.3.1. Greater silver smelt (Division Vb). Catch number-at-age (thousands) from the Faroese pairtrawler fleet.

Table 1 Catch numbers at age Numbers*10**-3

YEAR	1995	1996	1997	1998
AGE				
4	1	39	57	1
5	1	48	202	1558
6	40	207	882	2686
7	203	469	994	2963
8	847	1390	1340	5333
9	2486	2736	2394	3912
10	2635	3226	2971	3936
11	2820	2683	2281	4143
12	3377	3461	2244	3820
13	4237	1994	1739	4428
+gp	4395	3181	2525	4705
0 TOTALNUM	21042	19434	17629	37485
TONSLAND	12286	9498	8433	17570
SOPCOF %	100	100	100	100

YEAR	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
AGE										
4	1	1	73	64	1	1	1	2100	489	1413
5	708	273	662	1023	1	76	1374	4979	2228	3053
6	1381	1339	2612	2921	156	372	1911	3968	4997	4599
7	1780	1448	3888	2754	1145	1270	2398	3318	6043	6546
8	2248	2123	4658	3669	2572	2833	3096	6183	4880	5556
9	2279	1245	4943	3342	4223	4414	2939	4257	5881	5604
10	2755	1502	2303	1969	2869	3093	3939	4228	3731	6896
11	2706	1213	1821	1594	1738	1827	1851	2465	3079	4964
12	2364	831	1384	1508	1656	1041	1024	1291	1008	3613
13	2101	963	1408	818	749	560	651	963	756	3124
+gp	1627	898	1401	617	897	491	185	776	311	2112
0 TOTALNUM	19950	11836	25153	20279	16007	15978	19369	34528	33403	47480
TONSLAND	8214	5209	10081	7471	6549	6451	7009	12559	13357	19272
SOPCOF %	100	100	100	100	100	100	100	101	100	100

Table 8.3.3.2. Greater silver smelt (Division Vb). Catch weights-at-age (kg) from the Faroese pair-trawler fleet.

Table 2 Catch weights at age (kg)

YEAR	1995	1996	1997	1998
AGE				
4	.1900	.2020	.1610	.1900
5	.2360	.2240	.1980	.2570
6	.4550	.2600	.2740	.2680
7	.3380	.2940	.3400	.3080
8	.3630	.3590	.3630	.3980
9	.4320	.3730	.4000	.4160
10	.4690	.4300	.4530	.4700
11	.5430	.4850	.4790	.5170
12	.5920	.5020	.5230	.5290
13	.6800	.6240	.5790	.6280
+gp	.7220	.6590	.6890	.6360
0 SOPCOFAC	.9997	1.0002	1.0002	1.0001

YEAR	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
AGE										
4	.1900	.1900	.1870	.1460	.1900	.1900	.1900	.2100	.2210	.2020
5	.2120	.2880	.2200	.2180	.2360	.2180	.2150	.2450	.2800	.2540
6	.2340	.2860	.2610	.2540	.2490	.2760	.2710	.2980	.3190	.3010
7	.2910	.3450	.3140	.2960	.3240	.3040	.3080	.3350	.3670	.3560
8	.3240	.3660	.3520	.3530	.3520	.3740	.3170	.3500	.3800	.3670
9	.3710	.3770	.3990	.3760	.3620	.3740	.3830	.3750	.4110	.3710
10	.4190	.4590	.4260	.4060	.3860	.4100	.3910	.4180	.4850	.4280
11	.4460	.5170	.4970	.4540	.4560	.4550	.4430	.4890	.4890	.4720
12	.5050	.5730	.5310	.5060	.4840	.4970	.5130	.5130	.5390	.5360
13	.5320	.5980	.6180	.5480	.5400	.5630	.5360	.6030	.6300	.5790
+gp	.6020	.7050	.6520	.6390	.6680	.6260	.6390	.6450	.6680	.6340
0 SOPCOFAC	.9996	.9999	1.0003	1.0001	.9999	.9993	.9996	1.0103	.9999	1.0000

Table 8.3.3.3. Greater silver smelt (Division Vb). Proportions mature used in the VPA assessment.

AGE	4	5	6	7	8	9	10	11	12	13	14
Maturity (%)	0.05	0.13	0.29	0.52	0.75	0.89	0.96	0.98	0.99	1.00	1.00

Table 8.3.3.4. Greater silver smelt (Division Vb). Separable VPA analysis.

```
Title : Argentina Silus (ICES Division Vb)                 AS_IND

At 15/03/2009   9:37

Separable analysis
from 1995 to 2008 on ages  4 to 13
with Terminal F of  .400 on age 12 and Terminal S of 1.000

Initial sum of squared residuals was   597.357 and
  final sum of squared residuals is    211.956 after  78 iterations

Matrix of Residuals


 Years    1995/961996/971997/98
  Ages

  4/ 5     -.593  1.095   .087
  5/ 6    -2.537  -.656   .314
  6/ 7     -.782  -.435   .549
  7/ 8     -.622  -.305  -.340
  8/ 9     -.224  -.164  -.126
  9/10      .536   .134   .261
 10/11      .515   .293   .155
 11/12      .162  -.037  -.172
 12/13     1.104   .688  -.117

  TOT       .018   .015   .011
  WTS       .001   .001   .001

 Years    1998/991999/**2000/**2001/**2002/**2003/**2004/**2005/**2006/**2007/**        TOT         WTS

  4/ 5    -4.474 -3.612 -3.274  -.454  6.317 -1.575 -4.523 -5.655  2.319  1.004      -8.434        .068
  5/ 6     1.720   .875   .471   .213  3.553 -3.650 -1.012  1.302  1.880  1.611        .134        .118
  6/ 7      .870   .338   .526   .507  1.481  -.958  -.788   .662   .312   .903        .134        .302
  7/ 8      .310  -.192   .010   .199   .210  -.170  -.230  -.169  -.096   .800        .133        .634
  8/ 9      .471   .190  -.056   .069  -.384  -.186   .229   .043  -.090   .138        .133       1.000
  9/10     -.234  -.164  -.010   .460  -.271   .489   .191  -.209  -.228  -.111        .133        .762
 10/11     -.507  -.045   .141  -.383  -.582   .354   .311   .339  -.341  -.529        .133        .577
 11/12     -.471   .155   .054  -.715  -.904   .259   .226   .091   .094  -.534        .133        .586
 12/13     -.194   .101  -.122  -.142   .062  1.052   .342   .023  -.021 -1.266        .133        .374

  TOT       .008   .004   .001  -.001  -.001   .000   .001   .001   .001   .001      -6.473
  WTS       .001   .001   .001   .001   .001  1.000  1.000  1.000  1.000  1.000


  Fishing Mortalities (F)

            1995   1996   1997   1998
F-values   .0409  .0903  .1162  .2887

            1999   2000   2001   2002   2003   2004   2005   2006   2007   2008
F-values   .1941  .1191  .2485  .1841  .1326  .1737  .2157  .3133  .2814  .4000

 Selection-at-age (S)

               4      5      6      7      8      9     10     11     12     13
S-values   .0010  .0139  .1205  .3466  .6961 1.0029 1.2634 1.2281 1.0000 1.0000
```

Table 8.3.3.5. Greater silver smelt (Division Vb). Effort (hours) and catch in number-at-age for Faroese commercial pairtrawlers.

Argentina Silus (ICES Div. Vb)   PairTrawl.dat

101
PairTrawl >1000 HP
1995 2008
1 1 0 0
4 14

1319	1	1	7	34	140	410	435	465	557	699	725
1172	8	10	44	99	293	578	681	567	731	421	672
1599	21	75	325	367	494	883	1096	841	828	641	931
1323	1	322	556	613	1103	809	814	857	790	916	973
649	1	117	227	293	370	375	454	446	389	346	268
990	1	114	558	604	885	519	626	506	346	401	374
2187	36	327	1292	1924	2305	2446	1140	901	685	697	693
2032	29	462	1318	1243	1656	1508	888	719	680	369	278
1651	1	1	85	620	1393	2288	1554	941	897	406	486
807	1	28	136	466	1039	1619	1134	670	382	205	180
2900	1	1271	1769	2219	2864	2720	3645	1713	947	603	171
3062	1307	3100	2470	2065	3849	2650	2632	1534	804	599	483
4127	352	1602	3594	4346	3510	4230	2683	2214	725	544	224
3010	660	1426	2148	3057	2595	2618	3221	2319	1688	1459	986

Table 8.3.3.6. Greater silver smelt (Division Vb). Diagnostices from XSA with Faroese commercial pairtrawlers as tuning serie. Natural mortality 0.15 and shrinkage 2.0.

```
Lowestoft VPA Version 3.1
   9/03/2009  12:31
Extended Survivors Analysis

 Argentina Silus (ICES Division Vb)                 AS_IND

 CPUE data from file D:\gulllaksur\Stovnsmeting\VPA\GL4-14\PairTrawl.DAT

 Catch data for  14 years. 1995 to 2008. Ages  4 to  14.

      Fleet            First Last First Last Alpha  Beta
                        year year  age   age
 PairTrawl >1000 HP      1995 2008   4    13   .330   .750

 Time series weights :

      Tapered time weighting applied
      Power =    3 over  20 years

 Catchability analysis :
      Catchability dependent on stock size for ages <    7

         Regression type = C
         Minimum of   5 points used for regression
         Survivor estimates shrunk to the population mean for ages <  7

      Catchability independent of age for ages >=   11

 Terminal population estimation :

      Survivor estimates shrunk towards the mean F
      of the final   5 years or the   5 oldest ages.

      S.E. of the mean to which the estimates  are shrunk =   2.000

      Minimum standard error for population
      estimates derived from each fleet =    .300

      Prior weighting not applied

 Tuning had not converged after   50 iterations

 Total absolute residual between iterations
 49 and  50 =     .01487

 Final year F values
 Age              4      5      6      7      8      9     10     11     12     13
 Iteration 49  .0162  .0386  .0692  .0948  .1131  .1863  .3603  .3199  .2922  .3469
 Iteration 50  .0163  .0387  .0697  .0964  .1145  .1874  .3635  .3169  .2909  .3441

Regression weights
         .751  .820  .877  .921  .954  .976  .990  .997 1.000 1.000

 Fishing mortalities
    Age  1999  2000  2001  2002  2003  2004  2005  2006  2007  2008
      4  .000  .000  .001  .001  .000  .000  .000  .022  .005  .016
      5  .010  .004  .009  .015  .000  .001  .015  .048  .028  .039
      6  .024  .023  .043  .048  .003  .006  .030  .051  .059  .070
      7  .044  .030  .081  .056  .023  .026  .046  .064  .096  .096
      8  .087  .064  .123  .097  .064  .068  .077  .153  .121  .115
      9  .118  .060  .196  .115  .147  .142  .089  .137  .202  .187
     10  .192  .101  .143  .105  .130  .145  .172  .169  .162  .363
     11  .214  .115  .162  .132  .121  .108  .115  .146  .170  .317
     12  .224  .089  .176  .185  .187  .094  .077  .104  .078  .291
     13  .297  .127  .203  .142  .125  .084  .074  .092  .077  .344
```

XSA population numbers (Thousands)

	AGE									
YEAR	4	5	6	7	8	9	10	11	12	13
1999	9.02E+04	7.49E+04	6.20E+04	4.50E+04	2.91E+04	2.21E+04	1.70E+04	1.51E+04	1.27E+04	8.81E+03
2000	9.12E+04	7.76E+04	6.38E+04	5.21E+04	3.71E+04	2.29E+04	1.69E+04	1.21E+04	1.05E+04	8.72E+03
2001	8.57E+04	7.85E+04	6.66E+04	5.37E+04	4.35E+04	3.00E+04	1.86E+04	1.31E+04	9.25E+03	8.28E+03
2002	9.02E+04	7.37E+04	6.69E+04	5.49E+04	4.26E+04	3.31E+04	2.12E+04	1.38E+04	9.62E+03	6.68E+03
2003	9.29E+04	7.76E+04	6.25E+04	5.49E+04	4.47E+04	3.33E+04	2.54E+04	1.64E+04	1.04E+04	6.88E+03
2004	1.19E+05	7.99E+04	6.68E+04	5.36E+04	4.62E+04	3.61E+04	2.47E+04	1.92E+04	1.25E+04	7.45E+03
2005	1.34E+05	1.02E+05	6.87E+04	5.71E+04	4.50E+04	3.71E+04	2.69E+04	1.84E+04	1.48E+04	9.82E+03
2006	1.04E+05	1.15E+05	8.66E+04	5.74E+04	4.70E+04	3.59E+04	2.92E+04	1.95E+04	1.41E+04	1.18E+04
2007	1.01E+05	8.80E+04	9.46E+04	7.08E+04	4.63E+04	3.47E+04	2.69E+04	2.12E+04	1.45E+04	1.10E+04
2008	9.43E+04	8.66E+04	7.36E+04	7.68E+04	5.53E+04	3.53E+04	2.44E+04	1.97E+04	1.54E+04	1.16E+04

Table 8.3.3.6. Continues.

Estimated population abundance at 1st Jan 2009

0.00E+00 7.97E+04 7.12E+04 5.87E+04 5.92E+04 4.21E+04 2.52E+04 1.45E+04 1.24E+04 9.96E+03

Taper weighted geometric mean of the VPA populations:

9.55E+04 8.01E+04 6.57E+04 5.30E+04 4.14E+04 3.13E+04 2.33E+04 1.72E+04 1.27E+04 9.39E+03

Standard error of the weighted Log(VPA populations) :

.1745 .2023 .2229 .2264 .1925 .1777 .1797 .1836 .1875 .2514

Log catchability residuals.

Fleet : PairTrawl >1000 HP

Age	1995	1996	1997	1998
4	2.71	.25	-.55	2.33
5	-.25	.10	.11	.22
6	-.52	-.13	.29	.24
7	-2.73	-1.40	-.47	.28
8	-1.95	-.95	-.59	.41
9	-1.07	-.60	-.33	-.03
10	-.96	-.37	-.20	-.11
11	-.56	-.28	-.17	.11
12	-.16	.40	.11	.36
13	-.19	.07	.38	.96

Age	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
4	1.57	1.99	-.78	-.69	2.49	1.52	2.69	-4.29	-2.62	-3.51
5	.16	.06	.08	.21	-.70	-.15	-.02	-.02	.11	.15
6	.08	.17	.14	.16	-.41	-.18	.11	-.05	-.12	.09
7	.03	.18	.54	.14	-.37	.09	.32	.20	.45	.33
8	.05	.24	.28	.03	.00	.39	.16	.40	.00	-.17
9	-.04	-.21	.35	-.20	.44	.73	-.09	-.11	.12	-.07
10	.26	.11	-.15	-.48	.12	.55	.37	-.09	-.29	.41
11	.38	.26	-.02	-.24	.06	.27	-.02	-.23	-.23	.28
12	.42	.00	.06	.10	.50	.13	-.42	-.57	-1.02	.20
13	.71	.35	.21	-.17	.09	.02	-.46	-.70	-1.02	.37

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	7	8	9	10	11	12	13
Mean Log q	-11.4341	-10.7605	-10.3648	-10.1685	-10.1816	-10.1816	-10.1816

Regression statistics :

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
4	-1.01	-.429	6.49	.00	14	2.64	-16.37
5	.15	2.094	11.62	.39	14	.27	-13.54
6	.25	2.375	11.35	.51	14	.23	-12.13

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
7	.37	2.088	11.08	.54	14	.22	-11.43
8	.64	.666	10.71	.27	14	.33	-10.76
9	.70	.598	10.36	.30	14	.28	-10.36
10	1.10	-.136	10.18	.16	14	.43	-10.17
11	1.52	-.793	10.40	.20	14	.39	-10.18
12	7.49	-1.173	15.13	.00	14	3.34	-10.21
13	1.87	-.669	11.09	.06	14	1.06	-10.18

Terminal year survivor and F summaries :

Age 4 Catchability dependent on age and year class strength

Year class = 2004

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
PairTrawl >1000 HP	2383.	2.985	.000	.00	1	.004	.438
P shrinkage mean	80098.	.20				.985	.016
F shrinkage mean	240456.	2.00				.010	.005

Weighted prediction :

Survivors	Int	Ext	N	Var	F

Table 8.3.3.6. Continues.

```
Age  5   Catchability dependent on age and year class strength

 Year class = 2003

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP          81291.   .298       .285    .96   2  .346     .034

   P shrinkage mean       65668.    .22                        .646     .042

   F shrinkage mean      154027.   2.00                        .008     .018

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
     71191.       .18      .14    4    .801   .039

Age  6   Catchability dependent on age and year class strength

 Year class = 2002

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP          63917.   .212       .209    .99   3  .510     .065

   P shrinkage mean       53034.    .23                        .484     .077

   F shrinkage mean      141422.   2.00                        .006     .030

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
     58683.       .15      .13    5    .829   .070

Age  7   Catchability constant w.r.t. time and dependent on age

 Year class = 2001

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP          58751.   .203       .128    .63   4  .988     .098

   F shrinkage mean      115559.   2.00                        .012     .051

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
     59233.       .20      .12    5    .576   .096

Age  8   Catchability constant w.r.t. time and dependent on age

 Year class = 2000

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP          41984.   .190       .086    .45   5  .989     .116

   F shrinkage mean       50699.   2.00                        .011     .097

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
     42074.       .19      .08    6    .408   .115

 Age  9   Catchability constant w.r.t. time and dependent on age

 Year class = 1999

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP          25101.   .173       .082    .48   6  .990     .188

   F shrinkage mean       33644.   2.00                        .010     .144

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
     25178.       .17      .08    7    .439   .187
```

Table 8.3.3.6. Continues.

```
Age 10   Catchability constant w.r.t. time and dependent on age

 Year class = 1998

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP          14275.   .166       .168   1.01   7  .987     .370

   F shrinkage mean       37910.   2.00                       .013     .156

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
     14452.       .17      .16    8    .966   .363

Age 11   Catchability constant w.r.t. time and dependent on age

 Year class = 1997

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP          12341.   .144       .105    .73   8  .991     .317

   F shrinkage mean       32539.   2.00                       .009     .132

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
     12447.       .14      .10    9    .719   .317

Age 12   Catchability constant w.r.t. time and age (fixed at the value for age) 11

 Year class = 1996

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP           9867.   .140       .074    .53   9  .991     .292

   F shrinkage mean       29309.   2.00                       .009     .108

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
      9964.       .14      .08   10    .557   .291

Age 13   Catchability constant w.r.t. time and age (fixed at the value for age) 11

 Year class = 1995

 Fleet                 Estimated    Int       Ext    Var    N Scaled  Estimated
                       Survivors    s.e       s.e   Ratio     Weights    F
 PairTrawl >1000 HP           7081.   .139       .155   1.11  10  .990     .343

   F shrinkage mean        9953.   2.00                       .010     .256

 Weighted prediction :

 Survivors        Int      Ext    N    Var     F
 at end of year   s.e      s.e         Ratio
      7105.       .14      .15   11   1.054   .344
```

Table 8.3.3.7. Greater silver smelt (Division Vb). Fishing mortality (F)-at-age. Natural mortality 0.15 and shrinkage 2.0.

Table 8 Fishing mortality (F) at age

YEAR / AGE	1995	1996	1997	1998
4	.0000	.0006	.0007	.0000
5	.0000	.0010	.0034	.0230
6	.0011	.0051	.0219	.0539
7	.0055	.0148	.0290	.0904
8	.0238	.0451	.0506	.2022
9	.0859	.0949	.0969	.1937
10	.1159	.1453	.1342	.2162
11	.1702	.1571	.1375	.2649
12	.2540	.3073	.1807	.3380
13	.2472	.2211	.2357	.6052
+gp	.2472	.2211	.2357	.6052
0 FBAR 6-11	.0671	.0770	.0784	.1702

Table 8 Fishing mortality (F) at age

YEAR / AGE	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	FBAR **-**
4	.0000	.0000	.0009	.0008	.0000	.0000	.0000	.0219	.0052	.0163	.0145
5	.0102	.0038	.0091	.0151	.0000	.0010	.0146	.0477	.0277	.0387	.0380
6	.0243	.0229	.0432	.0482	.0027	.0060	.0304	.0507	.0586	.0697	.0597
7	.0435	.0304	.0813	.0556	.0227	.0258	.0463	.0643	.0965	.0964	.0857
8	.0871	.0637	.1227	.0974	.0641	.0684	.0771	.1531	.1205	.1145	.1294
9	.1180	.0603	.1958	.1152	.1472	.1415	.0892	.1369	.2019	.1874	.1754
10	.1922	.1008	.1435	.1054	.1299	.1449	.1715	.1694	.1619	.3635	.2316
11	.2142	.1148	.1618	.1325	.1211	.1083	.1148	.1462	.1699	.3169	.2110
12	.2245	.0891	.1758	.1851	.1875	.0939	.0774	.1038	.0778	.2909	.1575
13	.2970	.1268	.2026	.1415	.1248	.0845	.0742	.0920	.0773	.3441	.1711
+gp	.2970	.1268	.2026	.1415	.1248	.0845	.0742	.0920	.0773	.3441	
0 FBAR 6-11	.1132	.0655	.1247	.0924	.0813	.0825	.0882	.1201	.1349	.1914	

Table 8.3.3.8. Greater silver smelt (Division Vb). Stock number-at-age (start of the year) (thousands). Natural mortality 0.15 and shrinkage 2.0.

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR / AGE	1995	1996	1997	1998
4	59289	74822	85692	87024
5	50941	51029	64364	73703
6	40135	43844	43877	55211
7	39662	34507	37545	36947
8	38759	33949	29265	31393
9	32555	32574	27930	23946
10	25952	25714	25499	21819
11	19424	19892	19139	19191
12	16230	14102	14632	14357
13	20850	10836	8927	10512
+gp	21541	17223	12912	11076
0 TOTAL	365336	358493	369782	385178

YEAR / AGE	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	GMST 95-**	AMST 95-**
4	90180	91202	85722	90221	92883	118561	133955	104467	101178	94327	0	91042	92835
5	74901	77618	78497	73714	77595	79944	102045	115295	87968	86631	79733	74718	76637
6	61991	63811	66553	66949	62497	66785	68738	86556	94617	73647	71192	59234	60579
7	45029	52075	53681	54859	54913	53647	57138	57391	70818	76801	58683	47339	48116
8	29052	37105	43478	42596	44663	46202	44996	46954	46318	55348	59233	38475	39034
9	22073	22919	29967	33100	33259	36055	37138	35856	34678	35339	42074	30168	30615
10	16981	16884	18572	21207	25389	24709	26938	29239	26912	24391	25178	22892	23242
11	15128	12060	13139	13848	16426	19191	18397	19532	21243	19702	14452	16876	17114
12	12674	10510	9255	9619	10441	12526	14823	14117	14524	15428	12447	12573	12774
13	8813	8715	8275	6681	6880	7450	9815	11808	10953	11566	9964	9492	9964
+gp	6793	8107	8206	5026	8219	6519	2784	9495	4497	7778	11850		
TOTAL	383615	401006	415344	417822	433166	471589	516769	530711	513707	500958	384805		

Table 8.3.3.9. Greater silver smelt (Division Vb). Summary table. Natural mortality 0.15 and shrinkage 2.0.

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 4	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 6-11
1995	59289	145144	98725	12286	.1244	.0671
1996	74822	118323	75967	9498	.1250	.0770
1997	85692	115559	72096	8433	.1170	.0784
1998	87024	125526	72467	17570	.2425	.1702
1999	90180	107265	56846	8214	.1445	.1132
2000	91202	129053	66722	5209	.0781	.0655
2001	85722	124606	68292	10081	.1476	.1247
2002	90221	116605	64596	7471	.1157	.0924
2003	92883	128625	70491	6549	.0929	.0813
2004	118561	138823	74900	6451	.0861	.0825
2005	133955	145432	74702	7009	.0938	.0882
2006	104467	167345	88047	12559	.1426	.1201
2007	101178	176191	92839	13357	.1439	.1349
2008	94327	163627	90312	19272	.2134	.1914
Arith. Mean	93537	135866	76214	10283	.1334	.1062
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

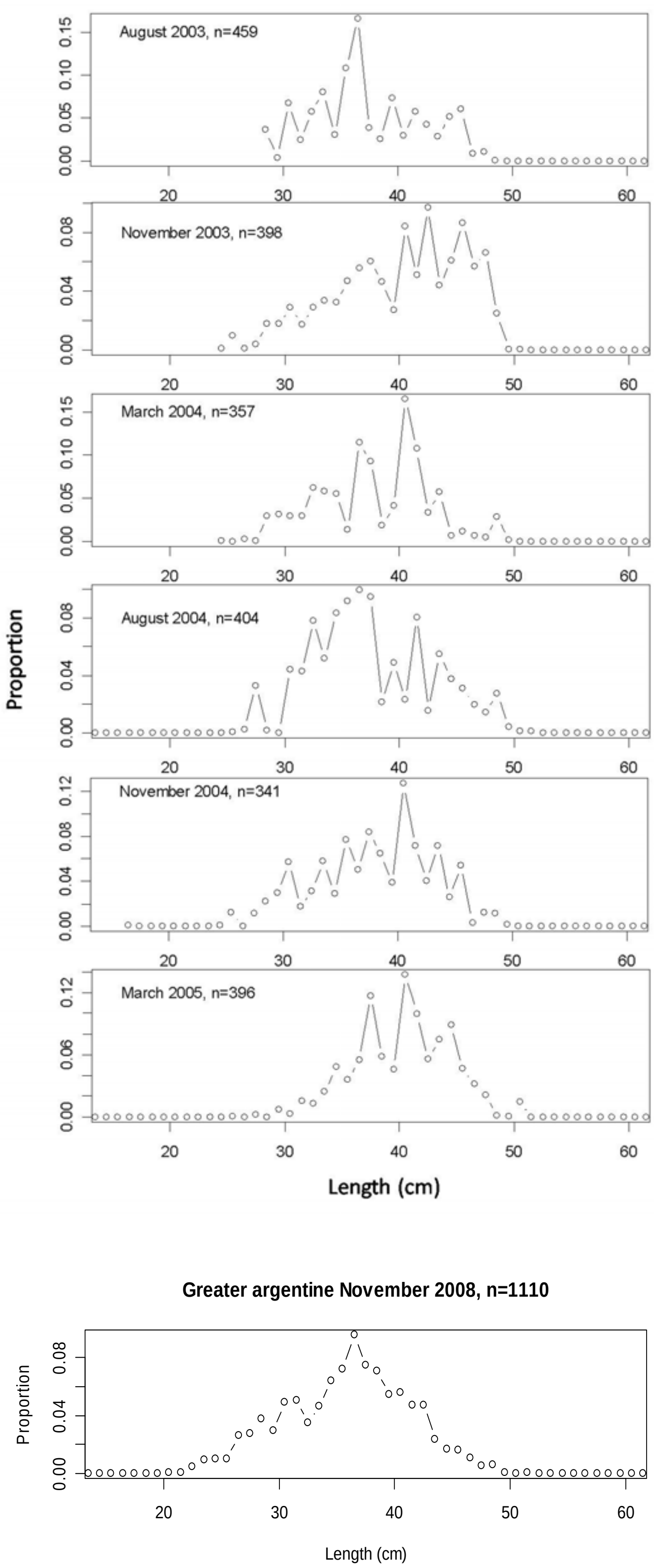
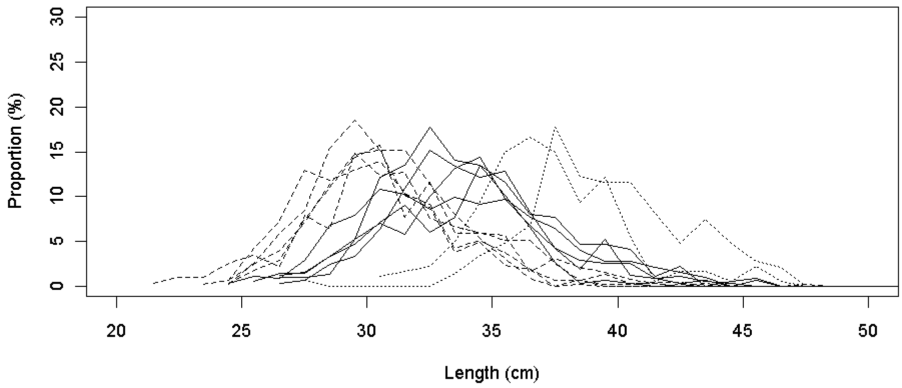


Figure 8.3.2.1 Length distribution for greater silver smelt in Greenland halibut surveys 2003–2005 (upper panels) and in beaked redfish survey in November 2008 (lower panel) in Subarea IIa.



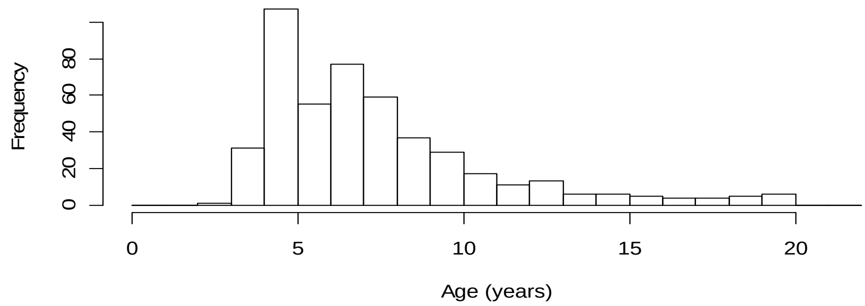


Figure 8.3.2.2 Size and age distributions of greater silver smelt based on a Norwegian survey conducted at the fishing grounds north of 62° N (ICES Division IIa) in 2008. Length distributions are from length samples at each station (greater silver smelt trawl). The distributions are approximately classified by weighted mean length; dashed lines 30.2–31.5 cm, solid lines 33.0–34.6 cm (station nr. 6, and dotted lines 37.2–39.6 cm. The age distribution is for all greater argentine sampled as the first 100 specimens in each sample in the same survey. Age-group 20 is a plus-group.

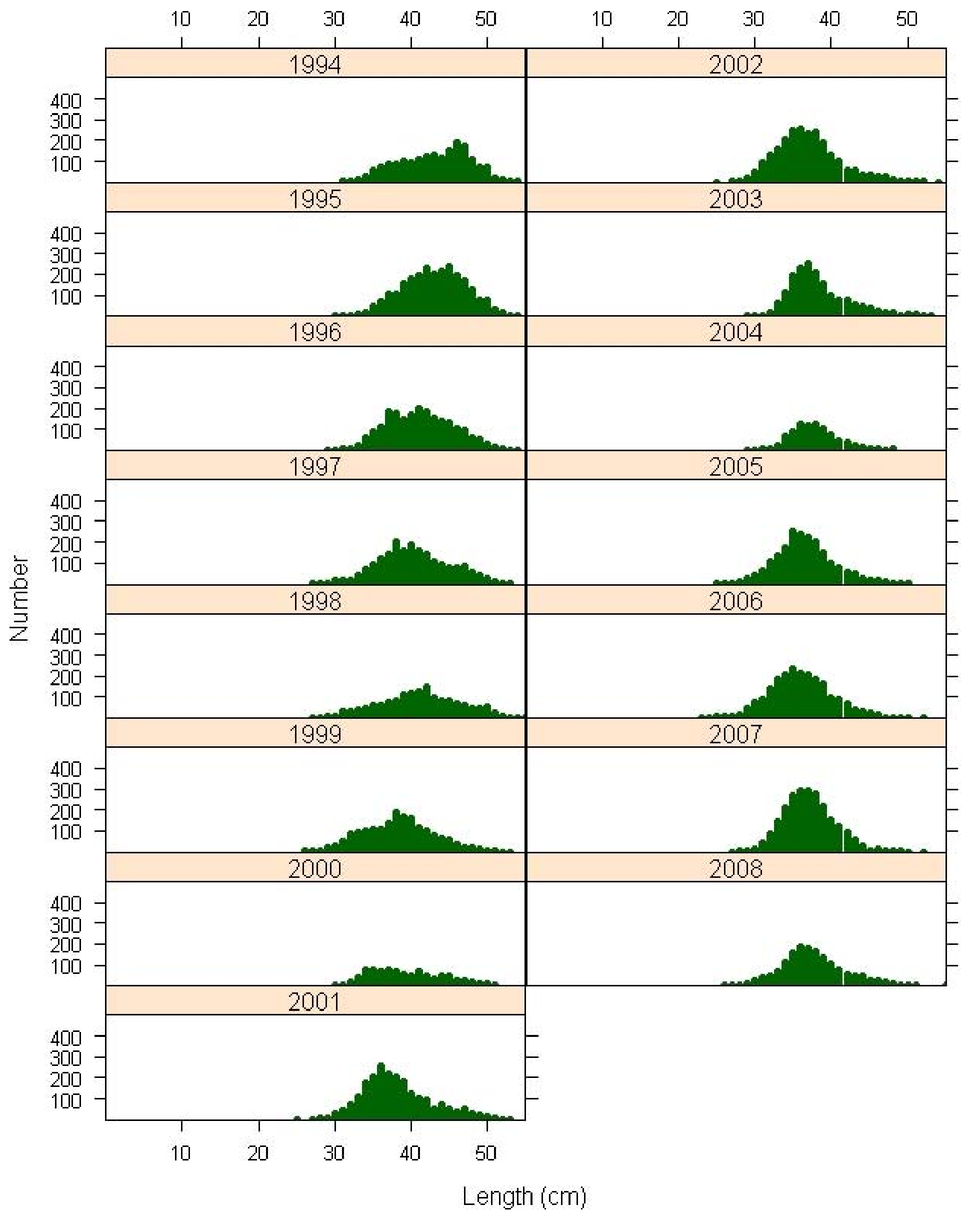


Figure 8.3.2.3. Length distributions of greater silver smelt in the Faroese landings 1994–2008.

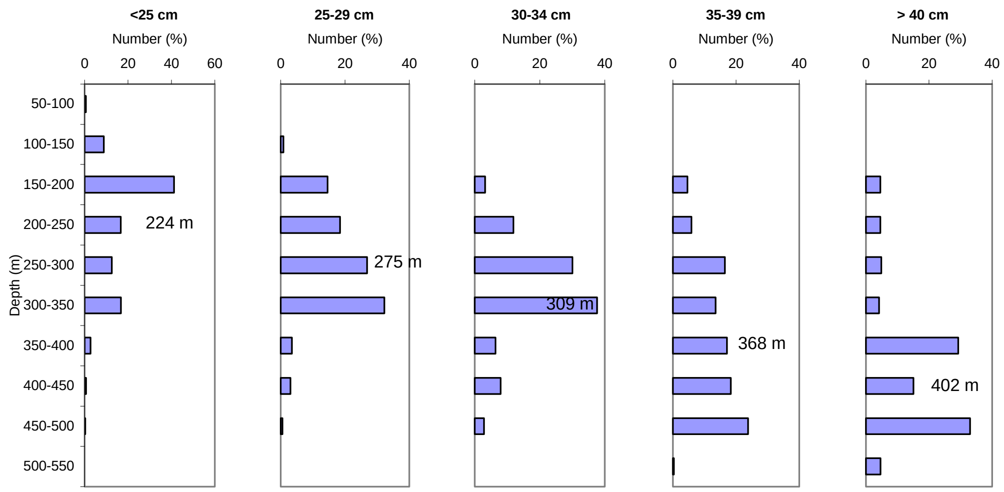


Figure 8.3.2.4. Greater silver smelt (Division Vb). Distribution of length groups in depth intervals from the Faroes surveys for cod, haddock and saithe. Number scaled against depth and number of hauls in the depth intervals. Mean depths for length groups are indicated.

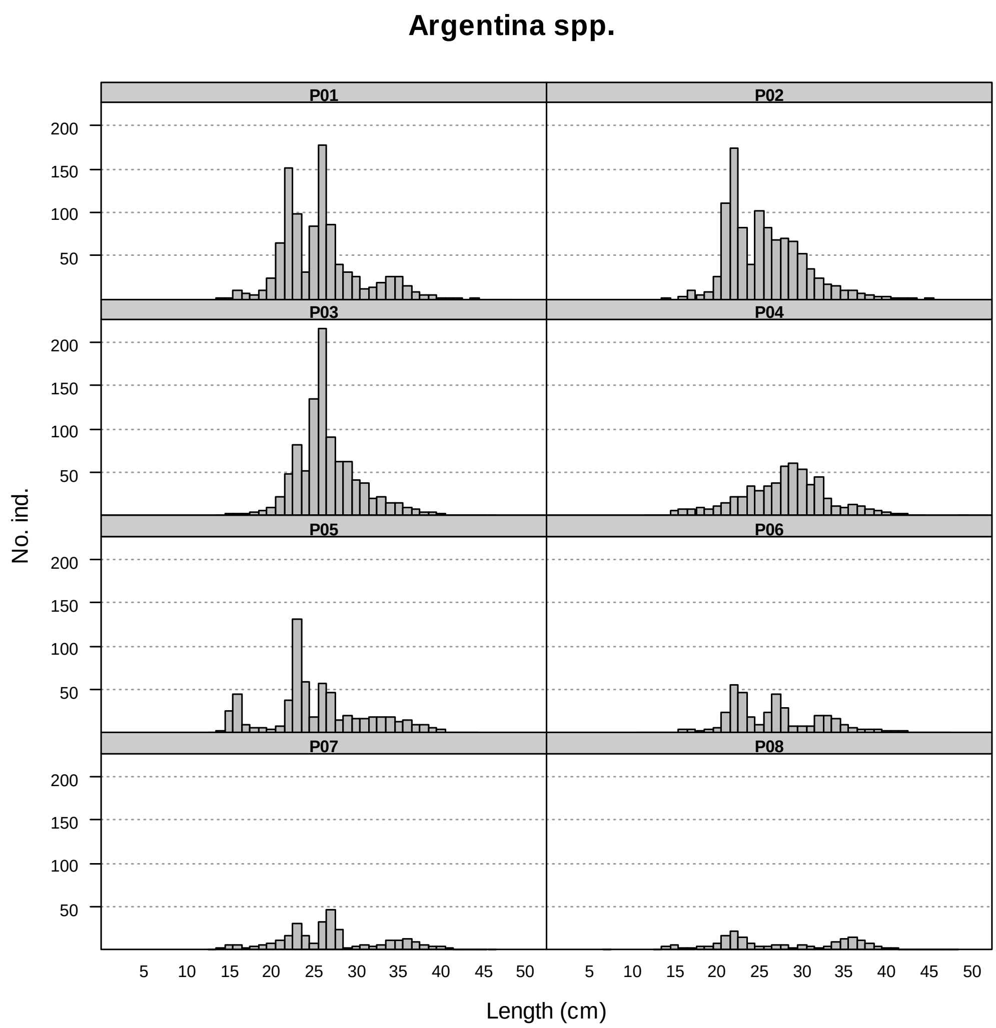


Figure 8.3.2.5. Mean stratified length distributions of *Argentina* spp. in Porcupine surveys (2001–2008).

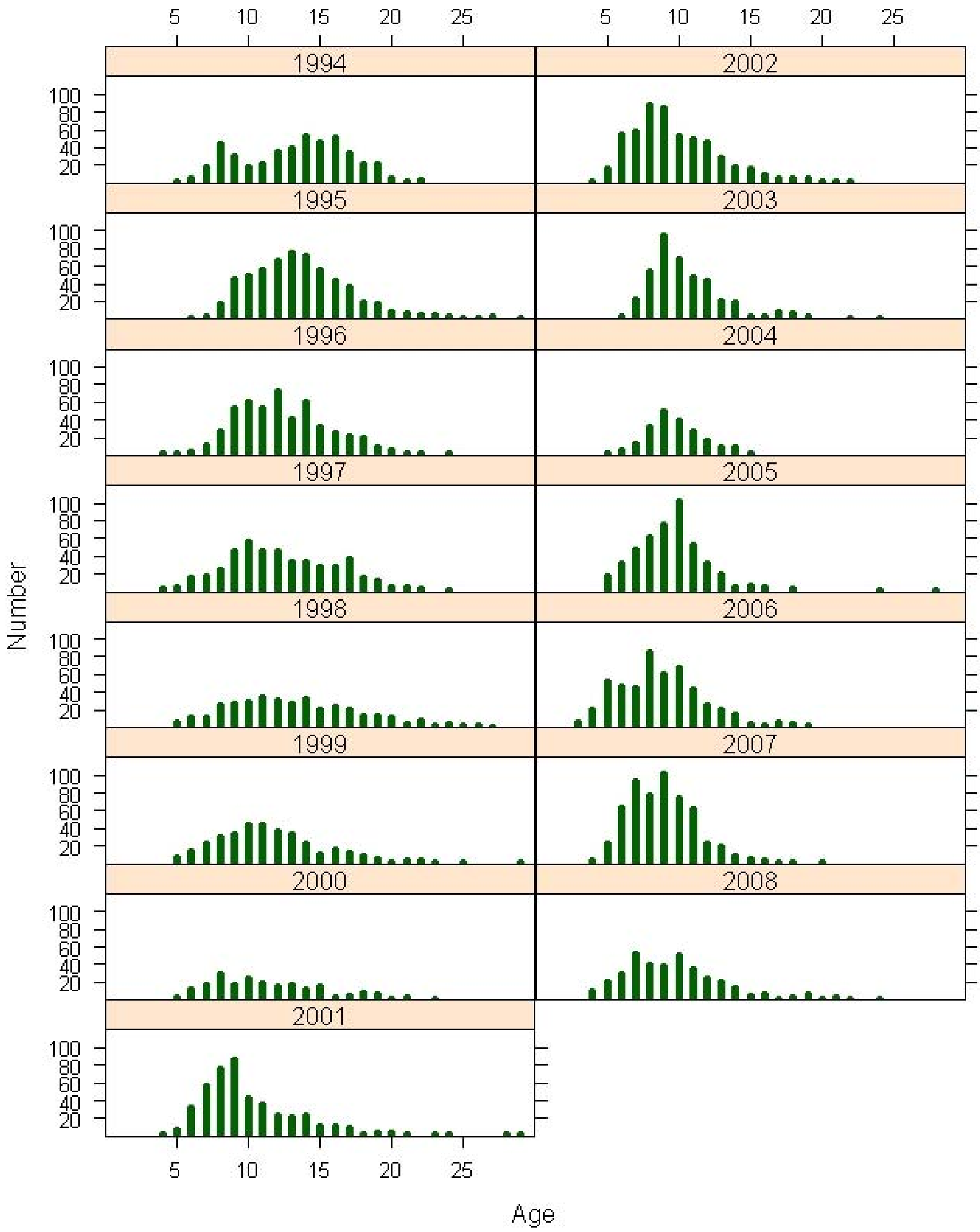


Figure 8.3.2.6. Age distribution of greater silver smelt in Faroese landings 1994–2008.

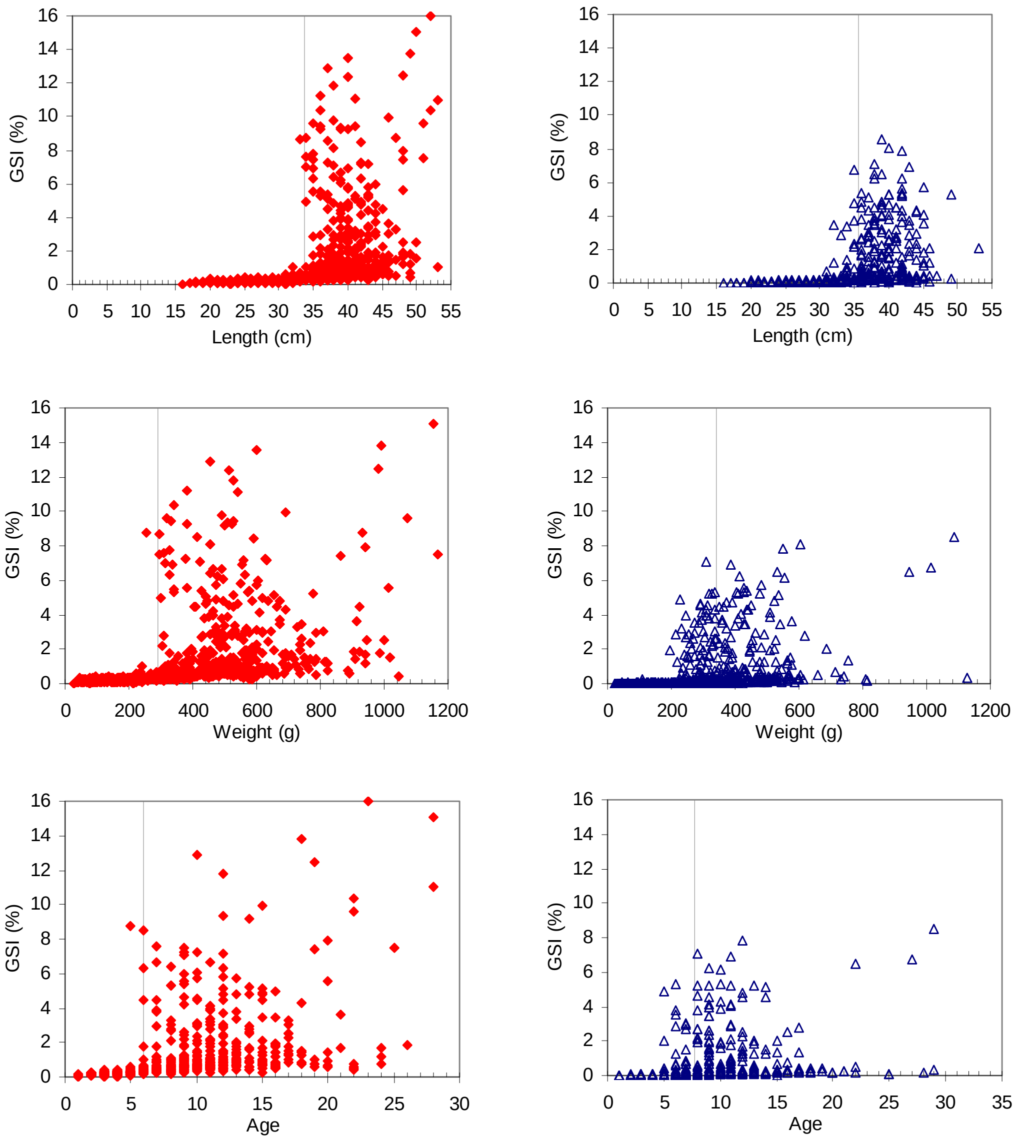


Figure 8.3.2.7. Greater silver smelt (Division Vb). Gonadosomatic index for female (left) and male (right) plotted against length (top), weight (middle) and age (bottom). Female L50=33 cm, W50=290 g, A50= 6 year and male L50=35 cm, W50=340 g, A50= 8 year (indicated as a line in the figures).

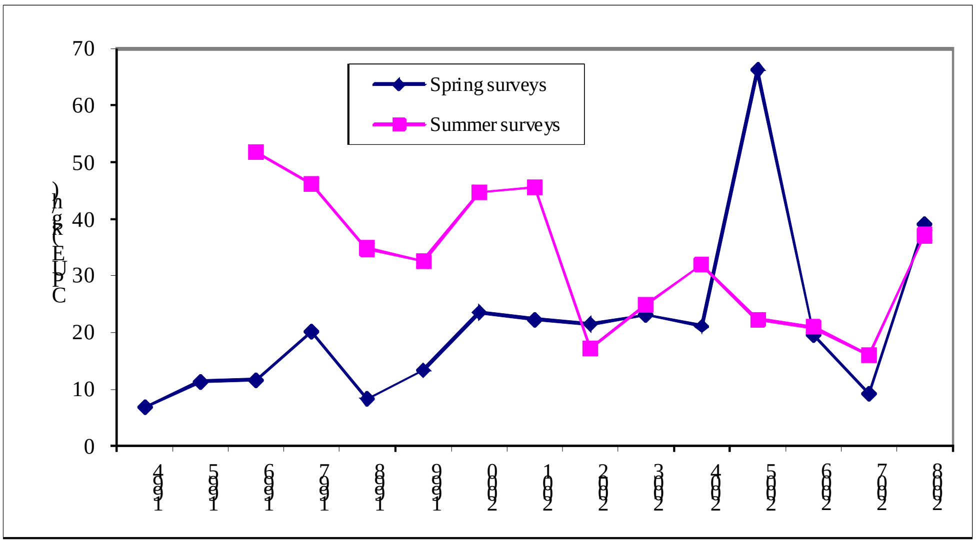


Figure 8.3.2.8. Cpue from Faroese surveys in Vb.

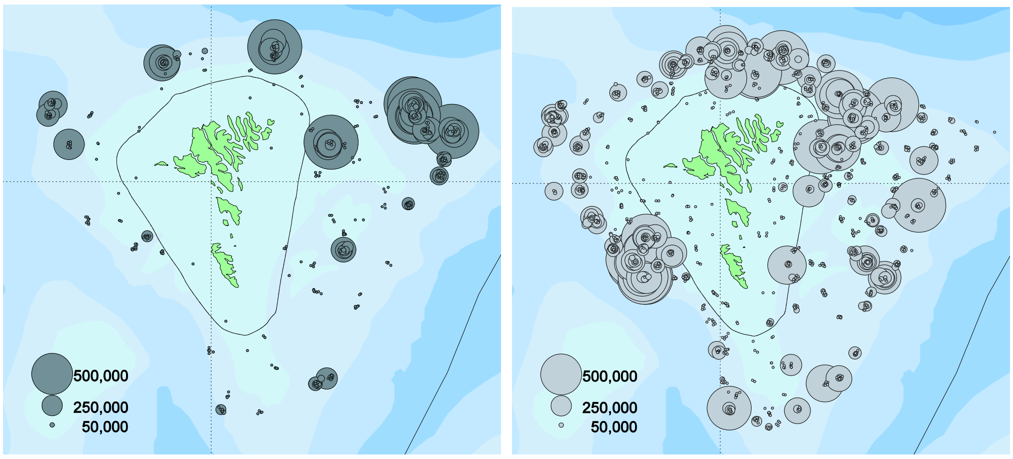


Figure 8.3.2.9. Distribution of greater silver smelt (kg/h) on the Faroe plateau (area Vb) from spring-(1994–2008) and summer survey for cod, haddock and saithe (1996–2008).

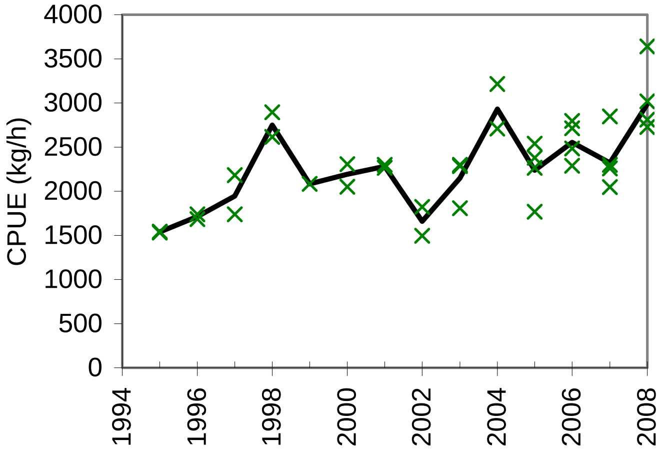


Figure 8.3.2.10. Catch per unit effort (kg/h) for three pairs of Faroese pairtrawlers (Area Vb). Only hauls where greater silver smelt is more that 50% of the total catch are used.

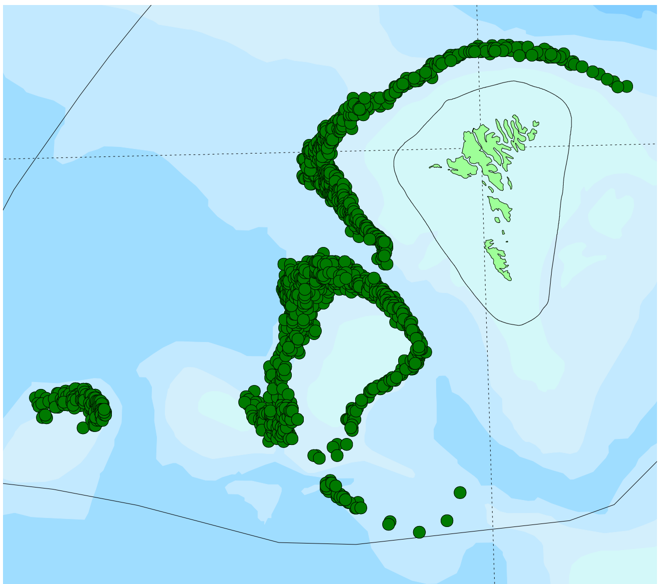


Figure 8.3.2.11. Greater silver smelt (Division Vb). Distribution of Faroese pairtrawler hauls with more than 50% greater silver smelt in the hauls (1995–2008).

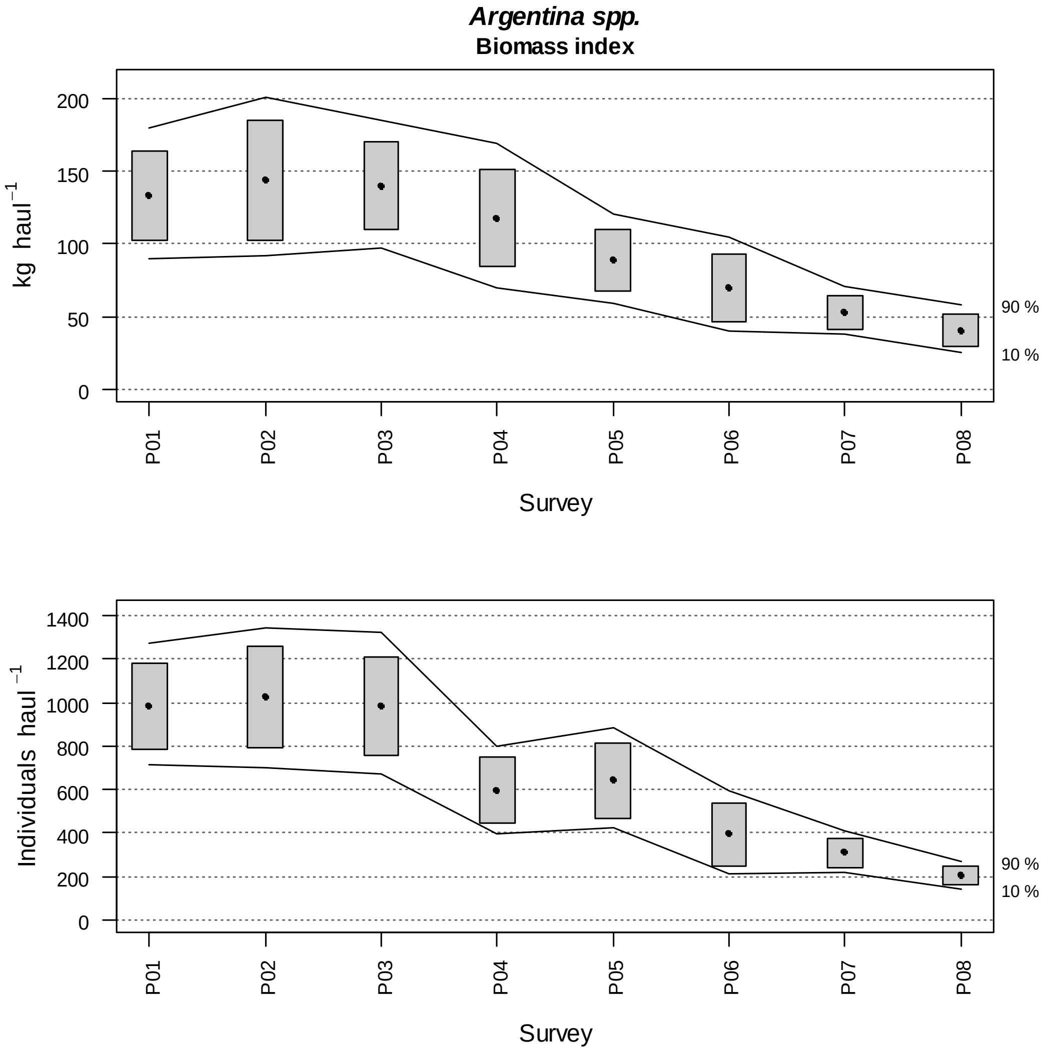


Figure 8.3.2.12. Changes in *Argentina* spp. biomass and abundance indices during Porcupine Survey time-series (2001–2008). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000).

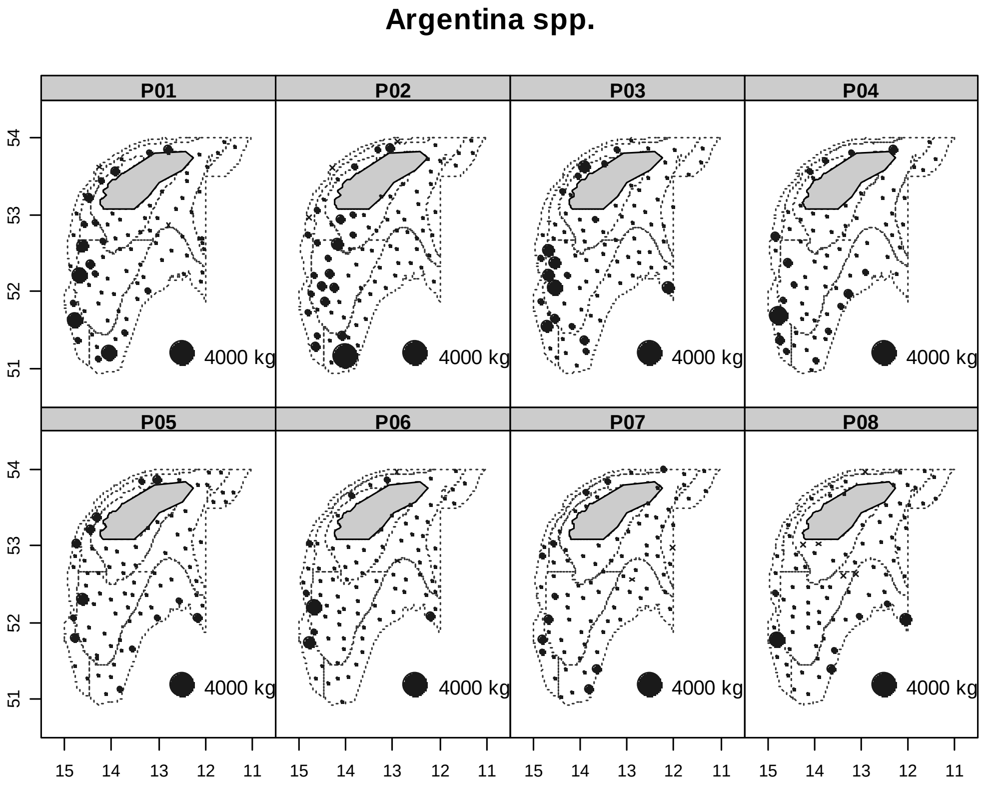


Figure 8.3.2.13. Geographic distribution of Argentina spp. catches (kg/30 min haul) in Porcupine surveys between 2001 and 2008.

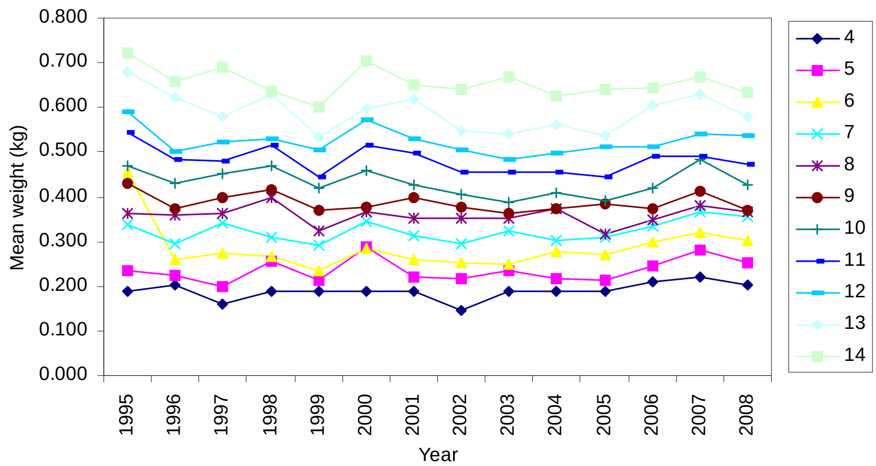


Figure 8.3.3.1. Greater silver smelt (Division Vb). Mean weight-at-age in the Faroese landings (1995–2008).

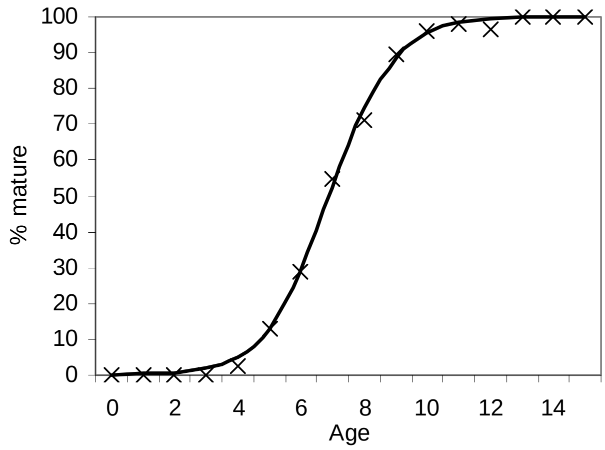


Figure 8.3.3.2. Greater silver smelt (Division Vb). Proportion mature used in the VPA exploratory assessment.

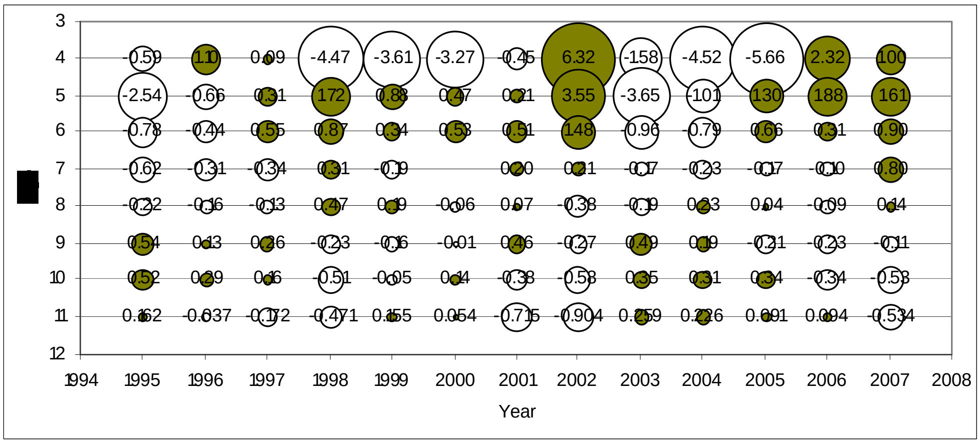


Figure 8.3.3.3. Greater silver smelt (Division Vb). Separable VPA residuals.

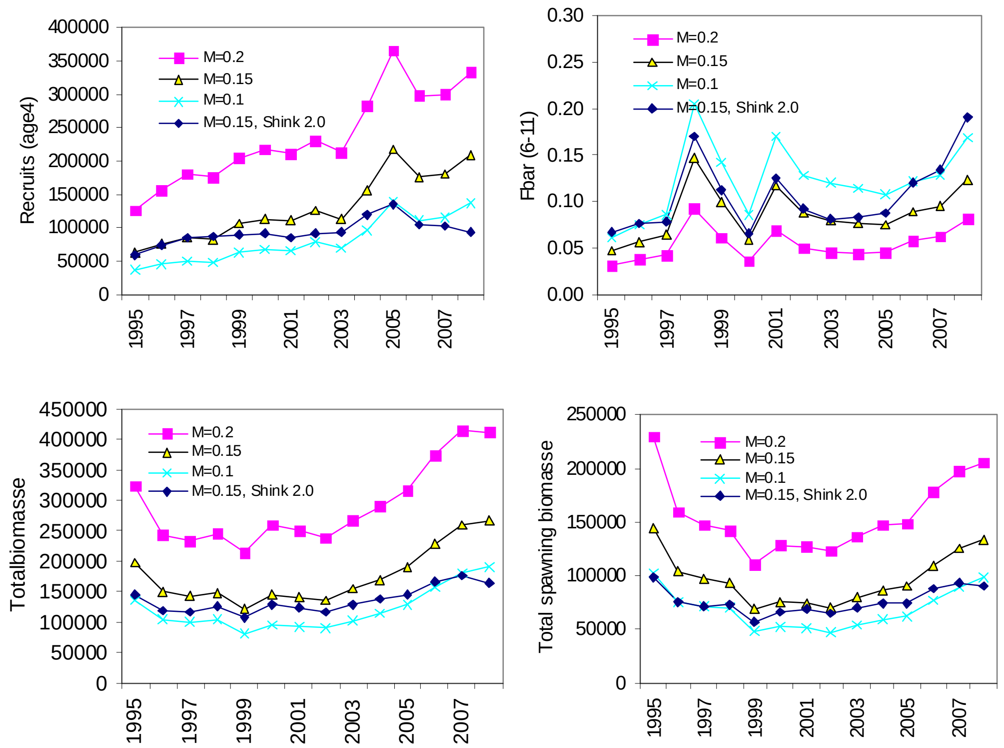


Figure 8.3.3.4. Greater silver smelt (Division Vb). Comparison of the output from the four exploratory XSA runs.

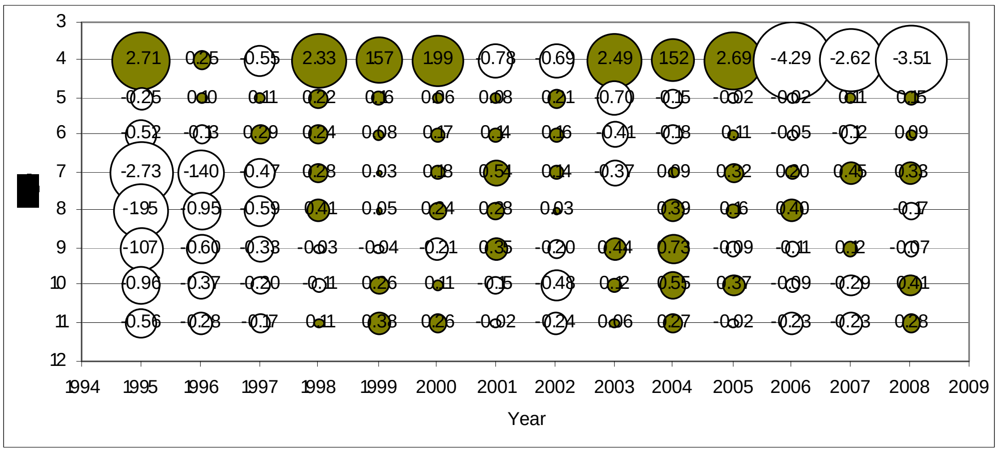


Figure 8.3.3.5. Greater silver smelt (Division Vb). Log catchability residuals for age group 4–11 from exploratory XSA run with M=0.15 and shrinkage=2.0.

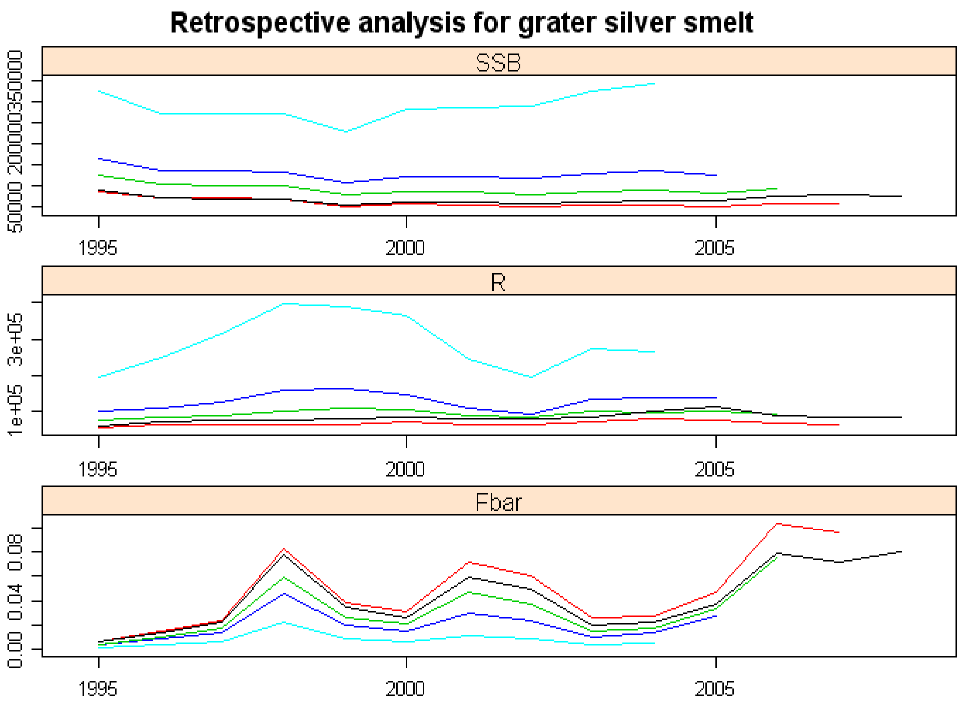


Figure 8.3.3.6. Greater silver smelt (Division Vb). Retrospective analysis of average spawning biomass, recruitment and fishing mortality from exploratory XSA with N=0.15 and shrinkage=2.0, for the years 2003–2008.

9 Orange Roughy (*Hoplostethus Atlanticus*) in the Northeast Atlantic

9.1 Stock description and management units

Orange roughy are typically associated with seamounts or other topographical features e.g. pinnacles or slopes. Because these features tend to be sequentially depleted by fisheries, there is potential for the fishery to expand out of Subareas VI and VII as fisheries decline. It is likely that exploratory fisheries will take place in Subareas VIII–XII.

Current stock units are completely inadequate for orange roughy. Experience from around the world demonstrates that stock units need to be small as topographical features may be inhabited by separate populations. ICES recommended that where the small-scale distribution is known, this be used to define smaller and more meaningful stock units. Where such information is lacking, such as in international waters, the ICES statistical rectangle is a more meaningful spatial stock unit.

However, recent information to ICES does not have a sufficient level of spatial resolution to identify individual exploited aggregations either within Subareas VI and VII or outside them. Because of this, and the very low quotas involved, it is not currently practical to manage at the level of statistical rectangle and therefore larger stock areas are used.

The current practice is to assume 3 stock units;-

Subarea VI

Subarea VII

Orange roughy in all other areas

Given the scarcity of spatial fisheries data and genetics data etc, WGDEEP in 2008 saw no reason to change this.

Catches data for orange roughy in 2007 and 2008 aggregated at the level of statistical rectangle were provided to the Working Group by France and Ireland. These are shown in Figures 9.1.1 and 9.1.2.

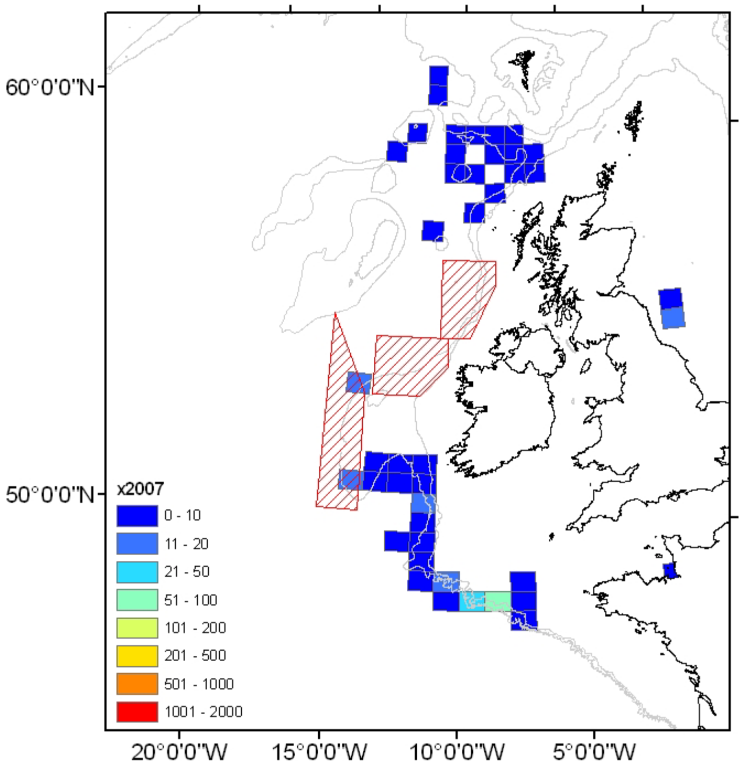


Figure 9.1.1. Catches of Orange roughy by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

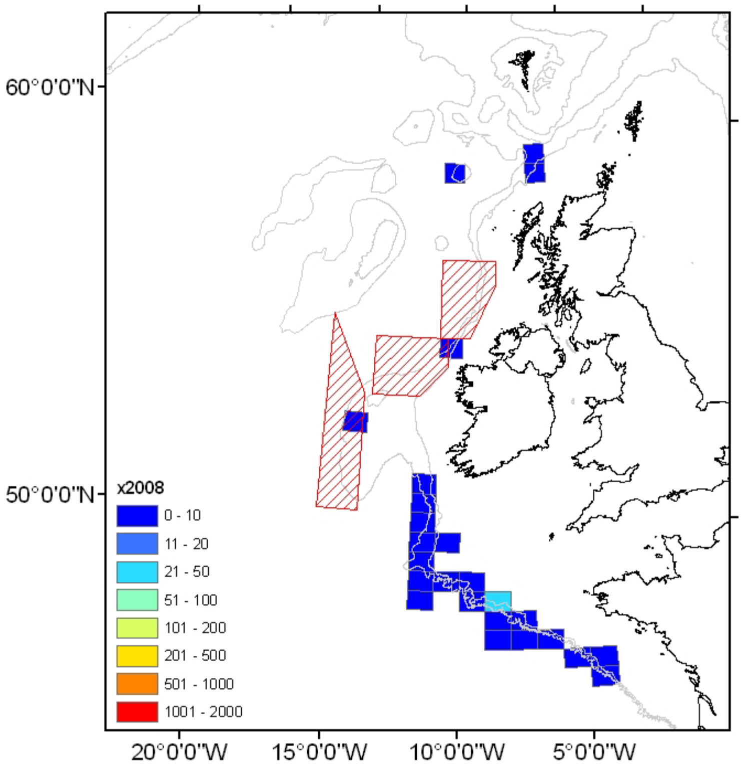


Figure 9.1.2. Catches of Orange roughy by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2008.

9.2 Orange Roughy (*Hoplostethus Atlanticus*) in Subarea VI

9.2.1 The fishery

There was a French target fishery, centred on spawning aggregations around the Hebrides Terrace Seamount. Irish vessels fished there for two years starting in 2001, but they have now effectively abandoned it.

9.2.1.1 Landings trends

Table 9.2.0 demonstrates the landings data for orange roughy for the ICES area as reported to ICES or as reported to the Working Group.

The fishery began in 1989 with landings peaking at 3500 t in 1991, and 5300 t removed from the stock by the end of 1993. This stock is now severely depleted (ICES, 2006) and some of the landings from France and Ireland starting in 2001 have been from further south in this Subarea and increased to over 300 t in 2002. It is not clear if over-reporting was a feature of the fishery in this area, in the years preceding the introduction of TACs. Reported landings since 2003 are decreasing and are consistently below the TAC. Reported landings of orange roughy in VI in 2008 were 5 tons.

9.2.1.2 ICES advice

ICES advice in 2008 was:

Due to its very low productivity, orange roughy can only sustain very low rates of exploitation. Currently, it is not possible to manage a sustainable fishery for this species. ICES recommends no directed fisheries for this species. Bycatches in mixed fisheries should be as low as possible.

9.2.1.3 Management

In 2003 a TAC was introduced for orange roughy in VI, this TAC remained at 88 tons until 2006. Landings in relation to TAC are displayed in the table below. This table illustrates that in the last number of years the reported landings were substantially lower than the set TAC.

		Landing (t)	
Year	TAC (t)	EC vessels	Total
2003	88	81	81
2004	88	56	56
2005	88	45	45
2006	88	33	33
2007	51	12	12
2008	34	5	5
2009	17		
2010	0		

In order to align the TAC with landings, the TAC for EC vessels in Area VI was reduced to 51 tons for 2007 with a further reduction to 34 tons for 2008 and 17 in 2009. The TAC is set for 0 in 2010.

In addition to a TAC, a number of orange roughy protection areas have been introduced in 2005, from which EU vessels have no permission to land or retain any catches of orange roughy. These areas are shown in Figures 9.1.1 and 9.1.2: Although the plots appear to show catches inside the protection areas, the boundaries of these areas do not correspond to ICES rectangles and therefore these catches could have occurred outside the protection areas. Given this, there may be a need to review the boundaries of these protection areas so that they cover entire ICES rectangles.

9.2.2 Data available

9.2.2.1 Landings and discards

Landings are in Table 9.2.0. Landings data were provided by France and Ireland at the level of ICES statistical rectangles to display the geographic distribution of the fishery in Figures 9.1.1 and 9.1.2.

9.2.2.2 Length compositions

No new information.

9.2.2.3 Age compositions

No new information.

9.2.2.4 Weight-at-age

No information.

9.2.2.5 Maturity and natural mortality

No new information.

9.2.2.6 Catch, effort and research vessel data

No new information.

9.2.3 Data analyses

No assessment was required for this stock in 2009.

9.2.4 Comments on the assessment

No assessment was required for this stock in 2009.

9.2.5 Management considerations

No advice was required for this stock in 2009.

Table 9.2.0. Orange roughy catch in Subarea VI.

YEAR	FAROES	FRANCE	E & W	SCOTLAND	IRELAND	SPAIN	TOTAL
1988	-	-	-	-	-	-	0
1989	-	5	-	-	-	-	5
1990	-	15	-	-	-	-	15
1991	-	3,502	-	-	-	-	3502
1992	-	1,422	-	-	-	-	1422
1993	-	429	-	-	-	-	429
1994	-	179	-	-	-	-	179
1995	40	74	-	2	-	-	116
1996	0	116	-	0	-	-	116
1997	29	116	1	-	-	-	146
1998	-	100	-	-	-	2	102
1999	-	175	-	-	0	1	176
2000	-	136	-	-	2	-	138
2001	-	159	-	11	110	-	280
2002	n/a	152	-	41	130	-	323
2003	-	79	-	-	2	-	81
2004	-	54	-	-	2	-	56
2005	-	41	-	-	6	-	47
2006		32			1		33
2007		12					12
2008		5					5

*** Preliminary.**

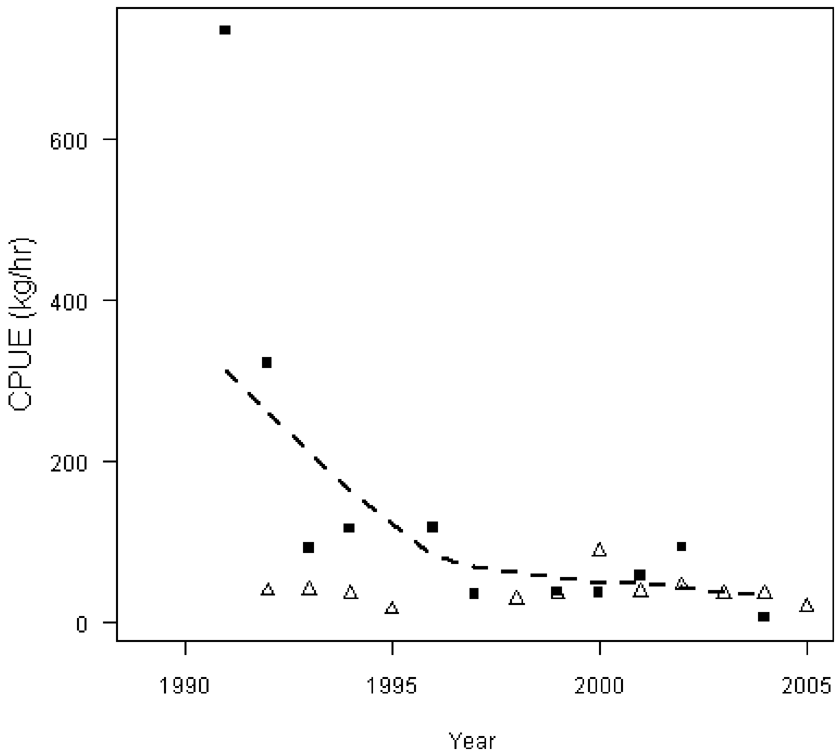


Figure 9.2.1. French 2006 cpue series (VIa) for 400–600 kw power vessels (open triangles) and for 1400–1600 kw vessels (solid squares). The line is a smooth curve through the latter series.

9.3 Orange Roughy (*Hoplostethus Atlanticus*) in Subarea VII

9.3.1 The fishery

Since the collapse of the VI fishery, the main fishery for orange roughy in the northern hemisphere is in this Subarea. French vessels used to prosecute this fishery alone, but in 2001, new Irish vessels became heavily involved in this fishery for a short number of years. Orange roughy aggregations are mainly associated with seamounts, but they are also found close to other features. Initially, trawlers targeted orange roughy at the base of seamounts, but since 2000 there has been a shift to fishing down the slopes of seamounts. In the past, as catch rates declined, new features were found to replace them, but finding new features is now unlikely. Large (~50 m) high-sea French trawlers targeted orange roughy in Subarea VII up to 2001. These large trawlers have reduced their activity in VII. In recent years, small catch of orange roughy are a bycatch of some remaining deep-water fishing by large trawler and some targeted fishing from a few or even one single artisanal trawlers.

9.3.1.1 Landings trends

Table 8.4.1 demonstrates the landings data for orange roughy as reported to ICES or as reported to the Working Group. The preliminary landings for 2008 are 89 t, which are the lowest in the time-series. Over-reporting is likely to have been a feature of this fishery prior to the introduction of TACs. The restrictive quotas that have been introduced from 2003 onwards may have resulted in underreporting and misreporting at other areas and species, specifically cardinal fish.

A French fishery developed in 1989, and landings peaked at over 3000 t in 1992. By the end of 2000 the French fleet had removed over 13 500 t of orange roughy from this Subarea. An Irish fishery commenced in 2001, and since then the combined Irish and French accumulated landings (preliminary data) have amounted to a further 10 800 t. There are two fisheries for Orange Roughy in the area. A single targeted peak fishery that has been occurring on distinct topographical features and a mixed trawl flat fishery that occurs along the continental slope and has Orange Roughy as a bycatch.

Historical landings data suggest several pulses in landings. The first occurred in 1992 when over 3000 t were landed. Landings declined until 1995, but then increased again to the highest in the series in 2002. A restrictive quota was introduced in 2003 and resulted in a decrease in declared landings since then.

9.3.1.2 ICES advice

The ICES advice statement from 2008 was:

Due to its very low productivity, orange roughy can only sustain very low rates of exploitation. Currently, it is not possible to manage a sustainable fishery for this species. ICES recommends no directed fisheries for this species. Bycatches in mixed fisheries should be as low as possible.

Management

A TAC for orange roughy in area VII was first introduced in 2003. .Landings in relation to TAC are displayed in the table below and illustrates that reported landings were substantially lower than the set TAC:

		Landing (t)	
Year	TAC (t)	EC vessels	Total
2003	1 349	541	541
2004	1 349	467	467
2005	1 149	255	255
2006	1 149	489	489
2007	193	172	172
2008	130	89	89
2009	65		
2010	0		

The TAC for orange roughy in VII has been fixed to 65 t in 2009 and to 0 t in 2010, respectively. Further to a TAC, a number of orange roughy protection areas have been introduced in 2005, from which EU vessels have no permission to land or retain any catches of orange roughy. These areas are shown in Figures 9.1.1 and 9.1.2. Although the plots appear to show catches inside the protection areas, the boundaries of these areas do not correspond to ICES rectangles and therefore these catches could have occurred outside the protection areas.

9.3.2 Data available

No new information.

9.3.2.1 Landings and discards

No new information.

9.3.2.2 Length compositions

No new information.

9.3.2.3 Age compositions

No new information.

9.3.2.4 Weight-at-age

No data.

9.3.2.5 Maturity and natural mortality

No new information.

9.3.2.6 Catch, effort and research vessel data

No new information.

9.3.3 Data analyses

No assessment was required for this stock in 2009.

9.3.4 Comments on the assessment

No assessment was required for this stock in 2009.

9.3.5 Management considerations

No advice was required for this stock in 2009.

Table 9.3.0. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus,* by nation in Subarea VII.

YEAR	FRANCE	SPAIN	E & W	IRELAND	SCOTLAND	FAROES	TOTAL
1988	-	-	-	-	-	-	0
1989	3	-	-	-	-	-	3
1990	2	-	-	-	-	-	2
1991	1,406	-	-	-	-	-	1406
1992	3,101	-	-	-	-	-	3101
1993	1,668	-	-	-	-	-	1668
1994	1,722	-	-	-	-	-	1722
1995	831	-	-	-	-	-	831
1996	879	-	-	-	-	-	879
1997	893	-	-	-	-	-	893
1998	963	6	-	-	-	-	969
1999	1,157	4	-	-	-	-	1161
2000	1,019	-	-	1		-	1020
2001	1022	-	1	2367	22	-	3412
2002	300		14	5114	33	4	5465
2003	369			172			541
2004	279			188			467
2005	165			90			255
2006	451			37			489
2007	145			28			164
2008*	89						

*Preliminary.

9.4 Orange Roughy (*Hoplostethus atlanticus*) IN I, II, IIIa, IV, V, VIII, IX, X, XII, XIV

9.4.1 The fishery

Small fisheries have existed in subareas Va, Vb, VIII, and X, and a relatively modestly sized one in XII. Most started in the early 1990s, the exception being Subarea X which started in 1996. There has been no real fishery in IX, just a few tonnes caught over a few years.

9.4.1.1 Landing trends

Table 9.4.0 demonstrates the landings data for orange roughy for the ICES area as reported to ICES or as reported to the Working Group. Figures 9.1.1 and 9.1.2 show the landings by statistical rectangle for 2007 and 2008.

In Division Va, the fishery peaked with landings of over 700 t in 1993, and landings have declined to very low levels by 2002. In Division Vb, landings were highest in 1995, at 420 t, but since 1997 they have been small in recent years except for in 2000.

In Subarea VIII, there have been small landings by France since the early 1990s. In Subareas VIII and IX, Spain has recorded small landings in some years.

In Subarea X, there were fluctuating Faroese landings, and in 2000, there was an experimental fishery by the Azores (Portugal). This fishery has not been continued.

In Subarea XII, the Faroes dominated the fishery throughout the 1990s, with small landings by France. In one year each, New Zealand and Ireland have targeted orange roughy in this area. There are many areas of the Mid-Atlantic Ridge where aggregations of this species occur, but the terrain is very difficult for trawlers.

9.4.1.2 ICES advice

The ICES advice statement from 2008 was:

Due to its very low productivity, orange roughy can only sustain very low rates of exploitation. Currently, it is not possible to manage a sustainable fishery for this species. ICES recommends no directed fisheries for this species. Bycatches in mixed fisheries should be as low as possible.

9.4.1.3 Management measures

For 2005 and 2006, an overall TAC of 102 t was set for EC vessels that covered the zones: I, II, III, IV, V, VIII, IX, X, XII, XIV. This TAC has been reduced every year since then and is 15 t in 2009 and 0 t in 2010. The TAC applies to Community waters and international waters. Landings in relation to TAC were as follows,

		LANDING (T)	
Year	TAC (t)	EC vessels	Total
2005	102	71	278
2006	102	58	149
2007	44	16	36
2008	30	9	33
2009	15		
2010	0		

9.4.2 Data available

9.4.2.1 Landings and discards

Landings are in Table 9.4.0.

9.4.2.2 Length composition

No new information.

9.4.2.3 Age composition

No data.

9.4.2.4 Weight-at-age

No data.

9.4.2.5 Maturity and natural mortality

No specific data for this Subarea.

9.4.2.6 Catch, effort and research vessel data

No new information.

9.4.3 Data analysis

No assessment has been carried out during WGDEEP 2009.

9.4.4 Management considerations

No new advice given in 2009.

Table 9.4.0a. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus*, in Division Va.

Year	Iceland	Total
1988	-	0
1989	-	0
1990	-	0
1991	65	65
1992	382	382
1993	717	717
1994	158	158
1995	64	64
1996	40	40
1997	79	79
1998	28	28
1999	14	14
2000	68	68
2001	19	19
2002	10	10
2003	0	0
2004	28	28
2005	9	9
2006	2	2
2007	0	0
2008	4	4

Table 9.4.0b. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus*, in Division Vb.

Year	Faroes	France	Total
1988	-	-	0
1989	-	-	0
1990	-	22	22
1991	-	48	48
1992	1	12	13
1993	36	1	37
1994	170	+	170
1995	419	1	420
1996	77	2	79
1997	17	1	18
1998	-	3	3
1999	4	1	5
2000	155	0	155
2001	1	4	5
2002	1	0	1
2003	2	3	5
2004		7	7
2005	3	10	13
2006	0	0	0
2007	0	1	1
2008		<1	<1

Table 9.4.0c. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus*, in Subarea VIII.

Year	France	Spain VIII and IX	E & W	Total
1988	-	-	-	0
1989	0	-	-	0
1990	0	-	-	0
1991	0	-	-	0
1992	83	-	-	83
1993	68	-	-	68
1994	31	-	-	31
1995	7	-	-	7
1996	22	-	-	22
1997	1	22	-	23
1998	4	10	-	14
1999	33	6	-	39
2000	47	-	5	52
2001	20	-	-	20
2002	20	-	-	20
2003	31			31
2004	43			43
2005	29			29
2006	43			43
2007	1			1
2008	9			9

Table 9.4.0d. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus*, in Subarea IX.

Year	Spain	Total
1990	-	0
1991	-	0
1992	-	0
1993	-	0
1994	-	0
1995	-	0
1996	-	0
1997	1	1
1998	1	1
1999	1	1
2000	0	0
2001	0	0
2002	0	0
2003	0	0
2004	0	0
2005	0	0
2006	0	0
2007	0	0
2008*		

Table 9.4.0e. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus*, in Subarea X.

Year	Faroes	France	Norway	E & W	Portugal	Ireland	Total
1989	-	-	-	-	-		0
1990	-	-	-	-	-		0
1991	-	-	-	-	-		0
1992	-	-	-	-	-		0
1993	-	-	1	-	-		1
1994	-	-	-	-	-		0
1995	-	-	-	-	-		0
1996	470	1	-	-	-		471
1997	6	-	-	-	-		6
1998	177	-	-	-	-		177
1999	-	10	-	-	-		10
2000	-	3	-	28	157		188
2001	84	-	-	28	343		455
2002	30	-	-	-	-		30
2003		1					1
2004	384					19	403
2005	128	2					130
2006	8						8
2007	37						37
2008*	0						0

Table 9.4.0f. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus*, in Subarea XII.

Year	Faroes	France	Iceland	Spain	E & W	Ireland	New Zealand	Russia	Total
1989	-	0	-	-	-			-	0
1990	-	0	-	-	-			-	0
1991	-	0	-	-	-			-	0
1992	-	8	-	-	-			-	8
1993	24	8	-	-	-			-	32
1994	89	4	-	-	-			-	93
1995	580	96	-	-	-			-	676
1996	779	36	3	-	-			-	818
1997	802	6	-	-	-			-	808
1998	570	59	-	-	-			-	629
1999	345	43	-	43	-			-	431
2000	224	21	-	-	2			12	259
2001	345	14	-	-	2		450	-	811
2002	+	6	-	-	-		0	-	6
2003		64				136	0	-	200
2004	176	131					0		307
2005	158	36					0		193
2006	81	15							96
2007	71								20
2008*	20								

Table 9.4.0g. Orange roughy total international landings in the ICES Area, excluding VI and VII.

YEAR	IV	VA	VB	VIII	IX	X	XII	ALL AREAS
1988		0	0	0	0	0	0	0
1989		0	0	0	0	0	0	0
1990		0	22	0	0	0	0	22
1991		65	48	0	0	0	0	113
1992		382	13	83	0	0	8	486
1993		717	37	68	0	1	32	855
1994		158	170	31	0	0	93	452
1995		64	420	7	0	0	676	1167
1996		40	79	22	0	471	818	1430
1997		79	18	23	1	6	808	935
1998		28	3	14	1	177	629	852
1999		14	5	39	1	10	431	500
2000		68	155	52	0	188	259	722
2001		19	5	20	0	455	811	1310
2002		10	1	20	0	30	6	67
2003		+	5	31	0	1	200	237
2004		28	7	43	0	403	307	788
2005		9	13	29	0	83	193	327
2006		2	0	43	0	8	96	149
2007	14		1	1	0	37	71	124
2008*	0	4	<1	9	0	0	20	33
Total	14	1687	1002	535	3	1870	5458	10448

***Preliminary.**

10 Roundnose grenadier (*Coryphaenoides rupestris*)

10.1 Stock description and management units

ICES WGDEEP has in the past proposed three stocks of roundnose grenadier in the NE Atlantic:

Skagerrak (IIIa)

The Faroe-Hatton area, Celtic sea (Divisions Vb and XIIb, Subareas VI, VII)

On the Mid-Atlantic Ridge (Divisions Xb, XIIc, Subdivisions Va1, XIIa1, XIVb1)

The current perception is based on what is believed to be natural restrictions to the dispersal of all life stages. The Wyville-Thomson Sill may separate populations further south on the banks and slopes off the British Isles and Europe from those distributed to the north along Norway and in the Skagerrak. Considering the general water circulation in the North Atlantic, populations from the Icelandic slope may be separated from those distributed to the west of the British Isles. It has been postulated that a single population occurs in all the areas south of the Faroese slopes, including also the slopes around the Rockall Trough and the Rockall and Hatton Banks but the biological basis for this remains hypothetical.

In 2007, WGDEEP examined the available evidence of stock discrimination in this species but, on the available evidence, was not able to make further progress in discriminating stocks. On this basis WGDEEP concluded there was no basis on which to change current practice.

Catches data for roundnose grenadier in 2006 and 2007 aggregated at the level of statistical rectangle were provided to the Working Group by France, Ireland, the UK (England and Wales and Scotland) and Iceland. These are shown in Figures 12.1.1 and 10.1.2.

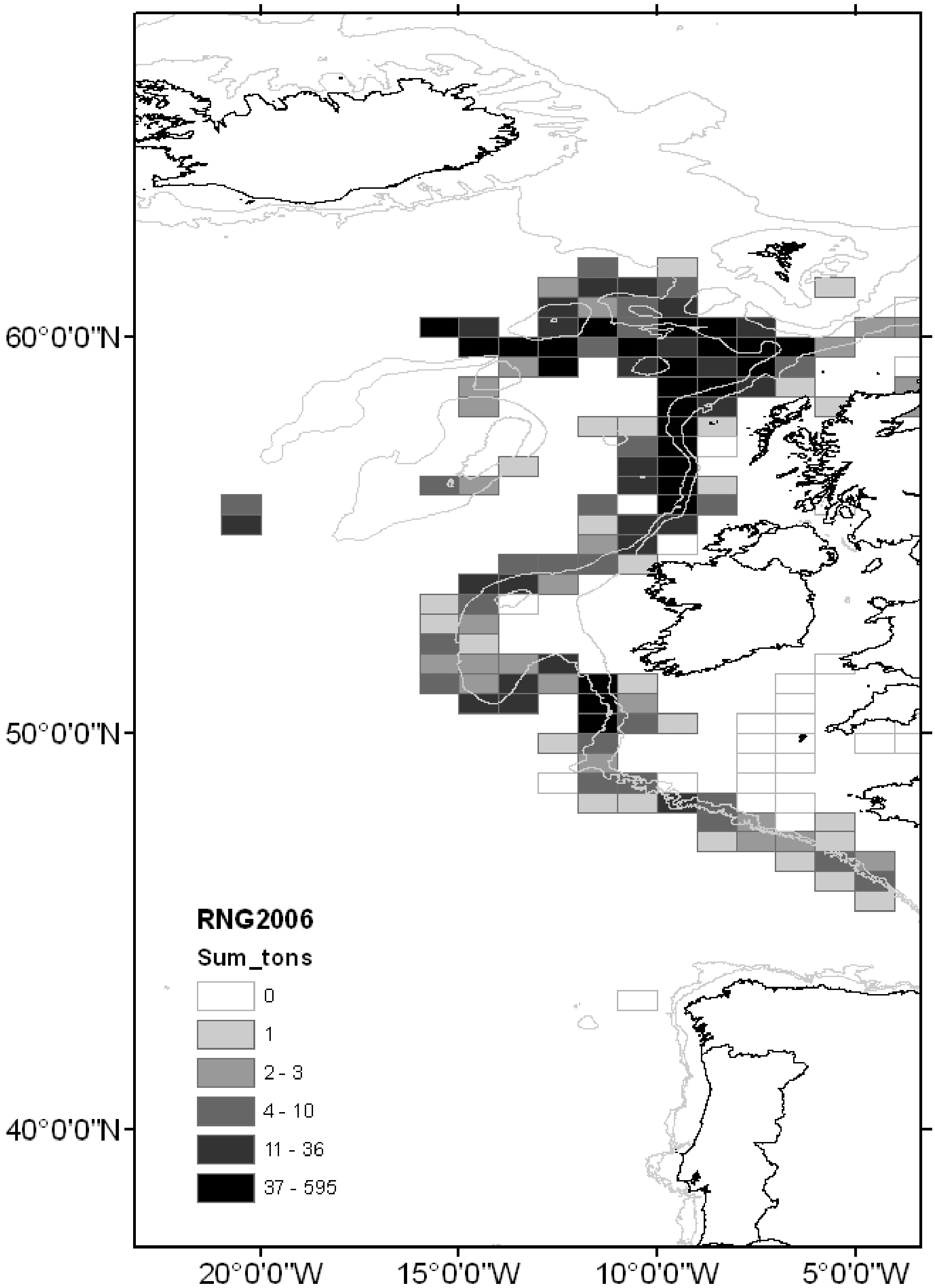


Figure 10.1.1. Catches of roundnose grenadier by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2006.

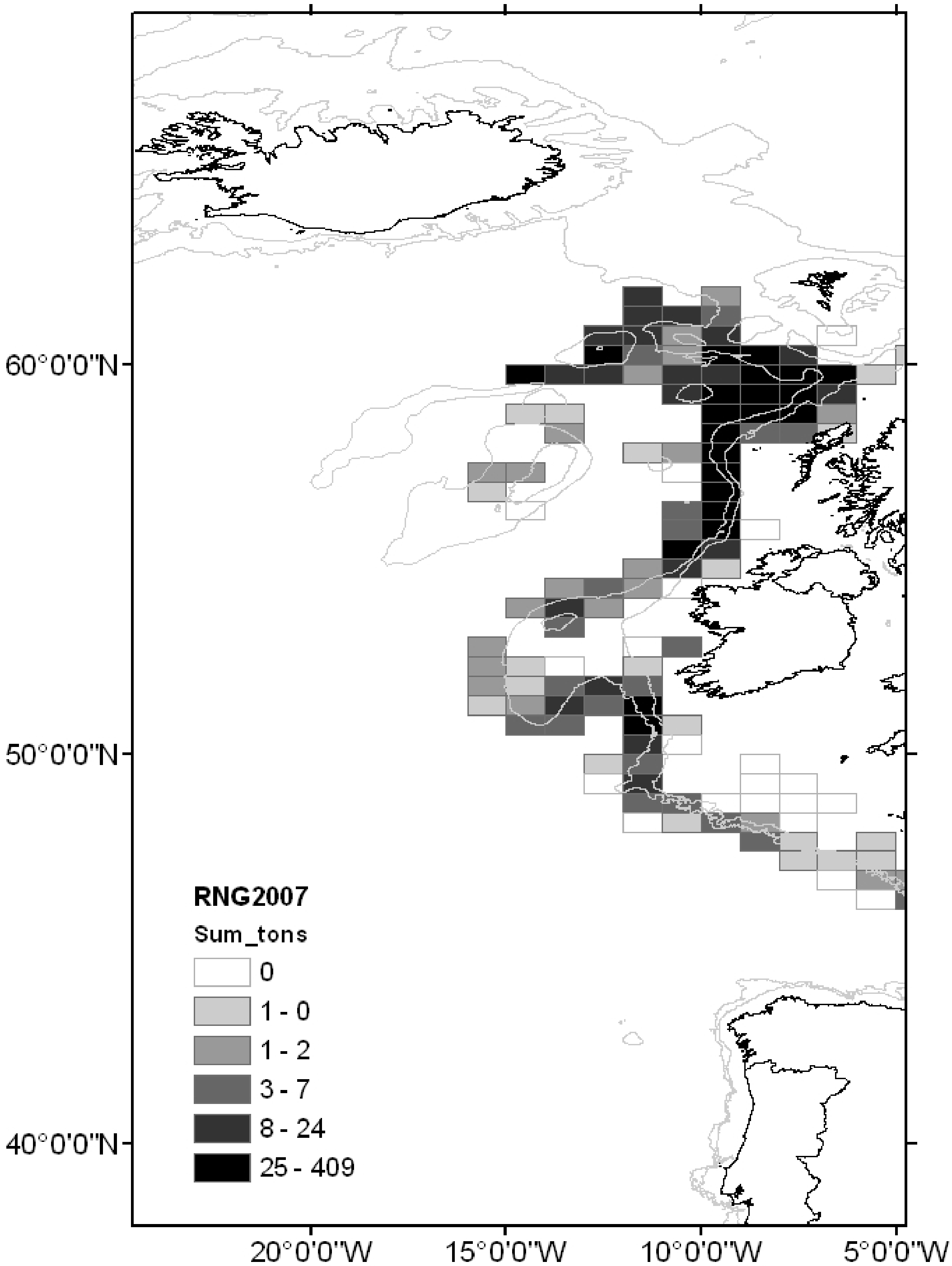


Figure 10.1.1. Catches of roundnose grenadier by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

10.2 Roundnose Grenadier (*Coryphaenoides rupestris*) in Division Vb and XIIb, Subareas VI and VII

10.2.1 The fishery

The majority of landings of roundnose grenadier from this area are taken by bottom trawlers. To the west of the British Isles, in Divisions Vb, VIa, VIb2 and Subareas VII, French trawlers catch roundnose grenadier in a multispecies deep-water fishery. The Spanish trawling fleet operates further offshore along the western slope of the Hatton Bank in ICES Divisions VIb1 and XIIb.

10.2.1.1 Landings trends

Over the past two decades, in Division Vb, the landings have reached more than 3 800 t in 1991 and more than 2000 t in 2001. Between these two periods, the landings were low in the mid-1990s (less than 700 t in 1994). After 2001, it decreased to about 1000 t in 2002 but increase further to about 1750t in 2005–2007 and 1000t in 2008. These landings are almost exclusively from French and Faroese trawlers (Table 10.2.0a–f).

In Subarea VI, the highest landings were observed in 2001 (close to 15 000 t) and has decreased to around 1400 t in 2008. Most of these landings are caught by French trawlers.

In Subarea VII, landings close to 2000 t were recorded in 1993–1994, recent annual landings are much lower (from 200 to 400 t/year in 2005–2007). In 2008, provisional landings are 87 t.

In ICES Division XIIb, the main fishery is by far from Spanish trawlers. After a peak to more than 32 000 t in 2001, the reported landings have decreased to about 6000 t in 2005 and 5700 t in 2007. There was significant Faroese landings in the mid-1990s, but this fishery disappeared in the 2000s, French landings has varied over time with a maximum of 1700 t in 2004 and has strongly decreased since that year to 85 t in 2006. At the time of the meeting, there were no reports of French landings in 2007–2008 and Spanish data in XII were not available for this year. Only 2 t were reported by Faroese fleet for Division XIIb.

The landings data are considered uncertain in Division XIIb, because unreported landings may occur in international waters. In addition to this, all national landings data were not reported by new ICES divisions and some landings were allocated to divisions according to knowledge of the fisheries from the working group. Lastly significant unallocated landings occurred in 2005 (Table 10.2.0e).

10.2.1.2 ICES advice

In 2008 ICES advised; *Due to its low productivity, roundnose grenadier can only sustain low rates of exploitation. Cpue in the areas has been at a reduced level. ICES recommends that catches should be constrained to 6000 t (50% of the level before the expansion of the fishery, 1990–1996). The fishery should not be allowed to expand unless it can be shown that it is sustainable.*

10.2.1.3 Management

TACs for EU vessels for deep-water species have been set since year 2003. These TACs are revised every second year. The EU TAC and national quotas from member countries apply to all vessels in EU EEZ and to EU vessels in international waters.

For Division Vb and Subareas VI and VII, a TAC 4600 t in 2008 and 3910 t in 2009.

In Subareas VIII, IX, X, XII and XIV the TAC was set at 6114 t in 2008 and 5197 t in 2009. This TAC covers areas with minor roundnose grenadier catches (VIII, IX and X), part of the assessment area (Division XIIb, the western slope of the Hatton bank) and the Mid-Atlantic Ridge (Divisions XIIa,c and Subarea XIV). The main countries having quotas allocations under this TAC are Spain and Poland. Therefore these quota allocations are based upon historical landings in XIIb for Spain and in XIIa,c (Mid-Atlantic Ridge) for Poland.

The table below summarizes the TACs in the two management areas and landings in the assessment area.

	Vb, VI, VII		VIII, IX, X, XII, XIV		Total international landings Vb, VI, VII, XIIb
	EU TAC	EU Landings	EU TAC	EU Landings XIIb	
2005	5253	5777	7190	5926	11790
2006	5253	4283	7190	5285	9569
2007	4600	3526	6114	5735	9263
2008	4600	2519*	6114	**	
2009	3910		5197		
2010	3324		5197		

***: provisional.**

****: unknown, the provisional figure for a UE catch in NEACF regulatory area is 2906t (NEAFC, 2008).**

After the introduction of TACs in 2003 and 2005, the reported landings have decreased. However, the reported decrease may not be real as significant misreporting is likely to have occurred.

In addition to TACs, further management measures applicable to EU fleets are a licensing system, fishing effort limits, the obligation to land the fish in designated harbours and a regulation for on-board observations according to Council Regulation (EC) No 2347/2002 of 16 December 2002. In the Faroes waters, the catch of roundnose grenadier is subject to a minimum size of 40 cm total length, other regulations that may apply to roundnose grenadier are detailed in the overview section.

10.2.2 Data available

10.2.2.1 Landings and discards

Landings time-series data per ICES areas are presented in Tables 10.2.1 and 10.2.2.

Landings data by new ICES areas were available from France, Norway and UK (England and Wales and Scotland) from 2005. No other country provided data by new ICES area. Catch in Subarea XII were allocated to Division XIIb (western Hatton bank) or XIIa,c (Mid-Atlantic Ridge) according to knowledge of the fisheries from WG members. The time-series of Spanish landings from Division XIIb was revised according to Statland data where very high landings were reported for some years (e.g. 31 000 t in 2001). Statland reports landings in Subarea XII consistently with what this Working Group did in the past. All these landings were allocated to Subarea XIIb because the Spanish fleet is not known to operate significantly on the Mid-Atlantic Ridge.

Landings per ICES rectangle were available from France, UK (England and Wales and Scotland) and Ireland and were plotted to display the geographical distribution of the fishery (Figures 10.2.0a–f).

Catch and discards by haul were available from observer programmes. From the French observer programme, total catch, landings and discards and catch, landings and discards of roundnose grenadier were available on a haul by haul basis for 2004–2006.

Discard data (quantities and length distribution) were also available from the on-board observation of the French fishery, 2004–2006, from French on-board observations on French vessels in 1997–1998 and from Scottish observers on board of French vessels, 1997–2001. The length distributions of discards from all these observations seem quite consistent.

Based on EU observer programme 2004–2005, about 30% by weight and 50% by number of the catch of roundnose grenadier is discarded, because of small size. This figure is higher than in previous sampling where the discarding rate in the French fisheries was estimated slightly above 20% from sampling in 1997-1998 (Allain *et al.*, 2003). The change may come from a combination of changes in the depth distribution of the fishing effort and a decrease in the abundance of larger fish as visible in the landings.

The modal discarded length has remained constant (Figures 10.2.1–10.2.4).

The mode of the length distribution of the discards from the Spanish fleet in Divisions VIb and XIIb is slightly smaller, probably because of different sorting habits in relation to different markets (Figure 10.2.6). It is therefore important that length distribution of the landings and discards are provided to the working group by all fleets exploiting the stock.

10.2.2.2 Length composition of the landings

Size frequency data (and corresponding weight data) for roundnose grenadier were available for French catches landed in France, 1990–2008 (Figure 10.2.5).

10.2.2.3 Age composition

Age estimates were available from France. This dataset may be heterogeneous, because 3 different readers estimated the age over these different years and also because measuring the fish on board may lead to different age–length relationship than measuring the landed fish that may have lost water for some days in ice. Large discrepancies between readers were observed in a recent otolith exchange (ICES 2007).

Age composition of the French landings have been routinely estimated since 2001. Formerly age–length keys were derived from a cruise in 1999 and from sampling on board of commercial trawler in 1996–1997 (Lorance *et al.*, 2001, 2003). Preliminary analysis of the length-at-age data demonstrated that age–length key (ALK) are very stable over years. ALK for years 1999 and 2001-04 were very similar, the ALK for 2005 appeared different and the change was ascribed to a change of the reader.

These data are based upon ALK from age estimates in 1996, 1999 and 2002–2005. Otoliths from 1996 and 1999 were collected respectively on board of commercial trawlers and during a scientific cruise; otoliths for 2002–2005 were routinely sampled from the landings.

10.2.2.4 Weight-at-age

No new data.

10.2.2.5 Maturity and natural mortality

No new data on maturity and natural mortality was collected in recent years. Natural mortality was previously estimated from catch curves and an estimated M=0.1 was used by the Working Group since 2002. It should be kept in mind than this estimate is based on limited data.

10.2.2.6 Research vessel survey and cpue

Research Vessel survey.

No new data.

Cpue from the French trawl fishery to the West of the British Isles.

Based upon French tallybooks (Pawlowski *et al.*, WD 1 WGDEEP 2009), lpues for roundnose grenadier were calculated.

10.2.2.6.1 Effort data

French effort dataseries were updated with 2008 data.

10.2.3 Data analyses

10.2.3.1 Cpue trends

Unlike the lpues for blue ling (see Section 6.3.3.6), the results for roundnose grenadier were not scrutinized in details, as no advice in required in 2009. Nevertheless, as the vessels formerly used as a reference fleet to derived4 abundance indices from commercial fishing were decommissioned or moved to other fisheries, the previous time-series of lpues is not reliable for 2008 as it includes only a few fishing days and will not be available in future. Therefore other methods to estimate stock trends will be necessary. Two options are possible:

- refine lpue calculation from EU-logbook data
- used additional data

For this latter, the French tallybooks database seem to be an interesting opportunity as it is more accurate than EU logbooks, being haul by haul and including data on fishing depth.

In the course of the DEEPFISHMAN project, both analyses of EU-logbook and additional data from the fishery are scheduled to derive abundance indices.

For roundnose grenadier the result from preliminary estimate based upon the tally book suggest a decline trends for this species in all studies areas (Figures 10.2.10 and 10.2.11).

10.2.3.2 Separable VPA

Three exploratory assessments have been compared during this meeting as attempts to rebuild catch data time-series from different source of information. Landings data of roundnose grenadier from ICES Subareas VI and VII and Division Vb were available from 1990 to 2008 from ICES (ICES, 2008). Because of doubts about the reliability of landings data for Division XIIb, this area was not considered. All assessments were performed through a separable virtual population analyses (SVPA) model using VPA95 (CEFAS, Lowestoft, UK). The same parameters were used for each assessment:

- Model was run on age groups 16 to 40, the 40 group being a plus group (40+).
- Reference age group was the 25 years old group.
- Terminal fishing mortality F was set to 0.1.
- Selectivity factor S was set to 0.8.
- The same age–length key was used for the whole time-series and all assessments. This was an aggregation of data from the years 1996–1997 and 2002–2004.

The separable model was run with three data combinations;

- Landings length distribution data only (1990 to 2008).
- Landings length distribution data combined with an average length distribution of discards based from the available datasets. Methods are detailed in (Pawlowski and Lorance, WD #15 WGDEEP 2009) (L-D Assessment).
- Estimated catch length distributions reconstructed from known length distribution at depth (from research vessel surveys) combined with depth distribution of fishing effort (from tally book data). Methods are detailed in (Pawlowski and Lorance, WD #15 WGDEEP 2009) (E-DD assessment).

Residuals exhibit different patterns from one assessment to another (Figure 10.2.6). The reference assessment based on landings only has the noisiest residuals as a consequence of various changes in fishing gear and strategies through time. The L-D assessment including landings and an average distribution of discards has in comparison smoothed residuals. This is probably related to the combination of a constant length distribution for discards with variable data for the landings. The E-DD assessment seems to have intermediate residuals. The reconstruction of catch is based on few data and requires interpolations between years and depth bands therefore results tend to be smoothed.

For all three assessments, fishing mortalities (Figure 10.2.7) exhibit the same pattern with a slow rise from 0.02–0.04 to 0.07–0.08 in 1998 before a peak at 0.29 in 2001. This peak may not appear as very high compared with fishing mortality for shelf stock but this is not considered sustainable for a long-lived species which natural mortality is believed to be around 0.1 (a 0.1 mortality implies about 1% survivors after 50 years). After 2001, fishing mortality slowly declines towards the terminal F value of 0.1 in 2008; however sensitivity analyses carried out by WGDEEP in 2008 indicated that this trend was heavily dependent on the choice of terminal F. The period prior 2001 is not influenced by the choice of F. The sensitivity analysis demonstrated the model is not substantially influenced by the value of S.

Stock biomass reveals a strong decline from 1990 to 2008 for all runs (Figure 10.2.8). Sensitivity analysis in 2008 indicated that this was not influenced by choice of S or terminal F. The time-series can be divided into two periods: before and after 1998. After 1998, all runs exhibit similar trends and magnitude of biomass and decline towards a minimum value in 2008 of around 40 000–52 000 t. Before 1998, the biomass for the reference run drops from 376 000 in 1990 to 160 000 t in 1998 while the E-DD estimates biomass declining from 186 000 to 145 000 t over the same period.

10.2.4 Comments on assessment

Given that only a small number of years were covered by the assessment and roundnose grenadier lives up to age 60, the results should be interpreted with considerable caution. These assessments are exploratory this year and should not be used as a basis for any management consideration.

These assessments do not include Area XIIb where substantial catches of roundnose grenadier have been reported. The very high catch in 2001, more than 31 000 t (ICES, 2008), would have strongly affected stock estimates. Moreover, the fleets harvesting Division XIIb are different and the length distribution of their landings and discards may not be representative of the other areas.

Taking account depth and using tuning data into the roundnose grenadier assessment have been recommendations of the group for several years. Rebuilding catch data using the E-DD method could be improved if more information was available about the vertical distribution of the stock back in time and over a wider geographical area and if fishing efforts per depth for the various fleets were also provided to the Working Group.

The incorporation of discards into assessments is a complex issue and the Working Group would welcome guidance from a benchmark workshop in 2010.

10.2.5 Management considerations

No new advice was required in 2009.

Table 10.2.0a. Working Group estimates of landings of roundnose grenadier from Division Vb.

Year	Faroes	France	Norway	Germany	Russia/USSR	UK (E+W)	UK (Scot)	TOTAL
1988				1				1
1989	20	181		5	52			258
1990	75	1470		4				1549
1991	22	2281	7	1				2311
1992	551	3259	1	6				3817
1993	339	1328		14				1681
1994	286	381		1				668
1995	405	818						1223
1996	93	983		2				1078
1997	53	1059						1112
1998	50	1617						1667
1999	104	1861	2			29		1996
2000	48	1699		1		43		1791
2001	84	1932						2016
2002	176	774				81		1031
2003	490	1032				10		1532
2004	508	985	0	0	6	0	76	1575
2005	903	884	1	0	1	0	48	1837
2006	900	875	0	0	0	0	0	1775
2007	838	862	0	0	0	0	0	1700
2008*	621	390	0	0	0	0	0	1011

Table 10.2.0b. Working Group estimates of landings of roundnose grenadier from Subarea VI.

Year	Estonia	Faroes	France	Germany	Ireland	Lithuania	Norway	Poland	Russia	Spain	UK (E+W)	UK (Scot)	TOTAL
1988		27		4							1		32
1989		2	2211	3								2	2218
1990		29	5484	2									5515
1991			7297	7									7304
1992		99	6422	142			5				2	112	6782
1993		263	7940	1								1	8205
1994			5898	15	14							11	5938
1995			6329	2	59							82	6472
1996			5888									156	6044
1997		15	5795		4							218	6032
1998		13	5170				21			3			5207
1999			5637	3	1					1			5642
2000			7478		41		1			1002	1	433	8956
2001	680	11	5897	6	31	137	32	58	3	6942	21	955	14773
2002	821		7209		12	1817		932			6	741	11538
2003	52	32	4924		11	939		452	3			185	6598
2004	26	12	4574	0	8	961	0	13	72	252	0	72	5990
2005	80	24	2897	0	17	92	1	0	71	468	0	44	3694
2006	34	25	1931	0	5	112	0	0	0	0	0	15	2122
2007	0	10	1552	0	2	31	0	0	0	0	0	4	1599
2008*	0	5	1373	0	0	0	0	0	16	0	0	27	1421

Table 10.2.0c. Working Group estimates of landings of roundnose grenadier from Subarea VII.

YEAR	FAROES	FRANCE	IRELAND	SPAIN	UK (SCOT)	TOTAL
1988						0
1989		222				222
1990		215				215
1991		489				489
1992		1556				1556
1993		1916				1916
1994		1922				1922
1995		1295				1295
1996		1051				1051
1997		1033		5		1038
1998		1146		11		1157
1999		892		4		896
2000		859				859
2001		938	416			1354
2002	1	449	605		3	1058
2003		373	213		1	587
2004	0	248	320	0	0	568
2005	0	191	55	0	0	246
2006		248	138	0	0	386
2007		207	20	0	0	227
2008*		87				87

Table 10.2.0d. Working Group estimates of landings of roundnose grenadier from Subarea XIIb.

YEAR	ESTONIA*	FAROES	FRANCE**	GERMANY	ICELAND	IRELAND	LITHUANIA	SPAIN***	USSR/RUSSIA	UK (E+W)	UK (SCOTL.)	NORWAY	TOTAL
1988													0
1989			0						52				52
1990			0										0
1991			14						158				172
1992			13										13
1993		263	26	39									328
1994		457	20	9									486
1995		359	285										644
1996		136	179		77			1136					1528
1997		138	111					2476					2725
1998		19	116					3829					3964
1999		29	287					6171	6				6493
2000		6	374	9				13418		9	6		13822
2001		2	159			3		31602			7	1	31774
2002			14				18	5359		1	2		5394
2003			539			1	31	18173			1		18745
2004		8	1 693				120	8151	91		4		10067
2005	20	5	508				13	5035	81		350		6012
2006	27	1	85				6	5167					5286
2007		2	0					5735					5737
2008***		0	0										0

Table 10.2.0e. Working Group estimates of landings of roundnose grenadier unallocated landings in Vb VI and VII.

YEAR	UNALLOCATED
1988	
1989	
1990	
1991	
1992	
1993	
1994	
1995	
1996	
1997	
1998	
1999	
2000	
2001	208
2002	504
2003	952
2004	0
2005	5003
2006	0
2007	0
2008*	0

Table 10.2.0f. Working Group estimates of landings of roundnose grenadier Vb, VI, VI and XIIb.

Year	Vb	VI	VII	XIIb	Unallocated	Vb,VI,VII	Overall total
1988	1	32	0	0	0	33	33
1989	258	2218	222	52	0	2698	2750
1990	1549	5515	215	0	0	7279	7279
1991	2311	7304	489	172	0	10104	10276
1992	3817	6782	1556	13	0	12155	12168
1993	1681	8205	1916	328	0	11802	12130
1994	668	5938	1922	486	0	8528	9014
1995	1223	6472	1295	644	0	8990	9634
1996	1078	6044	1051	1528	0	8173	9701
1997	1112	6032	1038	2725	0	8182	10907
1998	1667	5207	1157	3964	0	8031	11995
1999	1996	5642	896	6493	0	8534	15027
2000	1791	8956	859	13822	0	11606	25428
2001	2016	14773	1354	31774	208	18143	49917
2002	1031	11538	1058	5394	504	13627	19020
2003	1532	6598	587	18745	952	8717	27461
2004	1575	5990	568	10067	0	8133	18200
2005	1837	3694	246	6012	5003	5777	11790
2006	1775	2122	386	5286	0	4283	9569
2007	1700	1599	227	5737	0	3526	9263
2008*	1011	1421	87	0	0	2519	2519

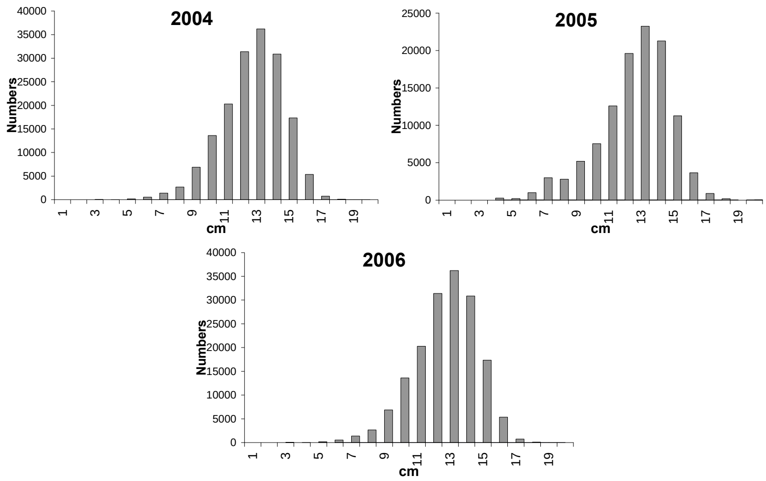


Figure 10.2.1. Length distribution of the discards of roundnose grenadier from 2004 to 2006, from observer programme.

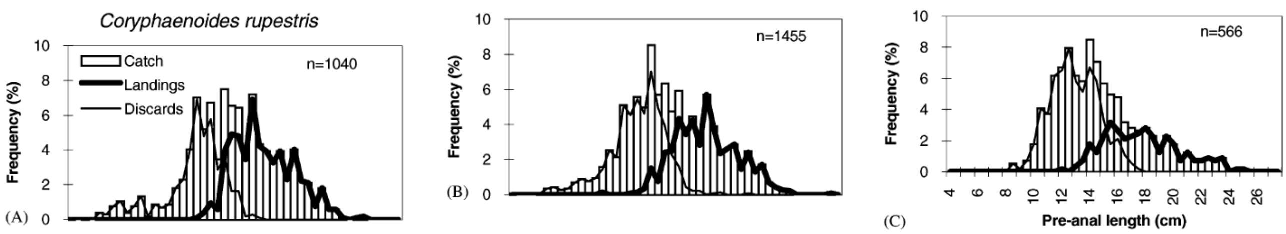


Figure 10.2.2. Length distribution of the discards and landings of roundnose grenadier in 1996–97 by depth, left: 800–1000 m, centre: 100–1200 m, right: 1200–1400 m, sampled on board French vessels, (redrawn from Allain, 2003).

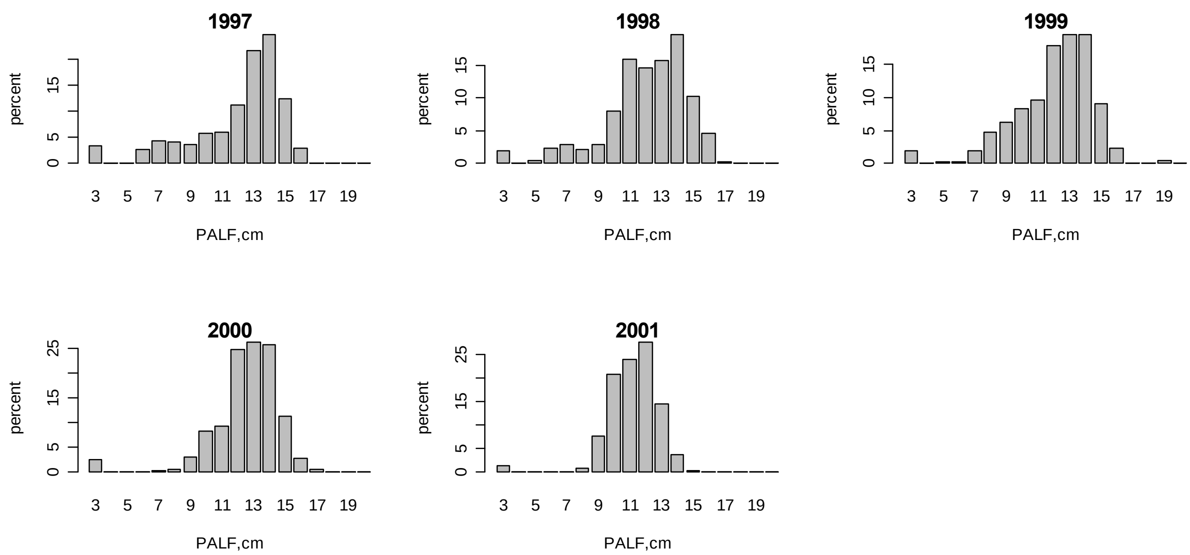
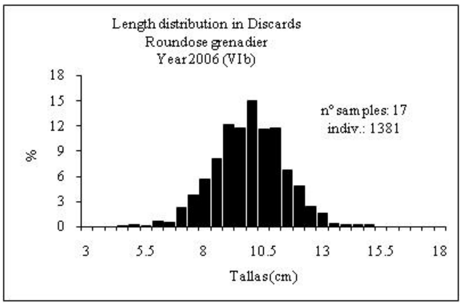


Figure 10.2.3. Length distribution of the discards of the French fleet, sampled on board French vessels by Scottish observers, 1997–2001.



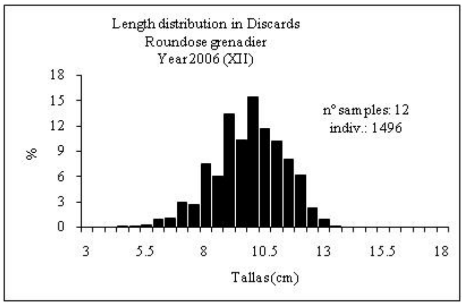


Figure 10.2.4. Length distribution of the discards of the Spanish fleet in Divisions VIb and XIIb based on on-board observations in 2006.

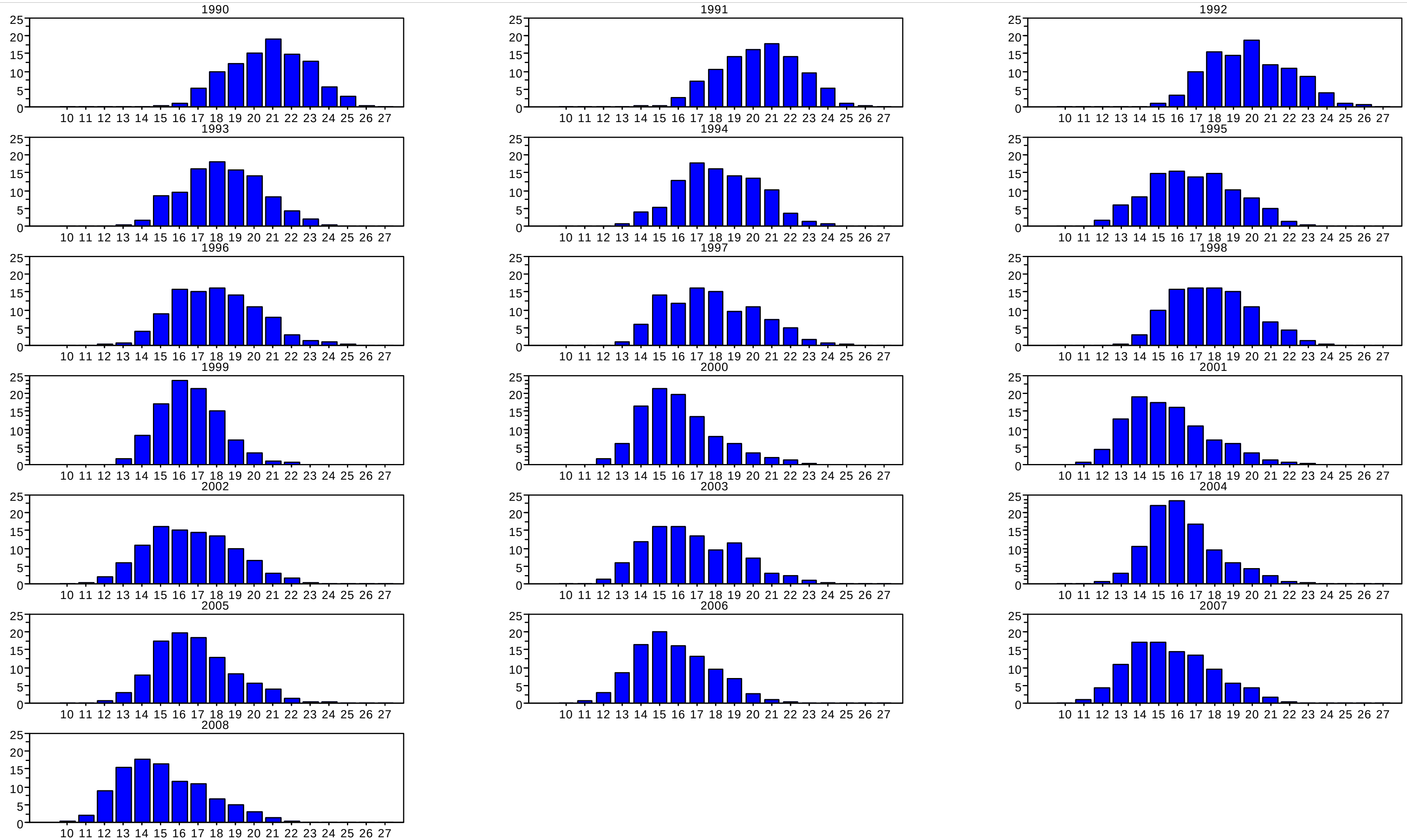
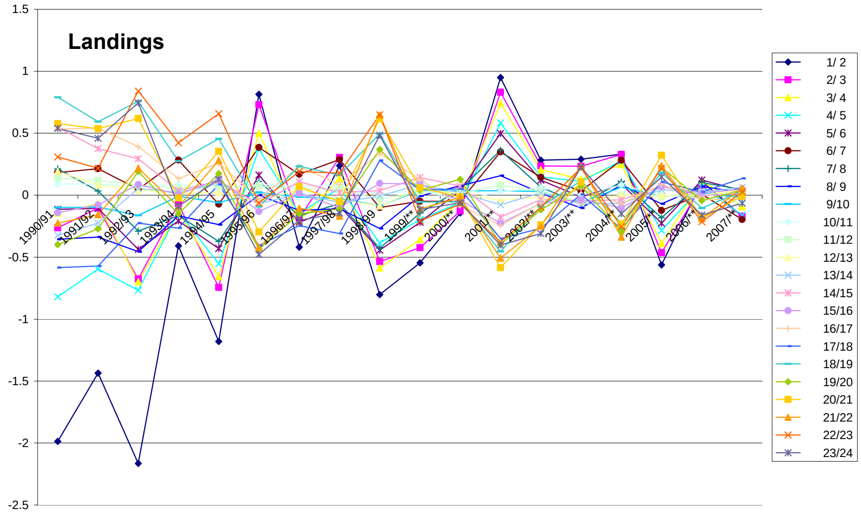
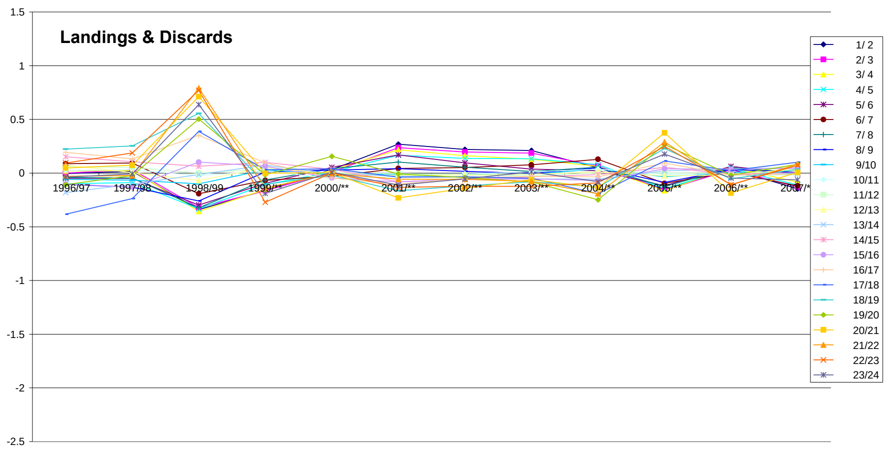


Figure 10.2.5. Length distribution of the discards of the French fleet, sampled on-board French vessels by Scottish observers, 1997–2001.





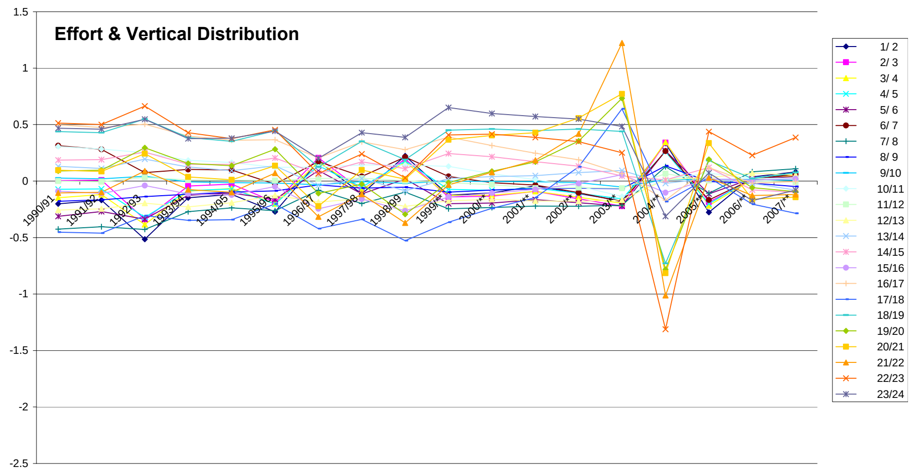
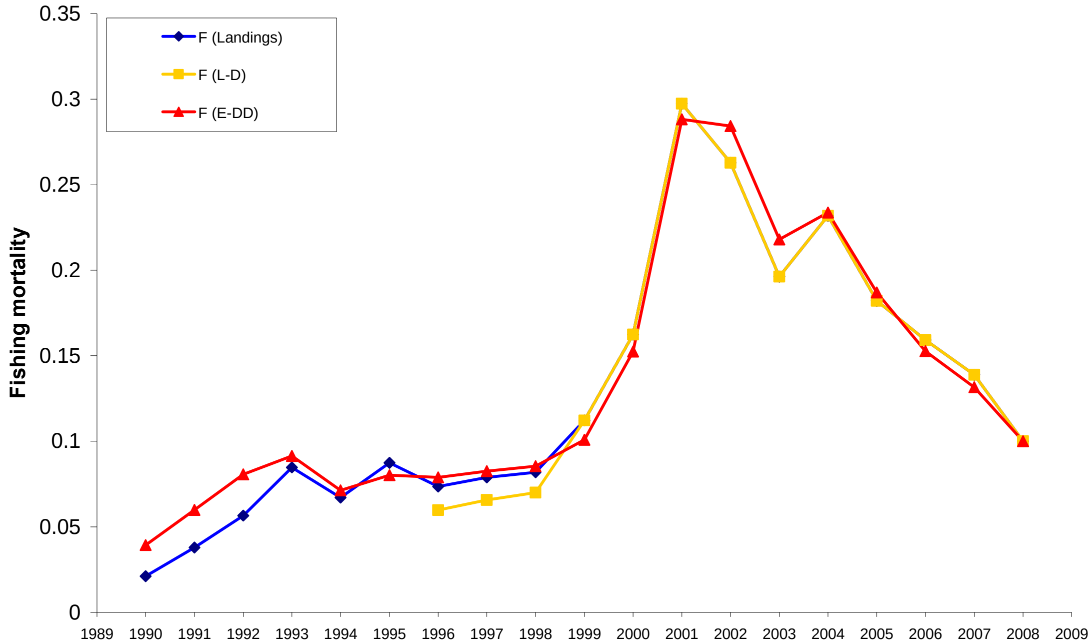


Figure 10.2.6. Residuals patterns for the different assessments.



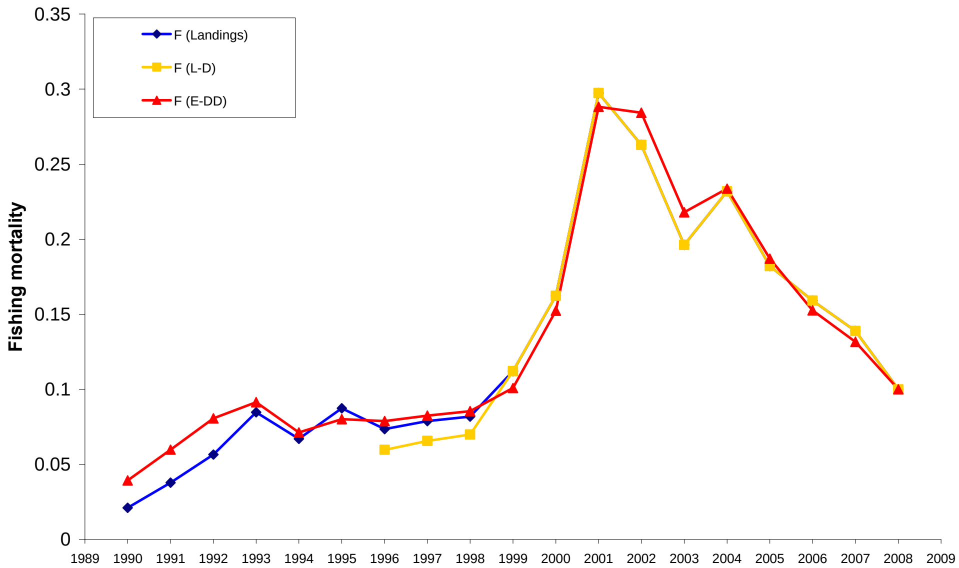


Figure 10.2.7. Fishing mortality for roundnose grenadier in Vb, VI, VII. The curve for the landings only assessment is obscured by the curve for the L-D assessment after 1999.

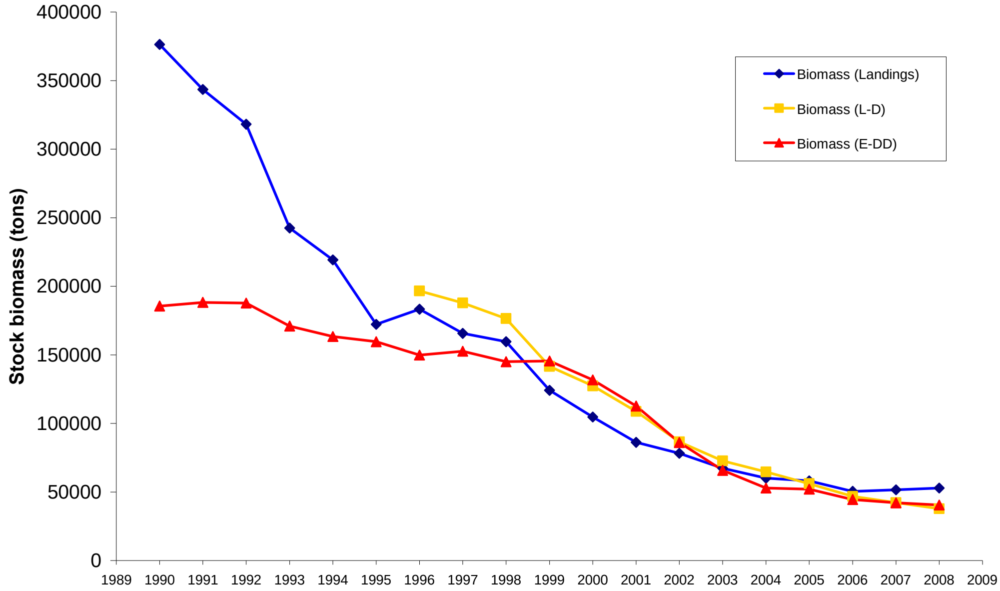


Figure 10.2.8. Estimates of stock biomass based on landings and two methods of reconstructed catch data based on separable VPA, for roundnose grenadier in Vb, VI, VII. Terminal F is set to 0.1 and S to 0.8.

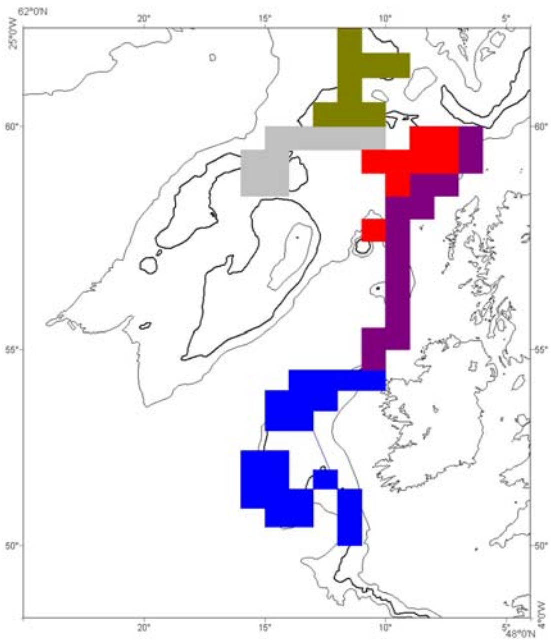


Figure 10.2.10 Reference areas (set of statistical rectangles) used to calculate French lpues (brown: New grounds in V (new5), grey new grounds in VI (new6); red: others in VI (other6); purple: edge in VI (edge6); blue: all grounds in VII (ref7). Depth contours are 200, 1000 and 2000 m.

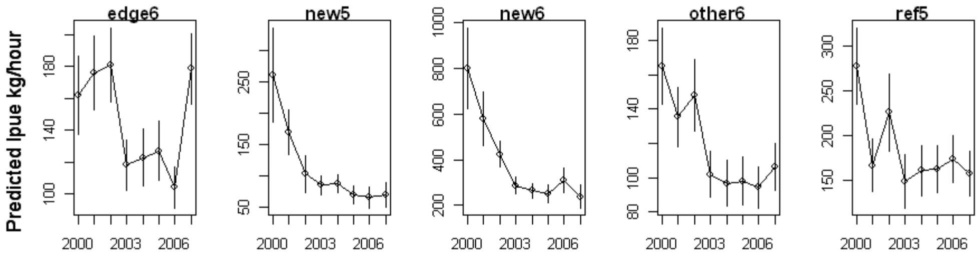


Figure 10.2.11. Lpue of French trawlers in 5 areas (labelled according to Biseau, 2006 WD) from tows targeting roundnose grenadier (defined as tows where the total catch include >10% of roundnose grenadier).

10.3 Roundnose Grenadier (*Coryphaenoides rupestris*) in Division IIIa

10.3.1 Fishery

The stock of roundnose grenadier has been the basis for commercial exploitation by a few Danish vessels since the late 1980s, in some years mainly by a single vessel. This directed fishery began in 1987 as an exploratory fishery. Up to 2003 landings fluctuated between 1000 and 3000 t. The recent geographical distribution of the fishery is shown in Figure 10.3.1 and Tables 10.3.2 a–c. It is seen that a major part of the catches is taken in the Norwegian zone of Skagerrak. However, this directed fishery stopped in 2007 because of retirement of the single fisher conducting this métier, and until now no other fishers have taken up this fishery. Bycatch of roundnose grenadier is also taken in the fisheries for *Pandalus*, also in IVa. However, the landings of this bycatch (for reduction) are generally insignificant, see Table 10.3.0.

10.3.1.1 Landings trends

WG figures for total landings, 1988–2006, by all countries are demonstrated in Table 10.3.0. It is seen that only Denmark has contributed significantly to this fishery. Table 10.3.1 shows the total Danish landings of this species split in landings for H.C. and for reduction. These landings figures have been estimated on basis of reported logbook records combined with samples of the landed catches for reduction. They differ slightly from the logbook recorded catches, which generally overestimate the true landings. For the period 2001–2006 peak landings within a year were recorded in March–April.

The development of this fishery in recent years has been remarkable considering the small area (Table 10.3.0 and Figure 10.3.2) From a level of around 2000 t up to 2002, taken by a mainly a single vessel, total landings increased to more than 11 000 t in 2005. In 2006 landings decreased again to 2261 tons, but this was because of special management agreements restricting the catch level in this area. In the years of peak catches, in all only 2–3 vessels participated significantly in the fishery. Since 2007, when the directed fishery ended, only negligible amounts have been landed and only as occasional bycatch.

10.3.1.2 ICES advice

In 2008, ICES advised; *It has not been possible to assess the status of the stock. However, as scientific investigations have indicated slow growth of this species, the drastic increase in exploitation of this stock during the years 2003–2005 gave rise for serious concern, even if no clear signs of the increasing fishing pressure were observed in recent years. No directed fishery has taken place since 2007, due to retirement of the fishers. A decrease in mean length in* *the catch from 1987 to 2004 and 2005 indicates heavy exploitation on this stock, see Figure 9.4.15.1.3.*

10.3.1.3 Management

The directed fishery for grenadier was mainly carried out in the Norwegian EEZ, and was largely unregulated and unrestricted. The EC introduced unilateral TACs for IIIa in 2004–2006, but this restriction did not apply in the Norwegian EEZ, for which the trilateral Skagerrak treaty between Denmark, Norway and Sweden is in force. The Skagerrak treaty allows Danish and Swedish vessels to operate freely in the Norwegian zone, and Norway has not set any TAC or introduced other regulations on grenadier fishing in IIIa or IVa. Therefore, the Danish (and Swedish) fleet(s) could in principle fish unrestricted by the (EU) TAC for grenadier in these waters.

At the consultative meeting in Oslo 31 January 2006, the EC and Norway agreed that "fishing opportunities on this stock should be limited to a "sustainable level", which in this case was set to average landings for the period 1996–2003. Following this agreement, a TAC of 2700 t for the EU in 2006 was set for IIIa including the Norwegian EEZ. In fact, because of this constraint, the fishery in 2006 was closed already in April that year.

10.3.2 Data available

10.3.2.1 Length compositions

Length frequency data for roundnose grenadier in IIIa are available for 1987 from resource surveys by the Danish and Norwegian research vessels and an experimental Danish fishery in the same year. Following the increasing focus on fisheries for deep-sea species samples from the current commercial fishery for roundnose grenadier are available for 2004–2006. These samples have been obtained in two ways:

Samples from landed catch of roundnose grenadier have been collected and analysed by the fishery inspection and the data are sent to DIFRES.

Samples taken at sea by observers, who have been participating in fishing trips on board the vessels

The number of samples collected in 2004–2006 is demonstrated in the text table below.

Sampling type	Year			Total
	2004	2005	2006	
Sampling in harbour	46	29	7	82
Sampling at sea	1	2	10	13
Total	47	31	17	95

Figures. 10.3.3 A–D show the size distribution of roundnose grenadier in 1987 and 2004–2006. Note that both in 1987 and 2004 there appear to be two clearly distinguishable components in the length composition. With the current lack of knowledge of the age structure, it is impossible to say whether the smaller one represents recruits to the fishery. In the 2005 and 2006 distribution no such clear mode of small individuals is seen.

10.3.2.2 Age composition

No recent age composition data are available. However, the investigation by Bergstad, 1990 based on data for 1987 in Skagerrak suggests very slow growth and consequently the age distributions in the catches could span over 20–30 years, both in 1987 and in 2004–2006.

10.3.2.3 Effort and cpue

Tables 10.3.2 A–C and Figure 10.3.2 show the overall trends in logbook recorded catch, effort and cpue for the directed fishery on this stock. A number of different mesh sizes have been used in the fishery. The cpue series has been recalculated in 2007 using mesh seizes between 35 mm and 70 mm only. The estimated catch per day has increased but the trend in the series has not changed. The catch figures demonstrated here differ slightly from the final (adjusted) landings figures (Table 10.3.0) because of the species allocation procedures in the recording the industrial landings.

Bergstad *et al*. (2003), analysed catches of roundnose grenadier in Norwegian shrimp trawl surveys between 2004 and 2009. Survey data demonstrate that abundance of (predominantly) juveniles (PAL<5cm) was highly variable from 1984–2009. Pulses in recruitment appear to be followed by many years with almost no recruitment**, see Figure10.3.4**. The pulse in the early 1990s was particularly prominent. The progression of the mode in the size distributions from 1991 onwards suggest that only a single year class 'rejuvenated' the population in this period. What appears as an elevated production of juveniles in the early 1990s probably explains the higher abundance of the population about ten years later, i.e. in 2003–2005.

The abundance indices and size frequency for roundnose grenadier since 1984 clearly reveals that the size distributions in 2008 and 2009 are dominated by smaller fish than in the 1980s. A distinct progression of the mode in the size distributions from 1991 onwards suggests that only a single year class 'rejuvenated' the population in this period **(Figure 10.3.5)**. Thus, what appears as an elevated production of juveniles in the early 1990s could explain the higher abundance of the population about ten years later, i.e. in 2003–2005, which was the period of the peak Danish exploitation. A decline in the survey abundance in 2006–2009 is observed, but the levels in recent years are similar to those in the periods prior to the heavy exploitation, see Figure 10.3.**6**. Any long-term effects of the heavy Danish commercial exploitation of this stock during the first half of the 2000s has not yet been detected, and it is still not known, if the level of exploitation in the years 2002–2006 was sustainable.

10.3.3 Data analyses

No assessment was required for this stock in 2009.

10.3.4 Comments on the assessment

No assessment was required for this stock in 2009.

10.3.5 Management considerations

No advice was required for this stock in 2009.

Table 10.3.0 Roundnose grenadier in Division IIIa and IVa. WG estimates of landings.

Year	Denmark	Norway	Sweden	TOTAL
1988	612		5	617
1989	884		1	885
1990	785	280	2	1067
1991	1214	304	10	1528
1992	1362	211	755	2328
1993	1455	55		1510
1994	1591		42	1633
1995	2080		1	2081
1996	2213			2213
1997	1356	124	42	1522
1998	1490	329		1819
1999	3113	13		3126
2000	2400	4		2404
2001	3067	35		3102
2002	4196	24		4220
2003	4302			4302
2004	9874	16		9890
2005	11922			11922
2006	2261	4		2265
2007	+	1		1
2008*	+	+		+

*** Preliminary data.**

Table 10.3.1. Danish landings, 1996–2006 of roundnose grenadier split into H.C. landings and landings for reduction.

	Landings of roundnose grenadier (kg)		Total landings
year	H. C.	Reduction	(tons)
1996	6493	2 207 000	2213
1997		1 356 280	1356
1998	635	1 489 000	1490
1999		3 113 000	3113
2000	315	2 400 000	2400
2001	6401	3 061 000	3067
2002	4	4 195 738	4196
2003	7	4 301 661	4302
2004	3129	9 870 664	9874
2005	17056	11 904 545	11 922
2006	2448	2 259 000	2261

Table 10.3.2 A–C. The Danish fishery for roundnose grenadier in IIIa. Trends in catch, effort and cpue by major ICES rectangle, see text.

Total catch (tons) by ICES rectangle						
year	44F8	44F9	45F8	45F9	46F9	total
1996	80	40	25	709	98	951
1997	28	0	115	1088	163	1393
1998	238	235	180	1483	1112	3248
1999	0	25	61	704	1353	2143
2000	0	0	40	893	854	1787
2001	105	11	65	862	956	1999
2002	165	79	0	928	1531	2702
2003	0	120	545	1223	1769	3657
2004	1104	5786	215	1704	1721	10529
2005	518	4073	682	4739	2823	12834
2006	26	517	40	1067	487	2136
Total effort (days) by ICES rectangle						
year	44F8	44F9	45F8	45F9	46F9	total
1996	5	23	2	59	6	95
1997	3		7	67	5	82
1998	7	9	4	54	32	106
1999		2	4	43	65	114
2000		2	4	57	48	111
2001	5	8	3	49	65	130
2002	11	7		42	70	130
2003		5	17	70	96	188
2004	99	391	9	74	65	638
2005	47	178	9	107	77	418
2006	2	19	2	24	20	67
Total cpue (tons/day) by ICES rectangle						
year	44F8	44F9	45F8	45F9	46F9	Average
1996	16.0	1.7	12.5	12.0	16.3	10.0
1997	9.2		16.4	16.2	32.5	17.0
1998	34.0	26.1	45.0	27.5	34.8	30.6
1999		12.5	15.3	16.4	20.8	18.8
2000		0.0	10.0	15.7	17.8	16.1
2001	21.0	1.4	21.7	17.6	14.7	15.4
2002	15.0	11.3		22.1	21.9	20.8
2003		24.0	32.1	17.5	18.4	19.5
2004	11.2	14.8	23.9	23.0	26.5	16.5
2005	11.0	22.9	75.7	44.3	36.7	30.7
2006	12.8	27.2	20.0	44.5	24.3	31.9

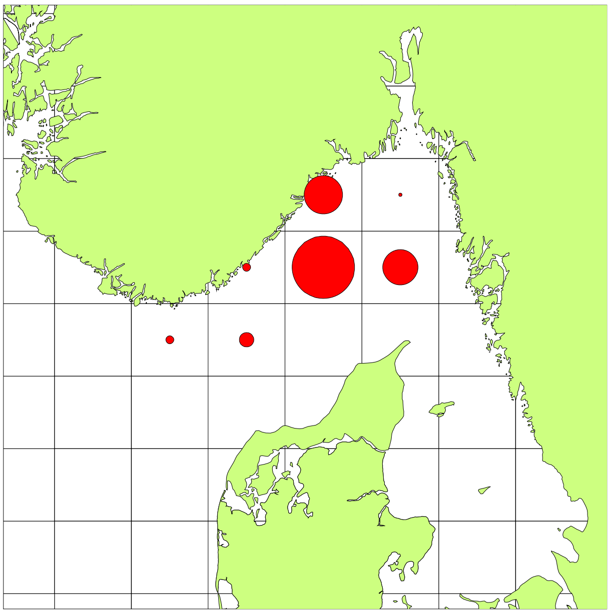


Figure 10.3.1 Geographical distribution of the fishery for roundnose grenadier in IIIa in 2006.

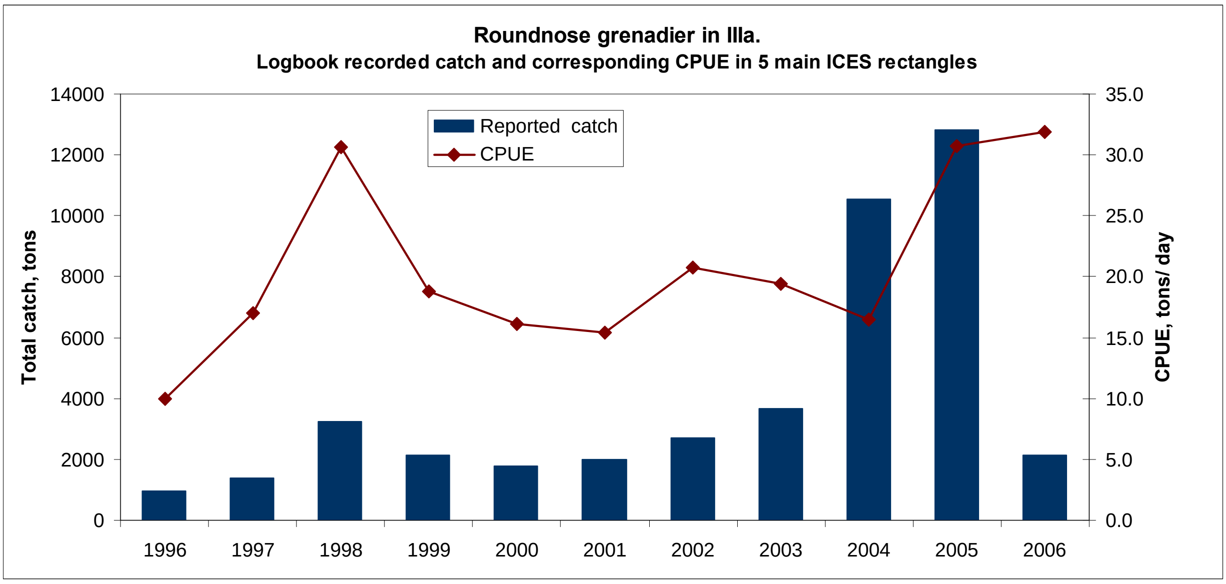
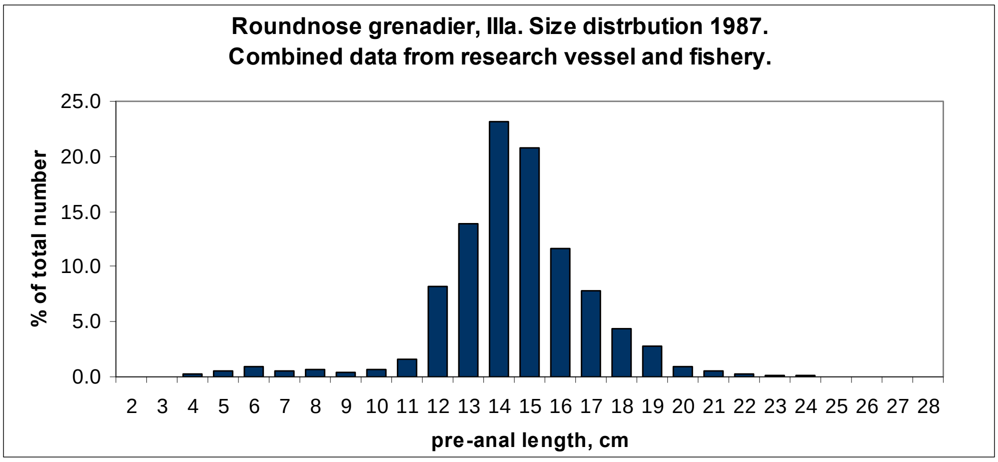
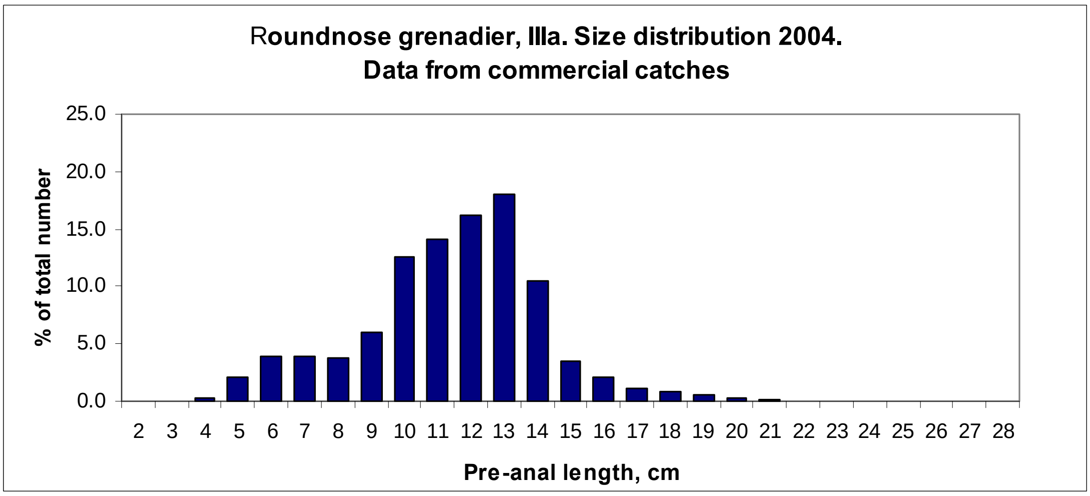


Figure 10.3.2. Danish catches and cpue by main ICES rectangle. Based on logbook records.





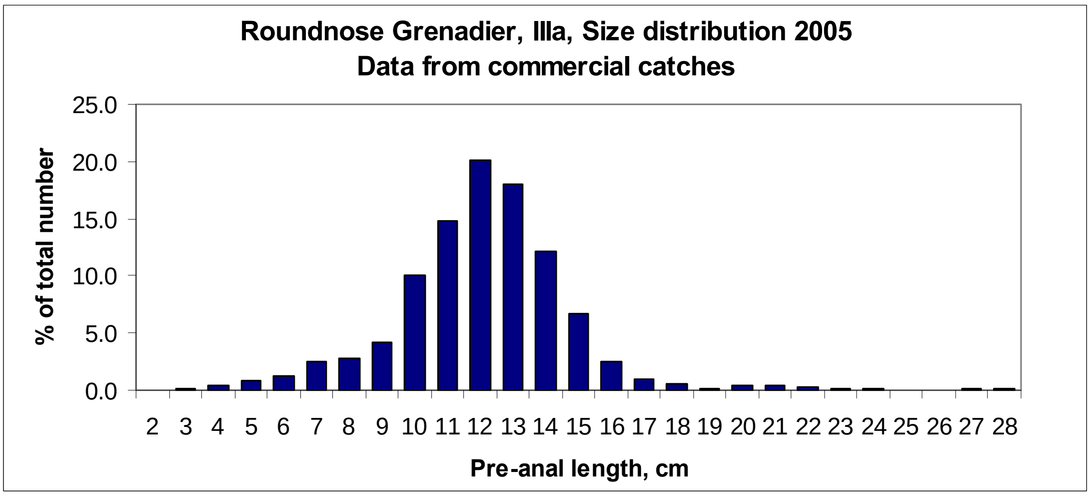


Figure 10.3.3 A–C. Length distribution Danish catches of roundnose grenadier.

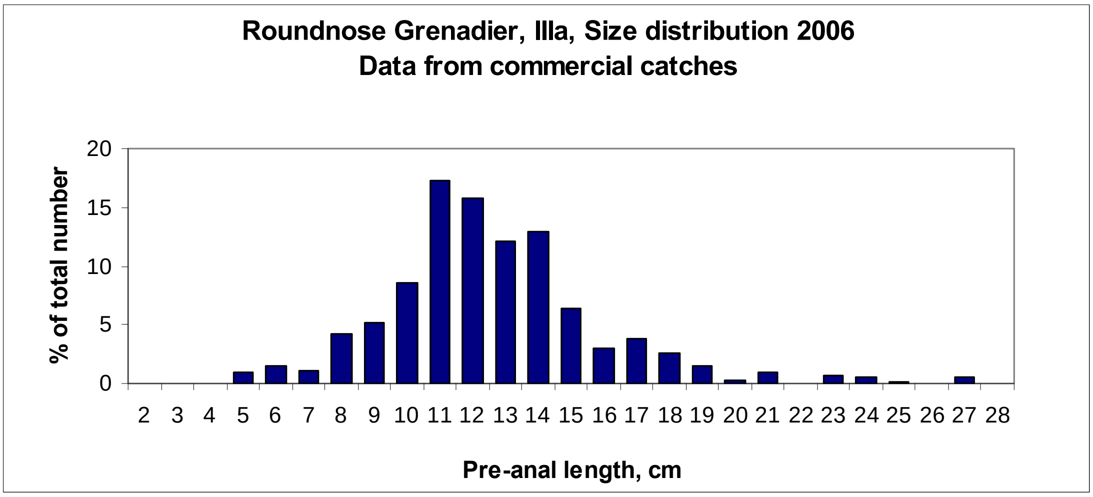


Figure 10.3.3 D. Length distribution Danish catches of roundnose grenadier.

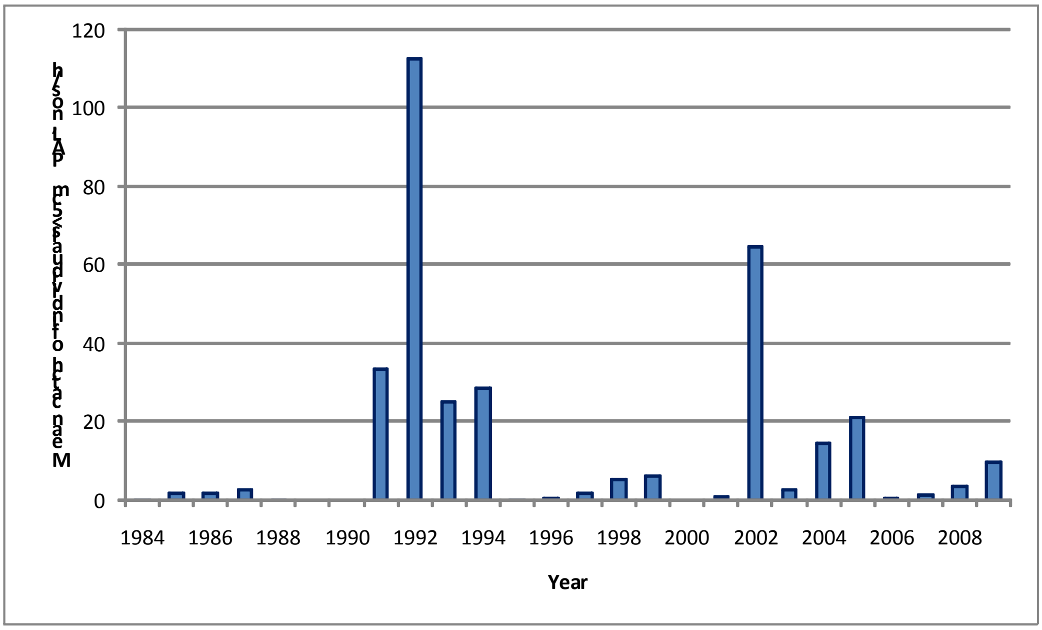
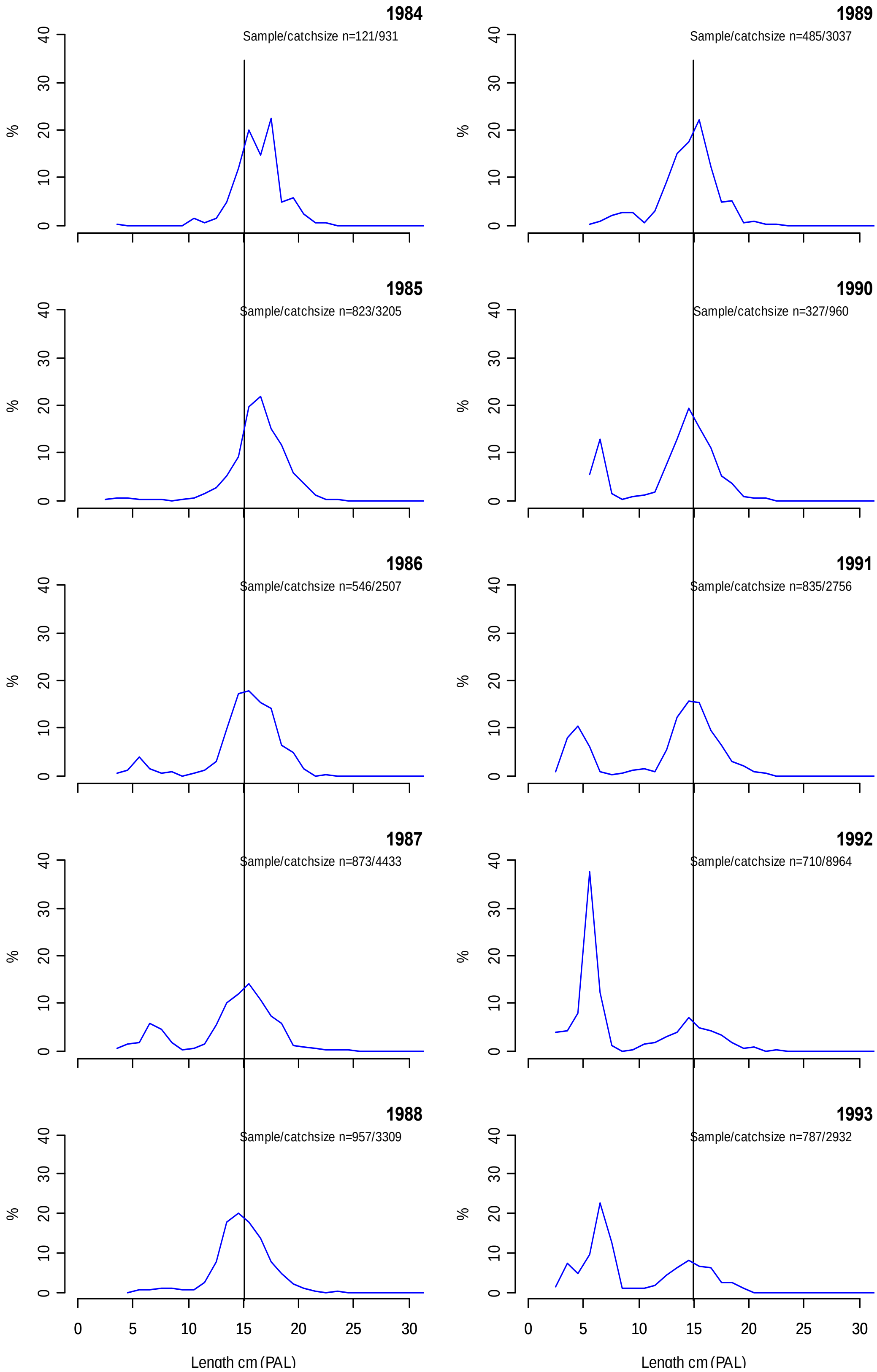
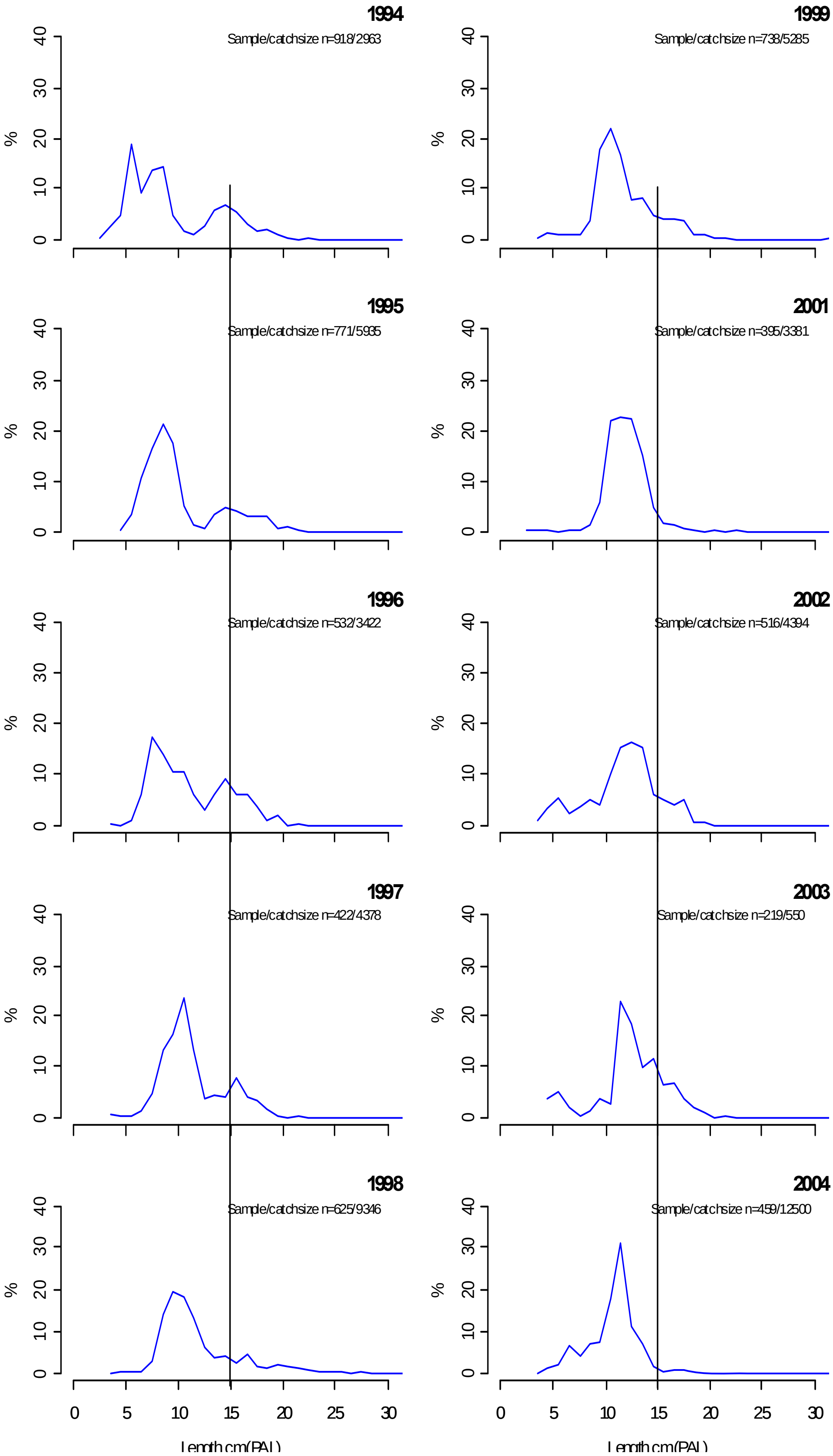


Figure 10.3.4. Mean catch of roundnose grenadier <5 cm PAL, 2005-2009. Data from shrimp survey, trawls deeper than 300 m. Note: in 1984, 2003, 2006, and 2007 only a single or no trawls were made deeper than 400 m and data from these years are unreliable.


1984
Sample/catchsize n=121/931
1985
Sample/catchsize n=823/3205
1986
Sample/catchsize n=546/2507
1987
Sample/catchsize n=873/4433
1988
Sample/catchsize n=957/3309
1989
Sample/catchsize n=485/3037
1990
Sample/catchsize n=327/960
1991
Sample/catchsize n=835/2756
1992
Sample/catchsize n=710/8964
1993
Sample/catchsize n=787/2932
%
0
10
20
30
40
0
5
10
15
20
25
30
Length cm (PAL)


1994
Sample/catchsize n=918/2963
1999
Sample/catchsize n=738/5285
1995
Sample/catchsize n=771/5935
2001
Sample/catchsize n=395/3381
1996
Sample/catchsize n=532/3422
2002
Sample/catchsize n=516/4394
1997
Sample/catchsize n=422/4378
2003
Sample/catchsize n=219/550
1998
Sample/catchsize n=625/9346
2004
Sample/catchsize n=459/12500
%
0 10 20 30 40
0 5 10 15 20 25 30
Length cm (PAL)

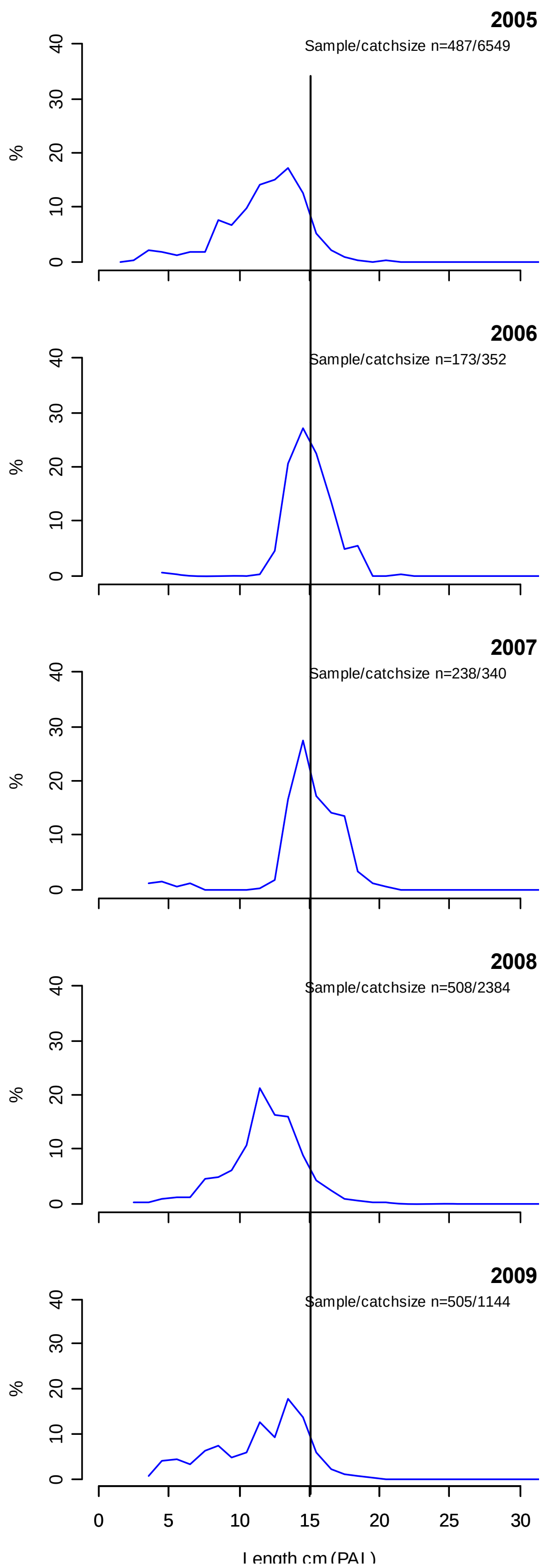


Figure 10.3.5. Length frequency distributions for roundnose grenadier, 1984–2009. Data from shrimp survey, all catches deeper than 300m.

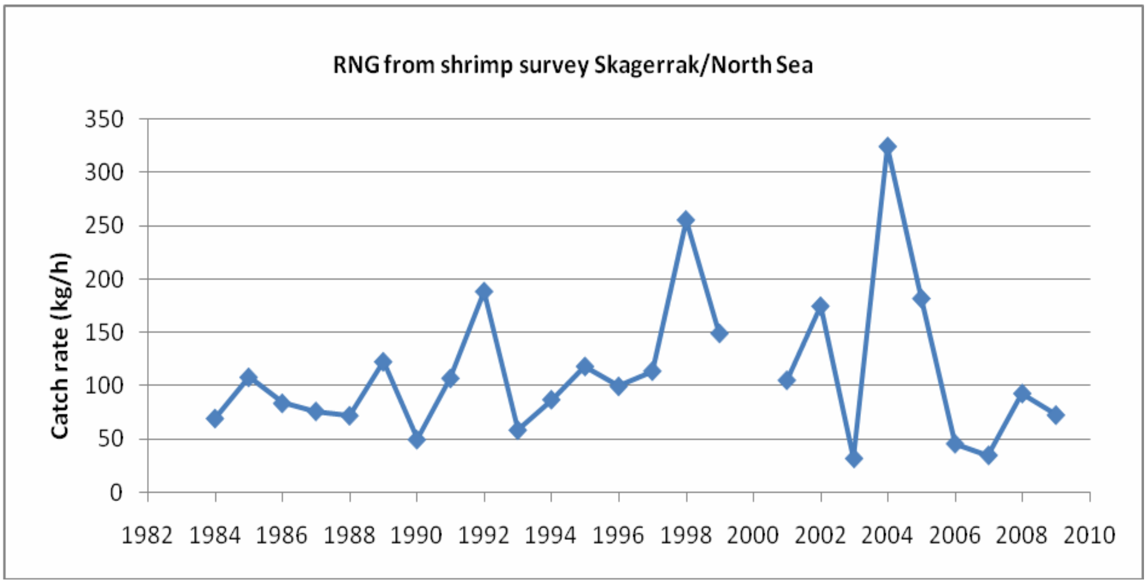


Figure 10.3.6. Mean standardized catch of roundnose grenadier in terms of numbers (upper) and weight (lower) in the 1984–2009 shrimp survey in ICES Division IIIa. For each year, the average catch was calculated for all trawls deeper than 300 m, including 0-catches. Note: in 1984, 2003, 2006, and 2007 only a single or no trawls were made deeper than 400 m and data from these years are unreliable.

10.4 Roundnose Grenadier (*Coryphaenoides rupestris*) in Divisions Xb, XIIc and Subareas Va1, XIIa1, XIVb1

10.4.1 The fishery

The fishery on the Northern Mid-Atlantic Ridge (MAR) started in 1973, when dense concentrations of roundnose grenadier were discovered by USSR exploratory trawlers. Roundnose grenadier aggregations may have occurred on 70 seamount peaks between 46–62°N but only 30 of them were commercially important and subsequently exploited. The fishery is mainly conducted using pelagic trawls although on some seamounts it is possible to use bottom gear.

10.4.1.1 Landings trends

The greatest annual catch (almost 30 000 t) in that area was taken by the Soviet Union in 1975 (Table 10.4.1, Figure 10.4.1) and in subsequent years the Soviet catch varied from 2800 to 22 800 t. The fishery for grenadier declined after the dissolution of the Soviet Union in 1992. In the last 15 years, there has been a sporadic fishery by vessels from Russia (annual catch estimated at 200–3200 t), Poland (500–6700 t), Latvia (700–4300 t) and Lithuania (data on catch are not available). Grenadier has also been taken as bycatch in the Faroese orange roughy fishery and Spanish blue ling fishery.

There is no information about target fishery of roundnose grenadier on the MAR in 2006 and 2007. In 2008 a Russian trawler made attempts at fishing with pelagic and bottom trawls in the southern part of the Division XIIc. Total catch was 29.5 t including 12.8 t of roundnose grenadier.

10.4.1.2 ICES advice

In 2008, ICES advised; *Due to its low productivity, roundnose grenadier can only sustain low rates of exploitation. Fisheries on such species should always be accompanied by pro-*

grammes to collect data on both target and bycatch fisheries. The fishery should not be allowed to expand from the current low level unless it can be shown that it is sustainable.

10.4.1.3 Management

There is TAC-based species-specific management of the roundnose grenadier fisheries in Subareas VIII, IX, X, XII, XIV for European Community vessels (Table 10.4.2). In the international waters there are NEAFC regulation of efforts in the fisheries for deep-water species.

10.4.2 Data available

10.4.2.1 Landings and discards

Data on catches are given in Table 10.4.1. There were no discards of roundnose grenadier on Russian trawlers where smallest fish and waste were used for fishmeal processing. There is no information on discards by other countries vessels.

10.4.2.2 Length compositions

No new data on length compositions were available.

10.4.2.3 Age compositions

No new data on age compositions were presented.

10.4.2.4 Weight-at-age

No new weight-at-age data are available.

10.4.2.5 Maturity and natural mortality

New data on maturity and natural mortality are unavailable.

10.4.2.6 Catch, effort and research vessel data

Catch and cpue data are given in Table 10.4.1 and Figure 10.4.1. The data for 2000–2005 are demonstrated together with the data for the period 1973–1999. There are gaps in the cpue time-series as a consequence of lack of catch statistics for 1973 and 1982 and absence of target fishery in 1994–1995 and 2006–2008. Effort data separated by subareas are available for Russian fleet in 2003–2005 only (Table 10.4.1). There were no research vessel data presented for 2008.

10.4.3 Data analyses

No assessment was required for this stock in 2009.

10.4.4 Comments on the assessment

No assessment was required for this stock in 2009.

10.4.5 Management considerations

No advice was required for this stock in 2009.

Table 10.4.1. Roundnose grenadier catches (t) by area, nation and Soviet/Russian efforts and cpue on the MAR.

Year	ICES Subarea and Division	Catch, t						Number of fishing days	Catch per fishing day, t
		USSR/ Russia	Poland[2]	Latvia[2]	Faroes[2]	Spain[2]	Total		
1973	XIIa1+XIIc	226					226		
	Va1	820					820		
1974	XIIa1+XIIc	5874					5874		35.2
	Va1	12561					12561		
1975	XIIa1+XIIc	29894					29894		36.6
1976	XIIa1+XIIc	4545					4545		24
	XIVb1	11					11		
	Xb	170					170		
1977	XIIa1+XIIc	9347					9347		17.3
1978	XIIa1+XIIc	12310					12310		17
1979	XIIa1+XIIc	6145					6145		19.6
1980	XIIa1+XIIc	17419					17419		17.3
1981	XIIa1+XIIc	2954					2954		18.4
1982	XIIa1+XIIc	12472					12472		
	XIVb1	153					153		
1983	XIIa1+XIIc	10300					10300		17.3
1984	XIIa1+XIIc	6637					6637		18
1985	XIIa1+XIIc	5793					5793		18.5
1986	XIIa1+XIIc	22842					22842		21
1987	XIIa1+XIIc	10893					10893		17.3
1988	XIIa1+XIIc	10606					10606		21.8
1989	XIIa1+XIIc	9495					9495		15.6
1990	XIIa1+XIIc	2838					2838		18.4
1991	XIIa1+XIIc	3214[1]		4296			7510[1]		14.5
1992	XIIa1+XIIc	295		1684			1979		12.9
1993	XIIa1+XIIc	473		2176	263		2912		10.7
	Xb				249		249		
1994	XIIa1+XIIc			675	457		1132		
1995	XIIa1+XIIc				359		359		
1996	XIIa1+XIIc	208			136		344		22.2
	Xb				3		3		
1997	XIIa1+XIIc	705	5867		138		6710		20.3
	XIVb1	336[1]					3361		
	Xb				1		1		
1998	XIIa1+XIIc	812	6769		19		7600		6.8
	Xb				1		1		
1999	XIIa1+XIIc	576	546		29		1151		8.8
	Xb				3		3		
2000	XIIa1+XIIc	2325					2325		9.1
	XIVb1	5					5		

[1]– revised catch data [2]– official ICES data [3]– preliminary data

Table 10.4.1 continued.

Year	ICES Sub area and Division	Catch, t USSR/ Russia	Poland[2]	Latvia[2]	Faroes[2]	Spain[2]	Total	Number of fishing days	Catch per fishing day, t
2001	XIIa1+XIIc	1714			2		1716		15.8
	XIVb1	69					69		
2002	XIIa1+XIIc	737					737		13.2
	XIVb1	4				235	239		
2003	XIIa1+XIIc	510					510	51	10.1
	XIVb1					272	272		
2004	XIIa1+XIIc	436			8		444	25	16.1
	XIVb1	20[1]					201		
	Xb				1		1		
2005	XIIa1+XIIc	600					600	42	17.7
	Xb	799					799	37	
2006	XIIc				1		1		
2007	XIIc				2		2		
2008[3]	XIIc	13							
Total		208156	13182	8831	1672	507	232348		

[1]– revised catch data [2]– official ICES data [3]– preliminary data

Table 10.4.2. Fishing opportunities applicable for European Community vessels for roundnose grenadier fisheries by countries and by areas in 2009–20010 (EC and international waters).

Country	TAC, t
Areas VIII, IX, X, XII, XIV	
Germany	34
Spain	3734
France	172
Ireland	7
United Kingdom	15
Latvia	60
Lithuania	7
Poland	1168
Total for EC vessels	5197

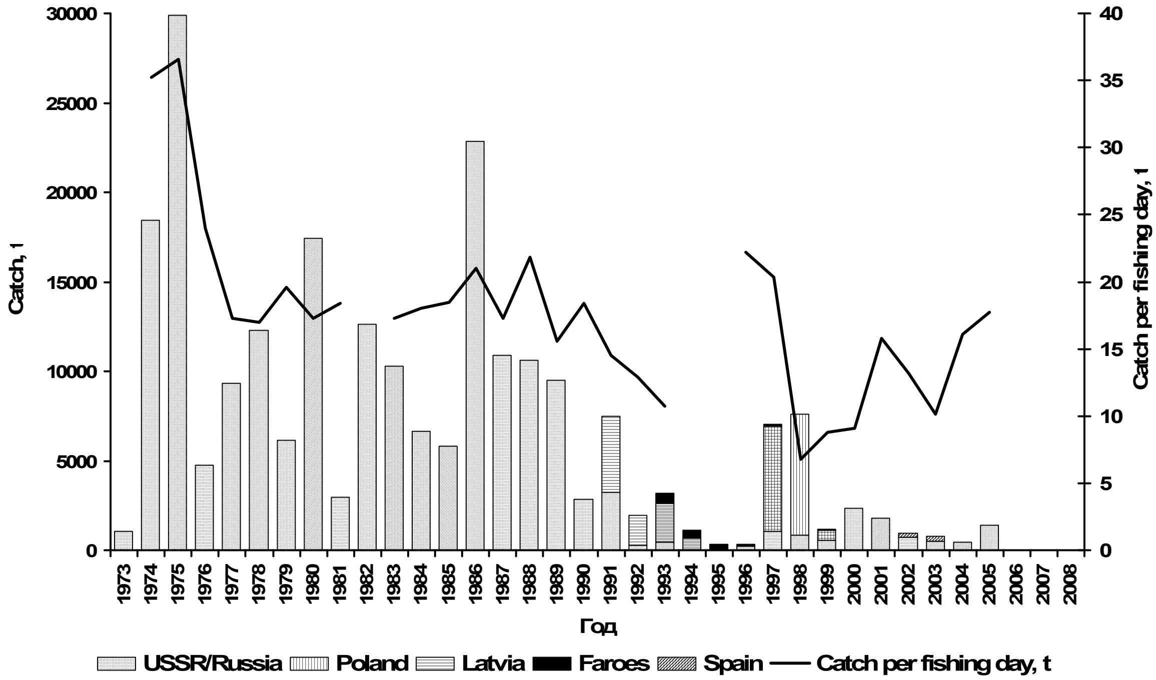


Figure 10.4.1. International catch in 1973–2008 and Soviet/Russian cpue of roundnose grenadier on the MAR in 1974–2005.

10.5 Roundnose grenadier (*Coryphaenoides rupestris*) in other Areas (I, II, IV, Va2, VIII, IX, XIVa, XIVb2)

10.5.1 The fishery

Outside the main fisheries dealt upon in other sections catches of roundnose grenadier were insignificant.

10.5.1.1 Landings trends

Landing statistics by nations in the period 1988–2008 are presented in Table 10.5.1–10.5.5.

In the Subareas I and II, the catch of roundnose grenadier in 2008 amounted to 10 t and was taken as bycatch by Norwegian fleet. During 1988–2008 catches varied from 0 to 106 t (Figure 10.5.1). France substantially contributed to the total catch in 1990–1992, when roundnose grenadier was taken as bycatch in the fisheries for saithe *Pollachius virens* and other gadoids. In 1997–1998, when total catch exceeded 100 t, the major contribution was made by Norway. Roundnose grenadier was partly taken in mixed deep-water fisheries; directed local fisheries in Norwegian fjords for this species also exist.

In Subarea IV, the catch of roundnose grenadier in 2008 comprised 1 t which was taken by the French fleet. During 1988–2008 total catches in this area varied between 1 and 525 t (Figure 10.5.2). The main contribution to the total catch in 1989–1994 (167–521 t) was made by the French fleet that conducted directed fishery in Division IVa off Shetland Islands. Roundnose grenadier is caught as incidental bycatch in this area by Scottish vessels in insignificant amount as well. In this area, reported catch may include a large proportion of misreported roughhead grenadier.

In 2004, the major part of the total catch (370 of 377 t) was taken by Danish fleet in the northeastern corner of IVb Division during directed trawl fishery. The WG notes that catches coming from this location in IV probably are taken from the same stock as the one in IIIa.

Total roundnose grenadier catch in Division Va in 2008 amounted to 29 t and was made by Iceland. During 1988–2008, the catches within Icelandic waters varied 2–398 t (Figure 10.5.3). Maximum catches were registered in 1992–1997 when 198–398 t were caught annually as bycatch in mixed deep-water fisheries. In recent years, roundnose grenadier is taken in Icelandic waters as bycatch in trawl fisheries for Greenland halibut and redfish.

Roundnose grenadier catches in Subareas VIII and IX during 1988–2008 were minor and amounted 0 to 28 t annually (Figure 10.5.4). The main contribution to the total catch was made by France.

Total catch in Greenland waters (Subdivision XIVb2) in 1998–2008 amounted to 15–126 t (Figure 10.5.5). There is no directed fishery for roundnose grenadier in these areas. The majority of catches is taken as bycatch by Greenland and Norway during Greenland halibut bottom-trawl fisheries. Recently (prior to 2005), Germany also contributed to roundnose grenadier bycatch, especially in 1998 and 1999, when 116 and 105 t were caught respectively.

10.5.1.2 ICES advice

ICES advice applicable to 2008 was: *…The fishery should not be allowed to expand unless it can be shown that it is sustainable.*

10.5.1.3 Management

There is a TAC management of the roundnose grenadier fisheries in Subareas I, II, IV, VIII, IX, Division Va and Subdivision XIVb1 for European Community vessels (Table 10.4.1). In international waters there are NEAFC regulation of efforts in the fisheries for deep-water species.

10.5.2 Data available

10.5.2.1 Landings and discards

Landings are given in Table 10.5.1–10.5.5. No discard data are available.

10.5.2.2 Length compositions

No data.

10.5.2.3 Age compositions

No data.

10.5.2.4 Weight-at-age

No data.

10.5.2.5 Maturity and natural mortality

No data.

10.5.2.6 Catch, effort and research vessel data

No data.

10.5.3 Data analyses

No assessment was required for this stock in 2009.

10.5.4 Comments on the assessment

No assessment was required for this stock in 2009.

10.5.5 Management considerations

No advice was required for this stock in 2009.

Table 10.5.1 Working Group estimates of landings of roundnose grenadier from Subareas I and II.

YEAR	FAROES	DENMARK	FRANCE	GERMANY	NORWAY	RUSSIA/USSR	GERMANY	UK (E+W)	UK (SCOT)	TOTAL
1989			1	2		16	3			22
1990			32	2		12	3			49
1991			41	3	28					72
1992		1	22		29					52
1993			13		2					15
1994			3	12						15
1995			7							7
1996			2							2
1997	1		5		100					106
1998					87	13				100
1999					44	2				46
2000										0
2001								2		2
2002					11	1				12
2003					4					4
2004					27					27
2005			1		12					13
2006					6	2				8
2007					11	1				12
2008*					10					10

*** Preliminary data**

Table 10.5.2 Working Group estimates of landings of roundnose grenadier from Subarea IV.

YEAR	FRANCE	GERMANY	NORWAY	UK (SCOT)	DENMARK	TOTAL
1989	167	1		2		170
1990	370	2				372
1991	521	4				525
1992	421			4	1	426
1993	279	4				283
1994	185	2			25	212
1995	68	1		15		84
1996	59			5	7	71
1997	1			10		11
1998	35					35
1999	56		5			61
2000	2					2
2001	2				17	19
2002	11		1	26		38
2003	5		1	11		17
2004	5			1	371	377
2005	18		2			20
2006	7		4			11
2007	25		1			25
2008*	1					1

*** Preliminary data**

Table 10.5.3 Working Group estimates of landings of roundnose grenadier from Division Va.

YEAR	FAROES	ICELAND**	NORWAY	RUSSIA	UK (E+W)	TOTAL
1989	2	2				4
1990		7				7
1991		48				48
1992		210				210
1993		276				276
1994		210				210
1995		398				398
1996	1	139				140
1997		198				198
1998		120				120
1999		129				129
2000		54				54
2001		40				40
2002		60				60
2003		572				57
2004		181				181
2005		76				76
2006		62				62
2007	1	13	2			16
2008*		29				29

*** Preliminary data, ** includes other grenadiers from 1988 to 1996.**

Table 10.5. 10.5.1 Working Group estimates of landings of roundnose grenadier from Subareas VIII and IX.

YEAR	FRANCE	SPAIN	TOTAL
1989			0
1990	5		5
1991	1		1
1992	12		12
1993	18		18
1994	5		5
1995			0
1996	1		1
1997			0
1998	1	19	20
1999	9	7	16
2000	5		5
2001	7		7
2002	3		3
2003	2		2
2004	2		2
2005	7		7
2006*	27	1	28
2007	10		10
2008*	5		5

*** Preliminary data**

Table 10.5.5 Working Group estimates of landings of roundnose grenadier from Division XIVb2.

YEAR	FAROES	GERMANY	GREENLAND	ICELAND	NORWAY	UK (E+ W)	UK (SCOT)	RUSSIA	TOTAL
1989	3	42							45
1990		45	1			1			47
1991		23	4			2			29
1992		19	1	4	6		1		31
1993		4	18	4					26
1994		10	5						15
1995		13	14						27
1996		6	19						25
1997	6	34	12		7				59
1998	1	116	3		6				126
1999		105	0		19				124
2000		41	11		5				57
2001		11	5		7	2	72		97
2002		25	5		15	1	1		47
2003			15		5	1			21
2004		27	3						30
2005			7		6	1			14
2006*		35	0		17				53
2007	1				1				2
2008								12	12

*** Preliminary data**

Table 10.5.6 Working Group estimates of landings of roundnose grenadier from I, II, IV, Va2, VIII, IX, XIVa, XIVb2.

Year	I+II	IV	Va	VIII+IX	XIVb2	Unallocated	Total
1989	22	170	4	0	45	0	241
1990	49	372	7	5	47	0	480
1991	72	525	48	1	29	0	675
1992	52	426	210	12	31	0	731
1993	15	283	276	18	26	0	618
1994	15	212	210	5	15	0	457
1995	7	84	398	0	27	0	516
1996	2	71	140	1	25	0	242
1997	106	11	198	0	57	0	373
1998	100	35	120	20	126	0	402
1999	46	61	129	16	124	0	382
2000	0	2	54	5	57	0	118
2001	2	19	40	7	97	208	373
2002	12	38	60	3	47	504	664
2003	4	17	57	2	21	952	1 054
2004	27	377	181	2	30	0	618
2005	13	20	76	7	14	0	130
2006	8	7	62	0	53	0	130
2007	12	25	16	10	2	0	65
2008*	10	1	29	5	12		57

*** Preliminary data**

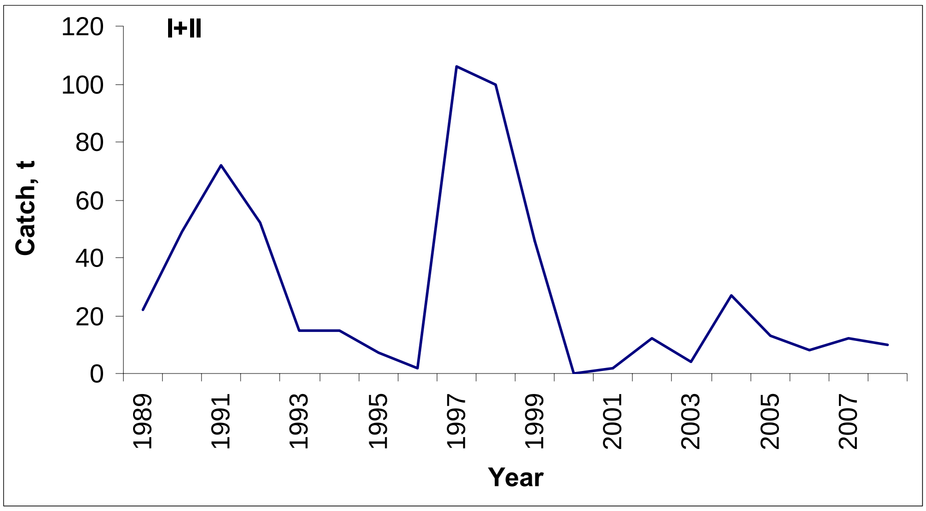


Figure 10.5.1. Roundnose grenadier catches in Subareas I and II, 1989–2008 (data for 2008 is preliminary).

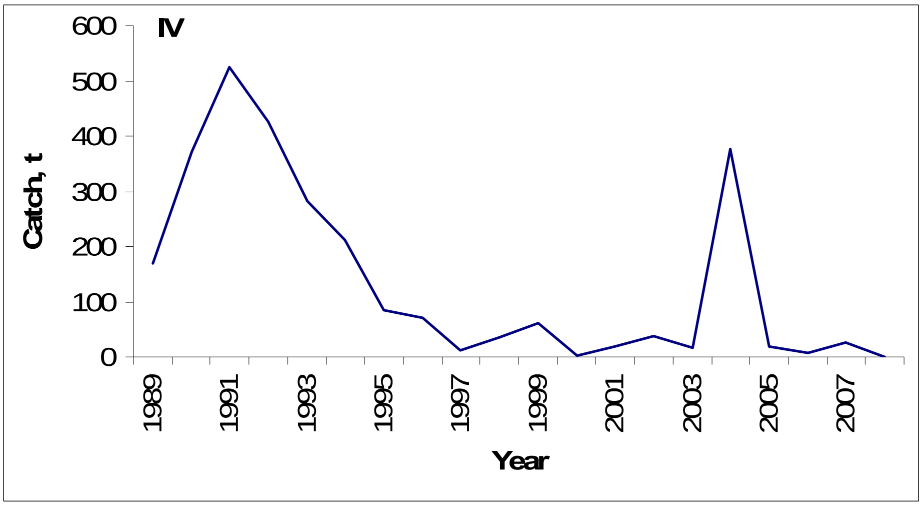


Figure 10.5.2. Roundnose grenadier catches in Subareas IV, 1989–2008 (data for 2008 is preliminary).

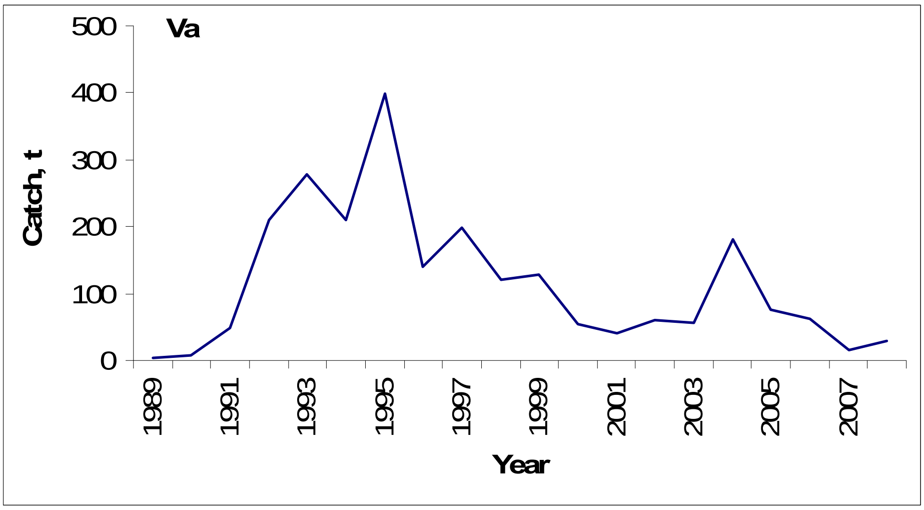


Figure 10.5.3. Roundnose grenadier catches in Division Va, 1989–2008 (data for 2008 is preliminary).

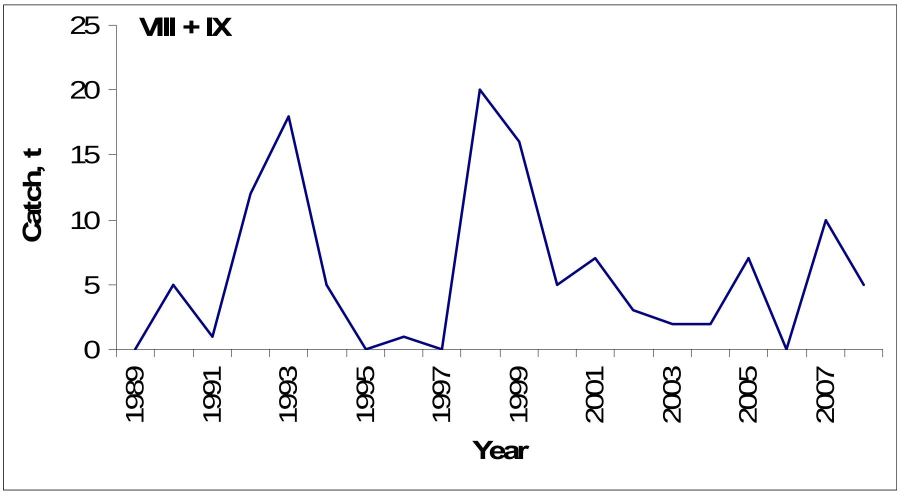


Figure 10.5.4. Roundnose grenadier catches in Subareas VIII–IX, 1989–2008 (data for 2008 is preliminary).

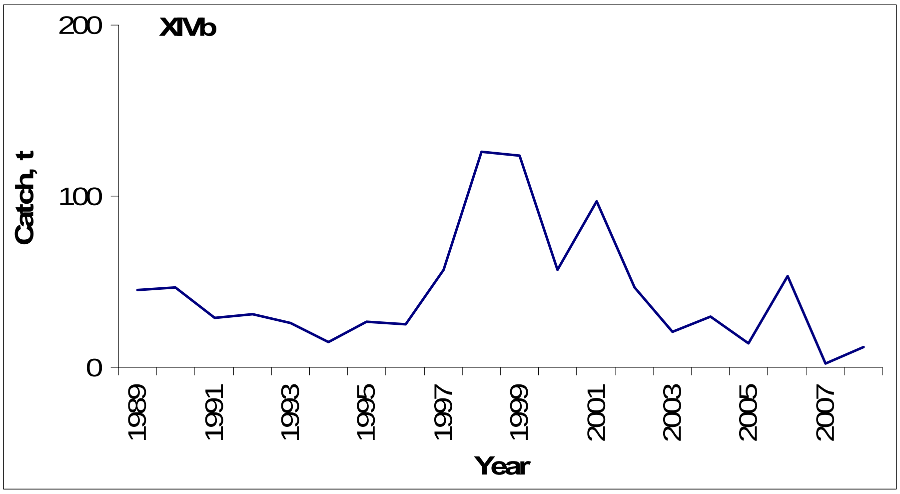


Figure 10.5.5. Roundnose grenadier catches in Subarea XIVb2, 1989–2008 (data for 2008 is preliminary).

11 Black scabbard fish (Aphanopus carbo) in the Northeast Atlantic

11.1 Stock description and management units

The species is distributed on both sides of the North Atlantic and on seamounts and ridges south to about 30ºN. It occurs only sporadically north of the Scotland-Iceland-Greenland ridges. Juveniles are mesopelagic and adults are bentho-pelagic. It is admitted that the species life cycle is not completed in just one area and also that either small or large-scale migrations occur seasonally. It has been postulated that fish caught to the west of the British Isles are pre-adults that migrate further south (possibly down to Madeira) as they reach maturity. As a consequence of the uncertainty of stock structure a single-stock in NE Atlantic is considered. However because of the different nature of fisheries in the northern and southern areas and lack of information on migration, the stock has traditionally been divided into northern and southern components for management purposes.

The northern component comprises fish exploited by trawl fisheries in Subareas V, VI, VII and XII, the southern component being exploited by a longline fishery in Subarea IX.

Catches data for black scabbard fish in 2006 and 2007 aggregated at the level of statistical rectangle were provided to the working group by France, Ireland, the UK (England and Wales and Scotland) and Iceland. These are shown in Figure 11.1.1.

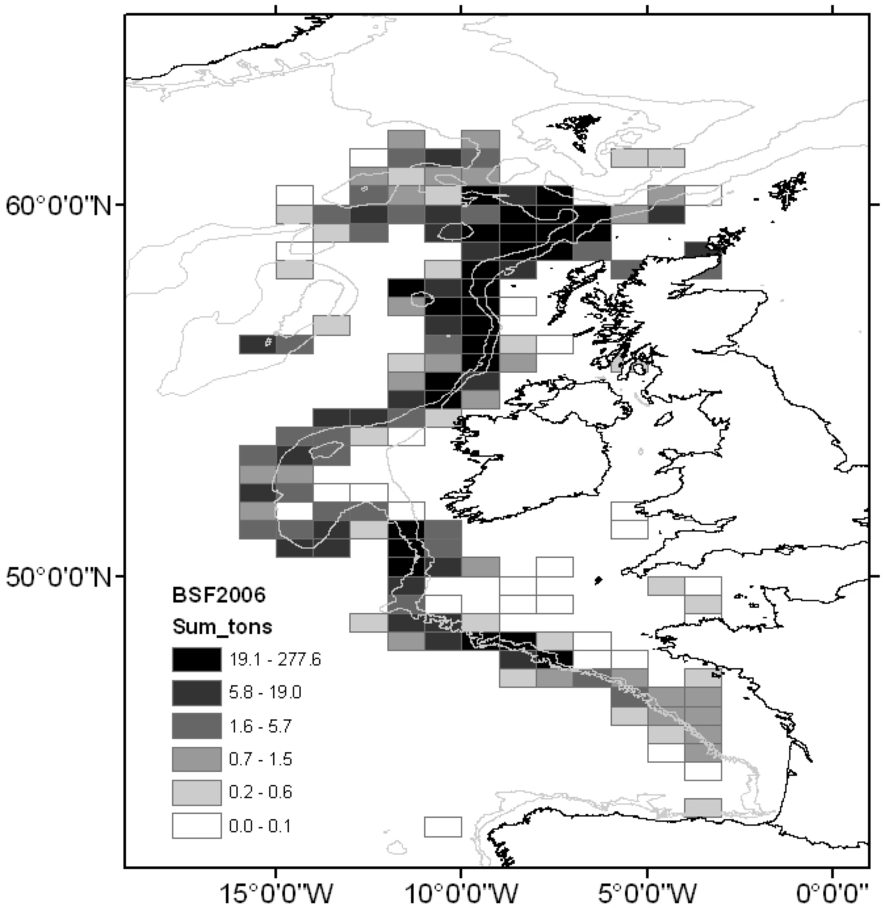


Figure 11.1.1. Catches of black scabbard fish by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2006.

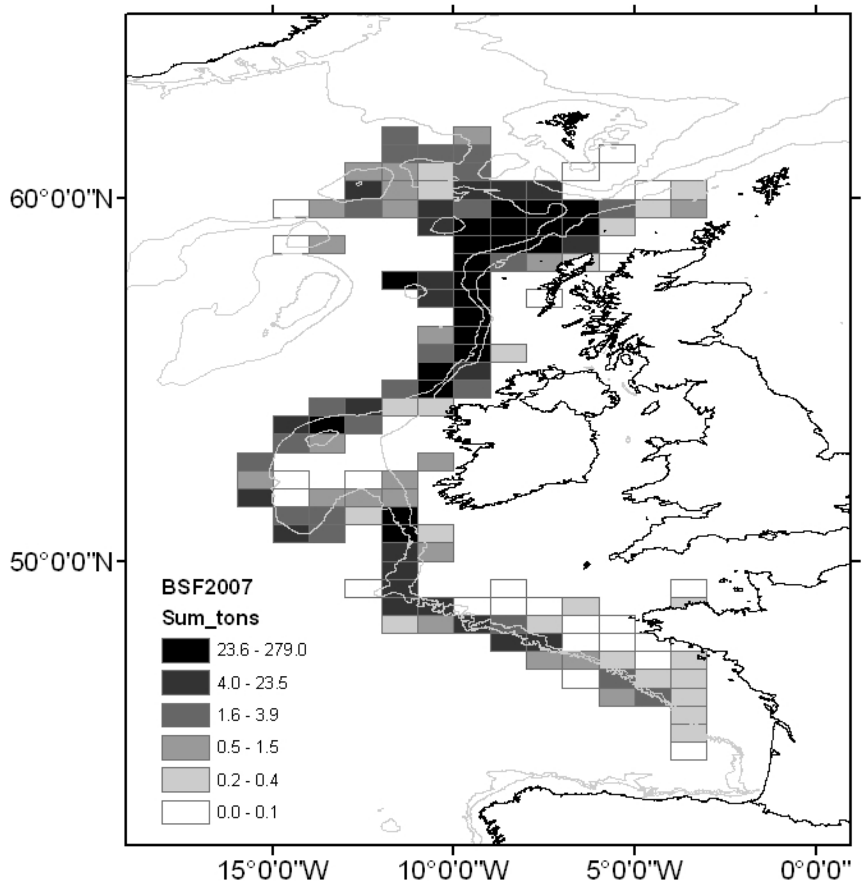


Figure 11.1.2. Catches of black scabbard fish by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

11.2 Black scabbard fish in Subareas Vb and XIIb and Divisions VI and VII

11.2.1 The fishery

The Faroese fisheries take mostly place in Division Vb with a minor activity in Subarea VI. Black scabbardfish is taken mainly as a bycatch of a fleet of 13 large deep-water trawlers (power>2000 hp) which target primarily blue ling, Greenland halibut and redfish.

A small Scottish mixed deep-water trawl fishery included some catches of black scabbard fish between the mid 1990s and early 2000s; however this fishery has decreased greatly since the introduction of TACs in 2003.

Following the decline of target orange roughy Irish trawl fishery, black scabbardfish became one of the main target species. Landings reached more than 1000 t in 2002 and have been low since then.

The French deep-water fishery operates mainly in Subareas VI and VII targeting roundnose grenadier, black scabbardfish, blue ling and deep-water sharks. Over recent years, the landings of black scabbardfish have declined but landings of other deep-water species (roundnose grenadier, orange roughy, deep-water sharks) have declined in a larger proportion.

The Spanish fisheries carried out by 29 stern bottom freezer trawlers in VIb1 and XIIb (Hatton Bank) targets primarily roundnose grenadier but lands a significant bycatch of black scabbardfish.

11.2.1.1 Landings trends

Landings from the Subareas Vb, VI, VII and XII demonstrated a markedly increasing trend from 1999 to 2002 followed by a decreasing trend (Figure 11.2.1). In Subareas VI and VII, French landings represent more than 90% of the total landings.

11.2.1.2 ICES advice

The most recent ICES advice, in 2008, was: Despite the lower landings in recent years, cpue in Areas Vb, VI, VII and XII has declined to about 20% of its initial level. ICES recommends that catches should be constrained to 2000 t (50% of the level before the expansion of the fishery, 1993–1997). The fishery should not be allowed to expand unless it can be demonstrated that it is sustainable.

11.2.1.3 Management

Since 2003, management of black scabbardfish by EU vessels fishing in EU and international waters includes a combination of TAC and licensing system. The TACs for 2007–2008; 2009–2010 and the total landings in Subareas V, VI, VII and XII in 2006, 2007 and 2008 are presented in the table below.

YEAR	EU TAC 2008 V, VI, VII AND XII	EU LANDINDS VB, VI, VII AND XII (INCLUDING CATCHES FROM FAROES EEZ)
2006	3042	3259
2007	3042	3123
2008	3042	3334
2009	2738	
2010	2547	

*** 2008 landing estimates are preliminary**

11.2.2 Data available

11.2.2.1 Landings and discards

Landing data were available for all fleet. The time-series of the Spanish catch in Subarea XII was revised according to Statlant data. No catch data were available for the Spanish trawling fleet operating on the Northern and Western Hatton Bank (Divisions VIb1 and XIIb) in 2008.

No new data on discards was made available.

11.2.2.2 Length compositions

No new data on length frequency distributions was presented.

11.2.2.3 Age compositions

No new data on age composition was presented.

11.2.2.4 Weight-at-age

No new data on weight-at-age was presented.

11.2.2.5 Maturity and natural mortality

No new information was made available nevertheless it is important to emphasize that so far the information available for ICES Subareas Vb, VI, VII and XII consistently points out to the predominance of immature small specimens.

11.2.2.6 Catch, effort and research vessel data

Based upon French tallybooks (Pawlowski *et al*., WD1, 2009), lpues for black scabbardfish were calculated. Unlike those for blue ling (see Section 6.3.3.6), the results for black scabbard fish were not scrutinized into details, as no advice in required in 2009. Nevertheless, as the vessels formerly used as a reference fleet to derived abundance indices from commercial fishing were decommissioned or moved to other fisheries, the previous time-series of lpues is not reliable for 2008 as it includes only a few fishing days and will not be available in future. Therefore other methods to estimate stock trends will be necessary. To option are possible:

- refine lpue calculation from EU-logbook data
- use additional data

For this latter, the French tallybooks database seem to be an interesting opportunity as it is more accurate than EU logbooks, being haul by haul and including data on fishing depth.

In the course of the DEEPFISHMAN project, both analyses of EU-logbook and additional data from the fishery are scheduled to derive abundance indices.

For black scabbardfish the result from preliminary estimate based upon the tallybooks demonstrate rather wide confidence intervals and do not indicate significant trends during the 2000s (Figure 11.1.2).

11.2.3 Data analyses

No assessment was required for this stock in 2009.

11.2.4 Comments on the assessment

No assessment was required for this stock in 2009.

11.2.5 Management considerations

No advice was required for this stock in 2009.

Table 11.2.0a Landings of black scabbard fish from Division Vb. Working group estimates.

	Faroe Islands			France	Germany	Scotland	E&W&NI	
Year	Vb 1	Vb 2	Vb		Vb1			Total
1988					-	-	-	0
1989	-	-		170	-	-	-	170
1990	2	10		415	-	-	-	427
1991	-	1		134	-	-	-	135
1992	1	3		101	-	-	-	105
1993	202	-		75	9	-	-	286
1994	114	-		45	1	-	-	160
1995	164	85		175	-	-	-	424
1996	56	1		129	-	-	-	186
1997	15	3		50	-	-	-	68
1998	36	-		144	-	-	-	180
1999	13	-		134	-	6	-	153
2000			116	186	-	9	-	311
2001	122	281		456	-	20	0	879
2002	222	1138		304	-	80		1744
2003	222	1230		172	-	11		1635
2004	80	625		94	-	70		869
2005	65	363		106	-	20		553
2006	54	637		92	-			783
2007	78	596		115		0		789
2008			828	143		0		971

Table 11.2.0b Landings of black scabbard fish from Division VIa. Working group estimates.

	France	Faroes	Germany	Ireland	Scotland	Netherlands **	Lituania*	
Year	VIa	VIa	VIa	VIa	VIa	VIa		Total
1988			-					
1989	138	46	-		-	-	.	184
1990	971		-		-	-	.	971
1991	2244		-		-	-	.	2244
1992	2998	3	-		-	-	-	3001
1993	2857		48		-	-	-	2905
1994	2331		30		2	-	-	2363
1995	2598		-		14	-	-	2612
1996	2980		-		36	-	-	3016
1997	2278		-		147	-	-	2425
1998	1553		-		142	-	-	1695
1999	1610		-		133	11	-	1754
2000	2971		-		333	7	-	3311
2001	3791		-		486	-	3	4280
2002	3830	2	-		603	21	9	4465
2003	2933	45	-		78	-	13	3069
2004	2637	59	-		100	-	86	2882
2005	2519	38	-		18	-	5	2580
2006	1714	59	-	1	63		1	1837
2007	1936	44		0	53		-	2033
2008	2187	2		0	25	0		2213

***STATLAND data**

Table 11.2.0b Landings of black scabbard fish from Division VIb. Working group estimates.

	France	Faroes	Germany	Scotland	Estonia *	Poland*	Russia	
Year	VIb	VIb	VI b	VIb	VIb	VIb	VIb	Total
1988			-					
1989	0		-	-	.	-	.	0
1990	53		-	-	.	-	.	53
1991	62		-	-	-	-	.	62
1992	113		-	-	-	-	-	113
1993	87	62	-	-	-	-	-	149
1994	55		15	-	-	-	-	70
1995	15		3	4	-	-	-	22
1996	1		2	<0.5	-	-	-	3
1997	16	3	-	88	-	-	-	107
1998	7		-	6	-	-	-	13
1999	8		-	58	-	-	-	66
2000	27		-	41	-	-	-	68
2001	29	3	-	145	224	-	2	403
2002	156		-	300	-	2	-	458
2003	67		-	9	7	2	-	85
2004	99		-	24	5	1	-	129
2005	59		-	62	11	-	-	133
2006	36		-	0	5	-		41
2007	4	37		0	7	-	0	48
2008	0	0		0			1	1

***STATLAND data**

Table 11.2.0c Landings of black scabbard fish from Subarea VII. Working group estimates.

	France						Ireland			Scotland	E&W&NI	Spain	
Year	VIIa	VIIb	VIIc	VIId-h	VIIj	VIIk	VIIb,j	VIIc	VIIk	VIIb,c,j,k	VIIj,k	VII	Total
1988													
1989	0	0	0	0	0	0				0			0
1990	0	2	8	0	0	0				0			10
1991	0	14	17	7	7	49				0			94
1992	0	9	69	11	49	183				0			322
1993	0	24	149	16	170	109				0			468
1994	0	32	165	8	120	336				0			662
1995	0	52	121	9	74	385				0			641
1996	0	104	130	2	60	360				0			658
1997	0	24	200	1	33	202				0			461
1998	0	15	104	6	52	211				0			388
1999	0	7	97	3	70	177				0			354
2000	0	25	173	5	100	253				3			559
2001	0	40	237	3	180	267				41			768
2002	0	33	105	8	138	49				53			386
2003	0	15	29	4	159	36				1			244
2004	0	31	28	16	115	63				0			253
2005	5	6	11	19	105	23						7	176
2006	0	3	10	24	315	20	1	32	37	0	2	1	446
2007	0	2	7	5	168	7	0	52	17	0	0	1	259
2008	0	2	4	5	134	2	0	0	0	0	0	0	147

Table 11.2.0d Landings of black scabbard fish from Subareas VI and VII (1988–2005). Working group estimates.

Year	Ireland	Spain	E&W&NI	Total
1988				
1989				0
1990				0
1991				0
1992				0
1993	8			8
1994	3			3
1995				0
1996			1	1
1997	0	1	2	3
1998	0	3	1	4
1999	1	0	1	2
2000	59	1	40	100
2001	68	150	37	255
2002	1050	0	43	1093
2003	159	0	5	164
2004	293	17	2	312
2005	79	0	0	79

Table 11.2.0e Landings of black scabbard fish from Subarea XII. Working group estimates.

	France	Spain	Scotland	Russia	Faroes	Germany	Ireland	E&W&NI	Iceland**	Lituania	Estonia	Poland	
Year	XIIa			XIIc									Total
1988												-	0
1989	0									.	.	-	0
1990	0									.	.	-	0
1991	2									.	-	-	2
1992	7									-	-	-	7
1993	24				1051	93				-	-	-	1168
1994	9				779	45				-	-	-	833
1995	8				301					-	-	-	309
1996	7	41			187				0	-	-	-	235
1997	1	106			102					-	-	-	209
1998	324	127			20					-	-	-	471
1999	1	117	0							-	-	-	118
2000	5	880			1					-	-	-	886
2001	3	1221								-	-	-	1224
2002	0	908	1					0		-	-	1	910
2003	7	163					1			1	-	-	172
2004	10	141	1		95					1	-	-	248
2005	14	107			127		0			-	1		249
2006	0	127			8								135
2007	0	177	0	0	0		0						177
2008	0	0	0	1	1		0						2

Table 11.2.0g Landings of black scabbard fish from Subarea VI, VII and XII and Division Vb. Working group estimates.

	Vb	VI	VI+VII	VII	XII	Total
1988						
1989	170	184	0	0	0	354
1990	427	1023	0	10	0	1461
1991	135	2307	0	94	2	2537
1992	105	3113	0	322	7	3547
1993	286	3054	8	468	1168	4984
1994	160	2433	3	662	833	4091
1995	424	2634	0	641	309	4008
1996	186	3019	1	658	235	4099
1997	68	2533	3	461	209	3273
1998	180	1708	4	388	471	2751
1999	153	1821	2	354	118	2448
2000	311	3379	100	559	886	5235
2001	879	4683	255	768	1224	7809
2002	1744	4923	1093	386	909	9054
2003	1635	3154	164	244	173	5371
2004	869	3011	312	253	248	4693
2005	553	2713	79	176	249	3770
2006	783	1879	0	446	135	3242
2007	789	2081	0	259	177	3305
2008	971	2214	0	147	2	3334

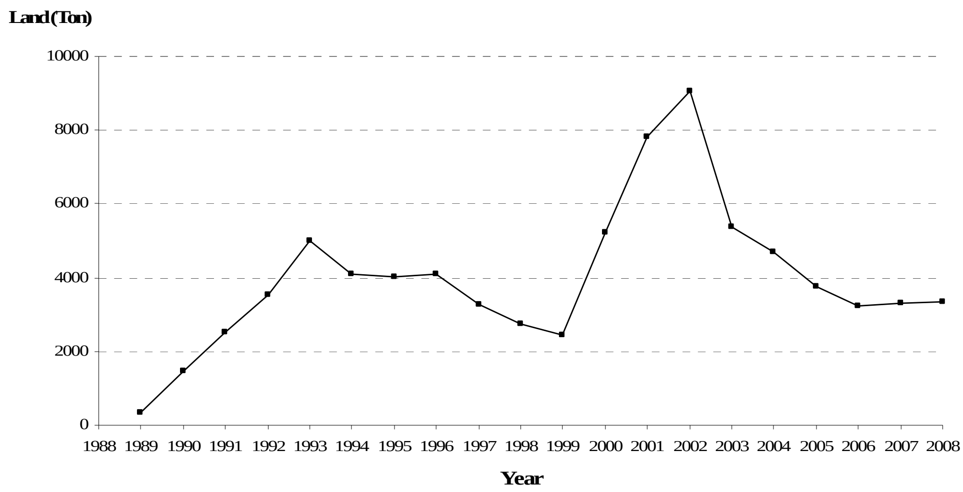


Figure 11.2.1 Black scabbardfish, total landings in ICES Division Vb and Subareas VI and VII.

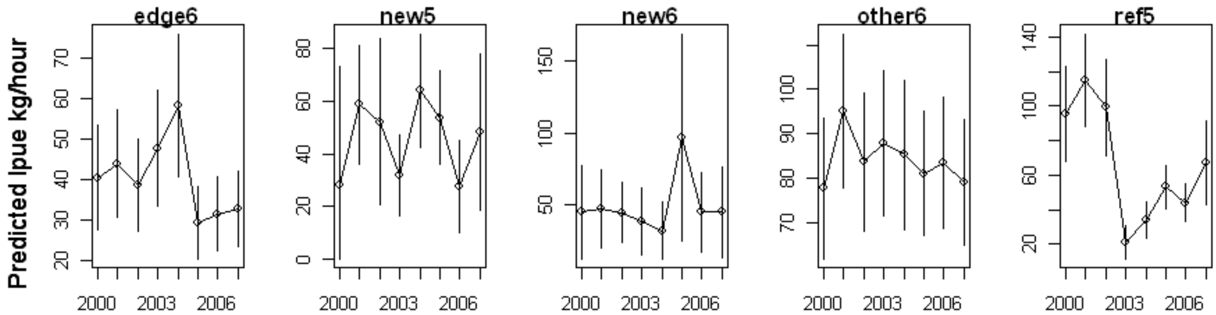


Figure 11.2.2. Lpue of French trawlers in 5 areas (Details of areas can be found in Pawlowski *et al.*, WD1, 2009) from tows targeting black scabbardfish (defined as tows where the total catch include >10% of black scabbardfish). Absolute levels should not be compared over areas as the prediction was carried out for one particular rectangle.

11.3 Black scabbard fish in Subareas VIII, IX

11.3.1 The fishery

The main fishery taking place in these Subareas is derived from the Portuguese longliners. This fishery was described in 2007 report (Bordalo_Machado and Figueiredo, 2007 WD). The French bottom trawlers operating in Subareas mainly VI and VII have a small marginal activity in Subarea VIII.

11.3.1.1 Landings trends

Landings in Subareas VIII and IX are almost all from the Portuguese longline fishery that takes place in Subarea IXa (more than 99% of the total landings). (Figure 11.3.1).

11.3.1.2 ICES advice

The most recent ICES advice, in 2008, was: Cpue in Subareas VIII and IX does not indicate any clear trends but no information is available before 1996. Recent levels of catches do not appear to have had a negative impact. ICES recommends that catches should be constrained to 2800 t. (average 2003–2007) and to collect information that can be used to evaluate a long-term sustainable level of exploitation.

11.3.1.3 Management

Since 2003, management of black scabbardfish by EU vessels fishing in EU and international waters includes a combination of TAC and licensing system. The TAC adopted for 2007 and 2008 as well as the total landings in Subareas VIII, IX and X are next presented. The TACs has not been fully taken in recent years suggesting that it is not restrictive.

YEAR	EU TAC 2008 VIII, IX & X	EU LANDINDS
2006	3042	2791
2007	4000	3556
2008	4000	3719
2009	3600	
2010	3348	

*** 2008 landing estimates are preliminary**

11.3.2 Data available

11.3.2.1 Landings and discards

The artisanal segment of the commercial fishing fleet of mainland Portugal is responsible for the largest landings' quantities of deep-water species. The on-board discard sampling for longline Portuguese commercial fleet started in mid 2005 and is integrated in the Portuguese Discard Sampling programme, included in the EU DCR/NP. On-board sampling in longline commercial vessels is carried out in a monthly basis to get discards and trip information.

Recent discard data from the Portuguese the black scabbardfish fishery reveals very low percentages of discards and that the target species constitute nearly 84% of catch in weight. The 2008 results don't differ much from the ones obtained for 2005–2007 period (Fernandes *et al.*, 2009, WD).

11.3.2.2 Length compositions

In the scope of the National Minimum Landings Sampling Programme, length frequency and biological samples from Portuguese landing port at Sesimbra were collected on a monthly basis during 2008.

11.3.2.3 Age compositions

The main results from a Portuguese Project revealed that sectioned otoliths were demonstrated to be more appropriate to age assignment because growth increments are more evident and ageing of larger specimens is easier than in whole otoliths. In addition although vertebrae are not the most appropriate structure for age assignment, this structure may be useful in the absence of otoliths (Figueiredo, 2009 WD).

11.3.2.4 Weight-at-age

No new data were available.

11.3.2.5 Maturity and natural mortality

Recent results demonstrate that sex ratio was clearly unbalanced, with females prevailing in larger lengths and being the smaller individuals predominantly males. Mature individuals only occurred in Madeira (Figueiredo *et al.*, 2003) and, more recently, in Canary Islands (Pajuelo *et al.*, 2008) and the northwest coast of Africa, while mainland specimens only achieve the developing stage (Figueiredo, 2009 WD).

11.3.2.6 Catch, effort and research vessel data

Standardized black scabbardfish lpue from the longline fleet operating in Subarea IXa were estimated for the period 1995–2008 (Figueiredo and Farias, 2009 WD).

11.3.3 Data analyses

No assessment was required for this stock in 2009.

11.3.4 Comments on the assessment

No assessment was required for this stock in 2009.

11.3.5 Management considerations

No advice was required for this stock in 2009.

Table 11.3.0a Black scabbard fish from Subarea VIII; Working Group estimates of landings.

	France			Spain	
Year	VIIIa	VIIIb,c	VIIId		Total
1988					0
1989	0	0	0		0
1990	0	0	0		0
1991	1	0	0		1
1992	4	0	4		9
1993	5	0	7		11
1994	3	0	2		5
1995	0	0	0		0
1996	0	0	0	3	3
1997	1	0	0	1	2
1998	2	0	0	3	5
1999	7	0	4	0	11
2000	15	0	20	1	36
2001	16	0	12	1	29
2002	17	2	16	1	36
2003	25	0	8	1	34
2004	25	0	14	1	40
2005	19	0	6	1	26
2006	30	2	19	0	51
2007	14	1	13	1	29
2008	9	0	33	0	42

Table 11.3.0b Black scabbard fish from Subarea IXa; Working Group estimates of landings.

YEAR	PORTUGAL	TOTAL
1988	2602	2602
1989	3473	3473
1990	3274	3274
1991	3978	3978
1992	4389	4389
1993	4513	4513
1994	3429	3429
1995	4272	4272
1996	3686	3686
1997	3553	3553
1998	3147	3147
1999	2741	2741
2000	2371	2371
2001	2744	2744
2002	2692	2692
2003	2630	2630
2004	2463	2463
2005	2746	2746
2006	2674	2674
2007	3453	3453
2007	3602	3602

11.4 Black scabbard fish other Areas (I, II, IIIa, IV, X, Va, XIV)

11.4.1 The fishery

There is almost no fishery in these areas.

11.4.1.1 Landings trends

Landings in these areas are mostly negligible. However, landings from Subarea X have fluctuated between 2 and 400 t per year between 1990 and 2008.

11.4.1.2 ICES advice

The most recent ICES advice, in 2008, was: The fishery in other areas should not be allowed to expand unless it can be demonstrated that it is sustainable.

11.4.1.3 Management

Since 2003, management of black scabbardfish by EU vessels fishing in EU and international waters includes a combination of TAC and licensing system. The TAC adopted for 2007 and 2008 by subareas are next presented.

	I, II, III AND IV
TAC 2007 and 2008	15 t
TAC 2009 and 2010	12 t

11.4.2 Data available

No new data were available.

11.4.2.1 Landings and discards

Landings are given in Table 11.4.0.

11.4.2.2 Length compositions

No new data were available.

11.4.2.3 Age compositions

No new data were available.

11.4.2.4 Weight-at-age

No new data were available.

11.4.2.5 Maturity and natural mortality

No new data were available.

In Azorean waters females in spawning condition (GSI > 3 up to 9) with total lengths between 108 and 137 cm occurred predominantly in October and in November (J. Pereira, pers comm.). The length 108 cm corresponds to the estimate of first maturity determined for Madeira specimens. Spawners were observed around the Azores from November to April (Vinnichenko, 2002).

11.4.2.6 Catch, effort and research vessel data

No new data were available.

11.4.3 Data analyses

No assessment was required for this stock in 2009.

11.4.4 Comments on the assessment

No assessment was required for this stock in 2009.

11.4.5 Management considerations

No advice was required for this stock in 2009.

Table 11.4.0 Black scabbard fish other Areas (II, IV, X, Va, XIV). Working Group estimates of landings.

Year	II	IV	Va	X	XIV	Total
1988	0	0	0	0	0	0
1989	0	3	0	0	0	3
1990	1	70	0	0	0	71
1991	0	107	0	166	0	273
1992	0	219	0	370	0	589
1993	0	34	0	2	0	36
1994	0	45	1	0	0	46
1995	1	8	0	3	0	11
1996	0	7	0	11	0	18
1997	0	2	1	3	0	6
1998	0	11	0	99	2	112
1999	0	7	6	112	0	124
2000	0	5	10	113	90	218
2001	0	11	5	16	0	32
2002	0	24	13	2	8	47
2003	0	4	14	91	2	112
2004	0	5	19	113	0	136
2005	0	2	19	379	0	400
2006	0	13	23	65	0	102
2007	0	1	1	75	0	77
2008	0	0	0	75	0	75

12 Greater forkbeard (*Phycis Blennoides*) in all ecoregions

12.1 The fishery

Greater forkbeard may be considered as a bycatch species in the traditional demersal trawl and longline mixed fisheries targeting species such as hake, megrim, monkfish, ling, blue ling.

Since 1988, around 80% of landings came from the Subareas VI and VII. Spanish, French and UK trawlers and longliners are the main fleets involved in this fishery. But also the Irish deep-water fishery around Porcupine Bank is based on the flat grounds and targets orange roughy, black scabbard, roundnose grenadier and deep-water siki sharks has landed historically important quantities of this species. The Russian fishery in the North-East Atlantic targeting roundnose grenadier, tusk and ling fish small quantities of greater forkbeard as bycatch of the trawler fleet in Hatton and Rockall Banks.

The rest of landings in that period (11%), come from Subareas VIII and IX (mainly from VIII) by the trawler and longliner Spanish and French fleet. In Subarea IX since 2001 small amounts of Phycis spp (probably *P. phycis*) are landed in ports of Strait of Gibraltar by the longliner fleet targeting scabbardfish in Algeciras, Barbate and Conil.

Minor quantities of *P. blennoides* from X Subdivision and Vb Subarea are landed by Portuguese and Norwegian vessels respectively. The Azores deep-water fishery is a multispecies and multigear fishery dominated by the main target species *Pagellus bogaraveo*. Target species can change seasonally according to abundance and market prices, but landings of *Phycis blennoides* representing less than 0.6% of total deep-water landings in last two years, and can be considered as bycatch.

Catches data for greater forkbeard in 2006 and 2007 aggregated at the level of statistical rectangle were provided to the Working Group by Basque Country (Spain) France, Ireland, the UK (England and Wales and Scotland) and Iceland. These are shown in Figures 12.1 and 12.2.

12.1.1 Landing trends

The Table 12.0 demonstrates greater forkbeard (*P. blennoides* and in some cases *Phycis spp.*) landings by subarea and country. For the WGDEEP 2009 landings of Spain and France have been revised since 1998.

From 1998 to 2007, Subareas VIII and IX landed on average 467 t but in 2008 only 176 t have been reported, mainly as a consequence of the decrease of the Spanish landings.

In Subareas I, II, III, IV and V only Norwegian landings are significant especially from 2002. The Norwegian longliners which fish in these areas catch *P. blennoides* as a bycatch in the ling fishery. The quantity of this bycatch depends on market price. After eight years without *P. blennoides* records, in 2002 the Norwegian fleet in Subareas I and II reported 315 t, but since this year the landings of this country have been reduced importantly until 2007 but increased again in 2008. In Subareas III and IV a strong decrease in landings is observed from 1992 to 2001, but like in Subareas I and II landings since 2002 reveal an important increase. Although the landings in Subarea Vb are lower than Subareas III and IV the historical trends are very similar.

The trend in VI and VII subdivision demonstrates an important increase in landings from 1994 to 2000. In this year the total landings reported reached a peak of 4967 t.

Since 2001 a continuous and notable decrease is observed and in 2008 only 1281 t are recorded. That is a value similar to the landings recorded in years from 1991 to 1994 (Figure 12.3).

Although In the Subarea X landings of greater forkbeard demonstrate ups and downs (is not a target species of the Portuguese demersal fleet), with two peaks in 1994 and 2000, since this last year a continuous decrease can be observed.

Landings by subarea and gear of Spanish fleet from 2003 to 2007 are displayed in Table 12.1. In this period the landings of *Phycis spp* of Spain comes from bottom-trawler and longliner fleet (41% and 21% respectively) operating mainly in Subareas VII and VIII.

12.1.2 ICES Advice

The only new information available for these species is landings information and it is not sufficient to change the Advice from 2006. The Advice for 2009 and 2010 is therefore the same as the Advice given in 2006: F*isheries on greater forkbeard should be accompanied by programmes to collect data. The fishery should not be allowed to expand unless it can be shown that it is sustainable.*

12.1.3 Management

The TAC for 2009 and 2010 only reduce slightly the catches in Subareas I, II, III, IV and in Subareas X and XII. In the next table a summary of *P. blennoides* international TAC by subareas and also landings in 2006 to 2008 are displayed. As a result of in some cases international landings are not available by species, these summary table could include significant landings of *Phycis spp*. Only landings of 2008 are above the TAC.

PHYCIS BLENNOIDES	EU TAC		EU LANDINGS	
SUBAREA	2007–2008	2009–2010	2007	2008
I, II, III, IV	36	31	285	362
V, VI, VII	2028	2028	2045	1322
VIII, IX	267	267	586	172
X, XII	63	54	17	18
Total	2394	2380	2933	1874

12.2 Stock identity

The Greater forkbeard is a gadoid fish which is widely distributed in the North-Eastern Atlantic from Norway and Iceland to Cape Blanc in West Africa and the Mediterranean (Svetovidov, 1986; Cohen *et al*., 1990). It is distributed along the continental shelf and slope in depths ranging between 60 and 800 meters but recent observations on board of commercial longliners and research surveys extend the depth range to below 1000 m (Stefanescu *et al*., 1992). Unfortunately very little is known about stock structure of the species.

Since the beginning of SGDEEP the information has been split into four different components according to the importance of the catches and their geographical distribution. However, this separation does not pre-suppose that there are four different stocks of Greater forkbeard and only offers a way of recording the available information in ICES area.

- Greater forkbeard in Subareas I, II, III, IV and V.
- Greater forkbeard in Subarea s VI, VII and XII (Hatton Bank).

- Greater forkbeard in Subarea s VIII and IX.
- Greater forkbeard in Subarea X (Azorean region)

12.3 Data available

12.3.1 Landings and discards

Landings are presented in Table 12.0a–g. An estimate of discards of Basque Country (Spain) trawler fleet by subdivision since 2003 is presented in this WG (Table 12.2). The estimation was made taking on board a subsample of the total discard of each haul then extrapolated to the whole discard of the trip and to the total fleet for each year.

12.3.2 Length compositions

The Figure 12.4 presents the comparison between length frequency distributions from 2001–2008 Spanish bottom-trawl surveys in Porcupine (Velasco *et al*., WD7, 2009). According to these authors since 2003 the number of greater forkbeard by any length have been decreased strongly, and in 2008 individuals smaller than 20 cm were not found at all.

No data on age composition are available.

12.3.3 Weight-at-age

No weight-at-age data are available.

12.3.4 Maturity and natural mortality

No data on maturity and natural mortality are available.

12.3.5 Catch, effort and research vessel data

Data of abundance of Greater forkbeard are provided from 2001 to 2008 for Spanish bottom-trawl surveys in Porcupine (Velasco *et al*., WD7, 2009). The results of these surveys demonstrate a decrease in the Biomass trend since 2005 and in the abundance indices since 2003. (Figure 12.5).

A geographic representation of *Phycis blennoides* catches (kg/30 min haul) in Porcupine bank is shown in Figure 12.4 The geographical distribution of catches abundance demonstrate continues decreasing trend in the last five years. The notable abundance in 2003 in all geographic area covered by the survey coincides with an important increase of sizes from 22 to 32 cm in this year (Figure 12.6).

A historical dataseries of Effort (days at sea) and lpues of *Phycis spp*. of commercial Baka trawler of Basque Country in VI, VII and VIII Subareas is displayed in Table 12.3. This is a bycatch fishery and abundance indices should be treated with caution.

12.3.6 Data analyses

No assessment was required for this stock in 2009.

12.3.7 Comments on the assessment

No assessment was required for this stock in 2009.

12.3.8 Management considerations

No Advice was required for this stock in 2009.

Table 12.0a Greater forkbeard (*Phycis blennoides*) in Subareas I and II. Working Group estimates of landings.

YEAR	NORWAY	FRANCE	RUSSIA	UK (SCOT)	GERMANY	UK (E +W)	TOTAL
1988	0						0
1989	0						0
1990	23						23
1991	39						39
1992	33						33
1993	1						1
1994	0						0
1995	0						0
1996	0						0
1997	0						0
1998	0						0
1999	0	0					0
2000	0	0					0
2001	0	1	7				8
2002	315	0		1		2	318
2003	153	0				2	155
2004	72	0	3	0			75
2005	51	0					51
2006	46	0	3				49
2007	41	0	5	1	0		47
2008	111	0	4	1			116

Table 12.0a Greater forkbeard (*Phycis blennoides*) in Subareas III and IV. Working Group estimates of landings.

Year	France	Norway	UK (EWNI)	UK (Scot)(1)	Germany	TOTAL
1988	12	0	3	0		15
1989	12	0	0	0		12
1990	18	92	5	0		115
1991	20	161	0	0		181
1992	13	130	0	2		145
1993	6	28	0	0		34
1994	11			1		12
1995	2			1		3
1996	2	10		6		18
1997	2			5		7
1998	1		0	11		12
1999	3		5	23		31
2000	4		0	7		11
2001	6		1	19	2	27
2002	2	561	1	21	0	585
2003	1	225	0	7		233
2004	2	138		3		143
2005	2	81	0	1		83
2006	1	134	3			139
2007	1	236	0	2		239
2008	0	244		1		245

Table 12.0c Greater forkbeard (*Phycis blennoides*) in Division Vb. Working Group estimates of landings.

YEAR	FRANCE	NORWAY	UK (SCOT) [1]	UK (EWNI)	FAROE ISLANDS	RUSSIA	TOTAL
1988	2	0					2
1989	1	0					1
1990	10	28					38
1991	9	44					53
1992	16	33					49
1993	5	22					27
1994	4						4
1995	9						9
1996	7						7
1997	7	0					7
1998	4	4					8
1999	6	28	0				34
2000	4	26	1	0			32
2001	9	92	1	0			102
2002	10	133	5	0			149
2003	11	55	7	0			73
2004	9	37	2	2			50
2005	7	39		0,3			46
2006	8	26			6		39
2007	11	34	0	0	9	2	56
2008	10	20	0			11	41

[1] Includes Moridae, in 2005 only data from January to June

Table 12.0d Greater forkbeard (*Phycis blennoides*) in Subareas VI and VII. Working Group estimates of landings.

Year	France	Ireland	Norway	Spain[1]	UK (EWNI)	UK (Scot) [2]	Germany	Russia	Faroe Islands	TOTAL
1988	252	0	0	1584	62	0				1898
1989	342	14	0	1446	13	0				1815
1990	454	0	88	1372	6	1				1921
1991	476	1	126	953	13	5				1574
1992	646	4	244	745	0	1				1640
1993	582	0	53	824	0	3				1462
1994	451	111		1002	0	7				1571
1995	430	163		722	808	15				2138
1996	519	154		1428	1434	55				3590
1997	512	131	5	46	1460	181				2335
1998	357	530	162	530	1364	97				3040
1999	314	686	183	824	929	518	1			3455
2000	671	743	380	1613	731	820	8	2		4967
2001	683	663	536	1332	538	640	10	4		4405
2002	613	481	300	1049	421	545	9	0		3417
2003	469	319	492	1100	245	661	1	1		3287
2004	441	183	165	1131	288	397		1		2606
2005	598	237	128	979	179	164		5		2290
2006	625	68	162	1075	148			2	0	2081
2007	578	56	188	875	117	179		2	0	1995
2008	663	42	174	236	31	108		27		1281

(1) Phycis spp.

(2) Includes Moridae, in 2005 only data from January to June.

Table 12.0e Greater forkbeard *(Phycis blennoides)* in Subareas VIII and IX. Working Group estimates of landings.

YEAR	FRANCE	PORTUGAL	SPAIN [1]	UK (EWNI)	TOTAL
1988	7	0	74		81
1989	7	0	138		145
1990	16	0	218		234
1991	18	4	108		130
1992	9	8	162		179
1993	0	8	387		395
1994		0	320		320
1995	54	0	330		384
1996	25	2	429		456
1997	4	1	356		361
1998	3	6	656		665
1999	8	10	361		379
2000	36	6	375		417
2001	36	8	453		497
2002	67	8	418		493
2003	28	11	387		427
2004	44	10	446		500
2005	58	14	312	0	384
2006	54	10	257		321
2007	32	44	510	0	586
2008	36	13	123		172

[1] Phycis spp.

Table 12.0f Greater forkbeard *(phycis blennoides*) in Subarea X. Working Group estimates of landings.

YEAR	PORTUGAL [1]	TOTAL
1988	29	29
1989	42	42
1990	50	50
1991	68	68
1992	91	91
1993	115	115
1994	136	136
1995	71	71
1996	45	45
1997	30	30
1998	38	38
1999	41	41
2000	91	91
2001	83	83
2002	57	57
2003	45	45
2004	37	37
2005	22	22
2006	15	15
2007	17	17
2008	18	18

[1] From 1988 to 2005 *Phycis spp.*

Table 12.0g Greater forkbeard ***(phycis blennoides*****) in Subarea XII. Working Group estimates of landings.**

YEAR	FRANCE	UK (SCOT) (1)	NORWAY	UK (EWNI)	SPAIN (2)	TOTAL
1988						0
1989						0
1990						0
1991						0
1992	1					1
1993	1					1
1994	3					3
1995	4					4
1996	2					2
1997	2					2
1998	1					1
1999	0	0				0
2000	2	4				6
2001	0	1	6	1		8
2002	0		2	4	73	79
2003	3		8	0	141	153
2004	3		6		34	43
2005	1	0	0		60	61
2006						0
2007						0
2008						0

(1) **Includes** ***Moridae*****, in 2005 only data from January to June.**

(2) ***Phycis spp*****.**

Table 12.0h Greater forkbeard (*phycis* blennoides) in the Northeast Atlantic. Working Group estimates of landings.

YEAR	I+II	III+IV	VB	VI+VII	VIII+IX	X	XII	TOTAL
1988	0	15	2	1898	81	29	0	2025
1989	0	12	1	1815	145	42	0	2015
1990	23	115	38	1921	234	50	0	2381
1991	39	181	53	1574	130	68	0	2045
1992	33	145	49	1640	179	91	1	2138
1993	1	34	27	1462	395	115	1	2035
1994	0	12	4	1571	320	136	3	2046
1995	0	3	9	2138	384	71	4	2609
1996	0	18	7	3590	456	45	2	4118
1997	0	7	7	2335	361	30	2	2742
1998	0	12	8	3040	665	38	1	3764
1999	0	31	34	3455	379	41	0	3940
2000	0	11	32	4967	417	91	6	5524
2001	8	27	102	4405	497	83	8	5131
2002	318	585	149	3417	493	57	79	5098
2003	155	233	73	3287	427	45	153	4373
2004	75	143	50	2606	500	37	43	3454
2005	51	83	46	2290	384	22	61	2937
2006	49	139	39	2081	321	15	0	2644
2007	47	239	56	1995	586	17	0	2940
2008	116	245	41	1281	172	18	0	1874

Table 12.1. ***Phycis spp*** **Spanish landings (t) by Subarea and gear in the period 2003–2008.**

PHYCIS SPP	2003						2004					
Gear	VI	VII	VIII	IX	XII	XIV	VI	VII	VIII	IX	XII	XIV
Hooks and (long)lines	64	359	103	5	0	0	1	157	242	0	0	0
Gillnets	0	43	37	1	0	0	0	26	28	0	0	0
Bottom trawl	66	541	167	34	71	0	57	891	112	32	34	0
Others	0	27	10	31	0	0	0	0	0	30	0	0
	2005						2006					
Gear	VI	VII	VIII	IX	XII	XIV	VI	VII	VIII	IX	XII	XIV
Hooks and (long)lines	1	180	148	0	0	0	0	376	80	1	0	0
Gillnets	0	10	8	0	0	0	0	9	21	1	0	0
Bottom trawl	146	699	97	39	3	0	37	653	84	28	0	0
Others	0	0	0	18	0	0	0	0	0	42	0	0
	2007						2008*					
Gear	VI	VII	VIII	IX	XII	XIV	VI	VII	VIII	IX	XII	XIV
Hooks and (long)lines	0	325	294	3	0	0	0	75	20	14	0	0
Gillnets	0	2	41	4	0	0	0	0	3	29	0	0
Bottom trawl	37	512	113	55	0	0	28	133	56	0	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0

*** Preliminary**

Table 12.2. Estimation of discards of Greater forkbeard by the Basque Country (Spain) trawler fleet.

ESTIMATE OF DISCARDS (KG)	SUBDIVISION	2003	2004	2005	2006	2007	2008
Phycis blennoides	VI	12	0	0	7047	0	n.a.
	VII	404	0	0	0	0	0
	VIIIabd	0	0	0	0	109	347

Table 12.3. ***Phycis spp*** **landings (t), effective effort (fishing days = trips*(days/trip)) and lpue (landings in kg/day) of different fleets landing in the Basque Country (Spain) ports in the period 1996–2007.**

(A)	BAKA TRAWLER-VIII			BAKA TRAWLER-VII			BAKA TRAWLER-VI		
Year	Landings (t)	Effort (days)	lpue (kg/days)	Landings (t)	Effort (days)	lpue (kg/days)	Landings (t)	Effort (days)	lpue (kg/days)
1996	5,3	4378	1,2	63,2	1170	54,0	45,7	695	65,7
1997	6,7	4286	1,6	15,4	540	28,6	36,2	710	51,0
1998	0,9	3002	0,3	52,5	1196	43,9	54,1	750	72,2
1999	1,5	2337	0,6	42,2	1384	30,5	140,7	855	164,7
2000	7,4	2227	3,3	59,6	1850	32,2	190,8	763	250,0
2001	4,1	2707	1,5	58,7	1531	38,3	183,7	1171	156,9
2002	11,3	3617	3,1	23,6	1055	22,4	164,1	1592	103,1
2003	11,7	3363	3,5	13,4	1060	12,7	65,1	827	78,8
2004	10,1	4232	2,4	17,0	1074	15,8	52,8	510	103,5
2005	8,6	3697	2,3	26,7	663	40,3	49,9	484	103,1
2006	13,0	2979	4,4	3,9	501	7,9	37,1	449	82,7
2007	8,3	2780	3,0	4,5	476	9,5	36,7	369	99,6
2008	19,6	2553	7,7	0,1	107	0,6	27,0	349	77,6

-. from 1996 to 2000 Effort and Landings OF Baka Otter trawl of Ondarroa fishing port in Divisions VIIIa,b,d, Subarea VII and VI.

-. from 2001 to 2008 Effort and Landings of Baka Otter trawl of all fishing ports in Divisions VIIIa,b,c d, Subarea VII and VI.

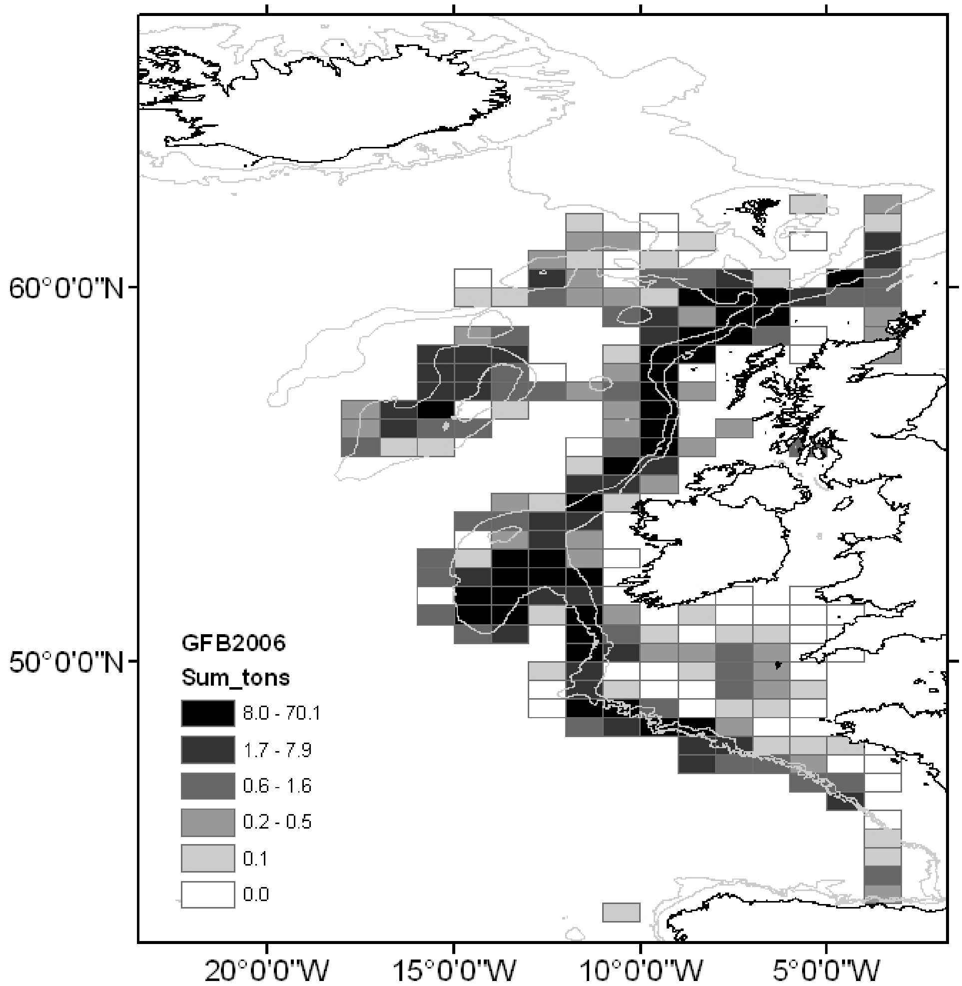


Figure 12.1. Catches of greater forkbeard by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2006.

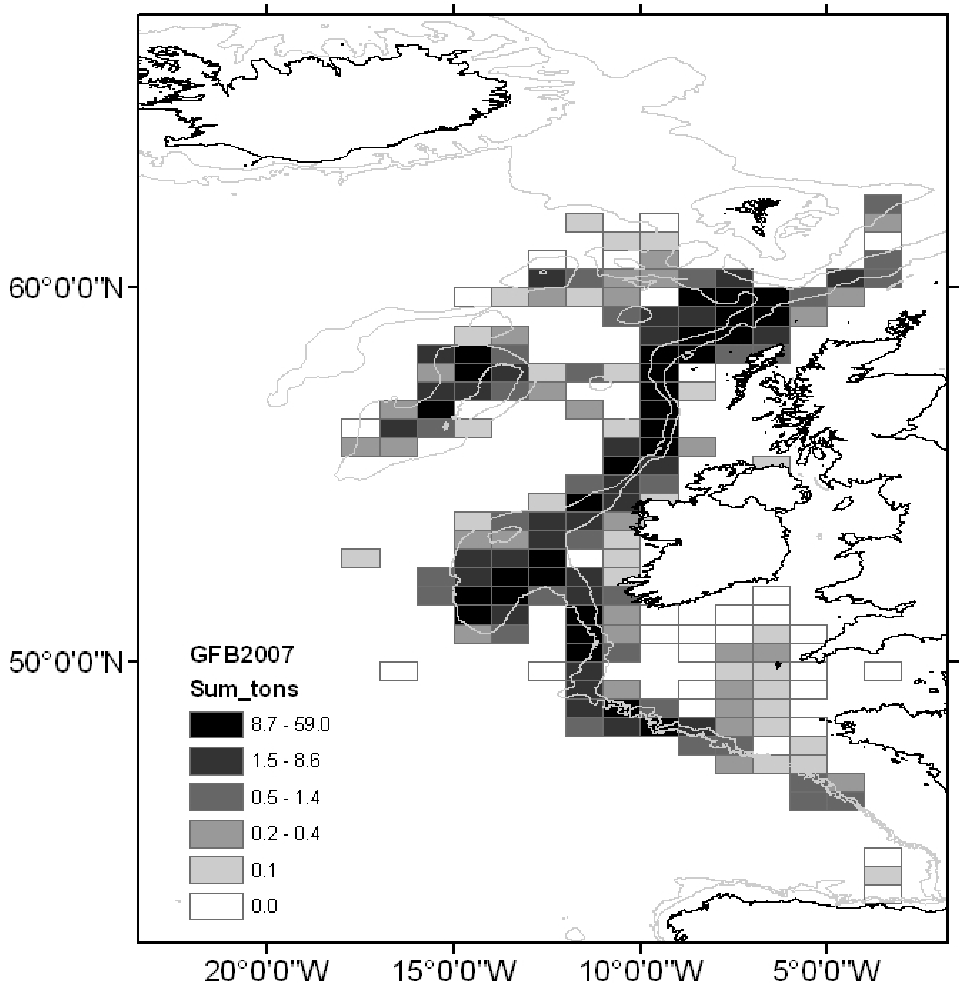


Figure 12.2. Catches greater forkbeard by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

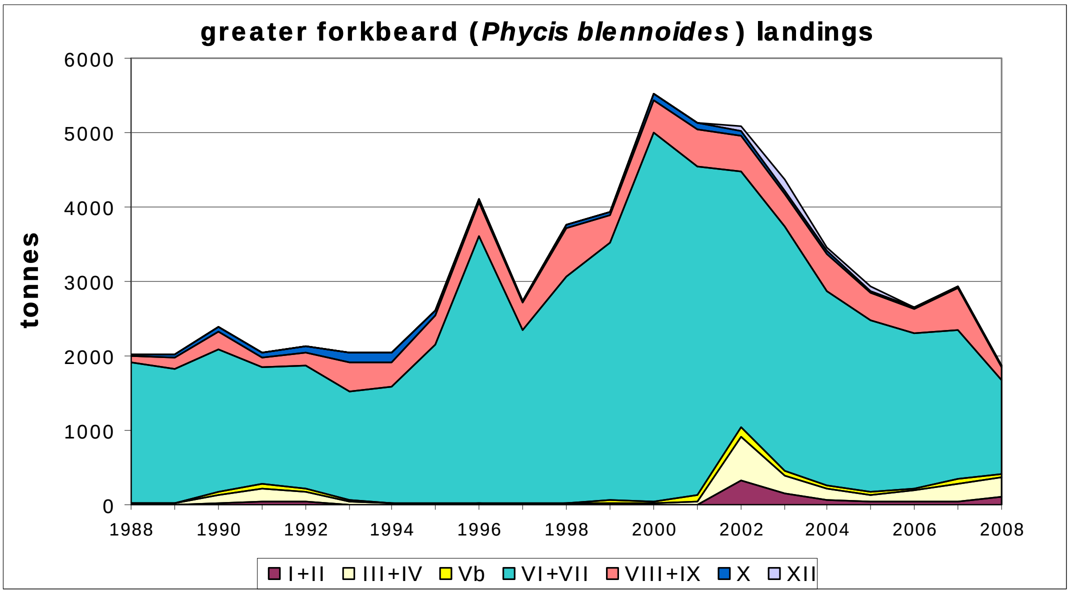


Figure 12.3. Greater forkbeard landing trends in all ICES Subareas since 1988.

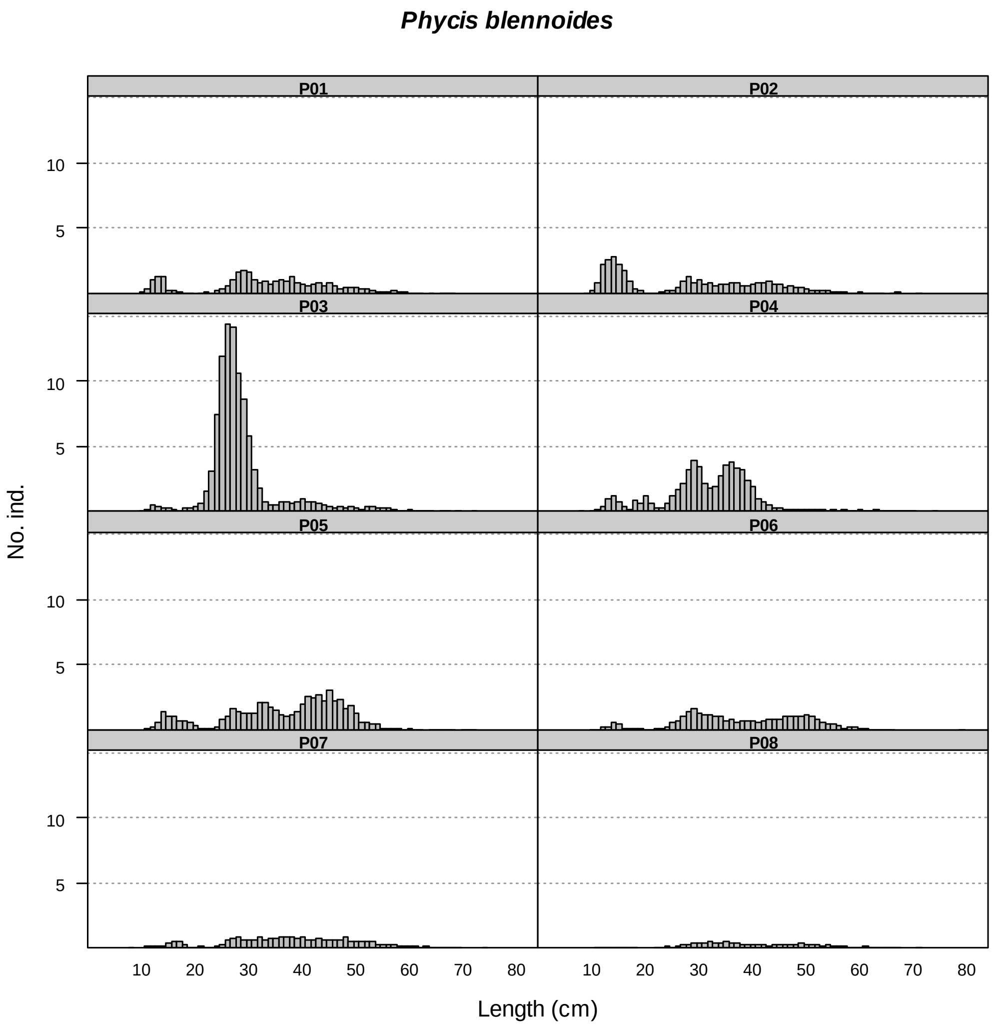


Figure 12.4. Mean stratified length distributions of *Phycis blennoides* in Porcupine surveys (2001–2008).

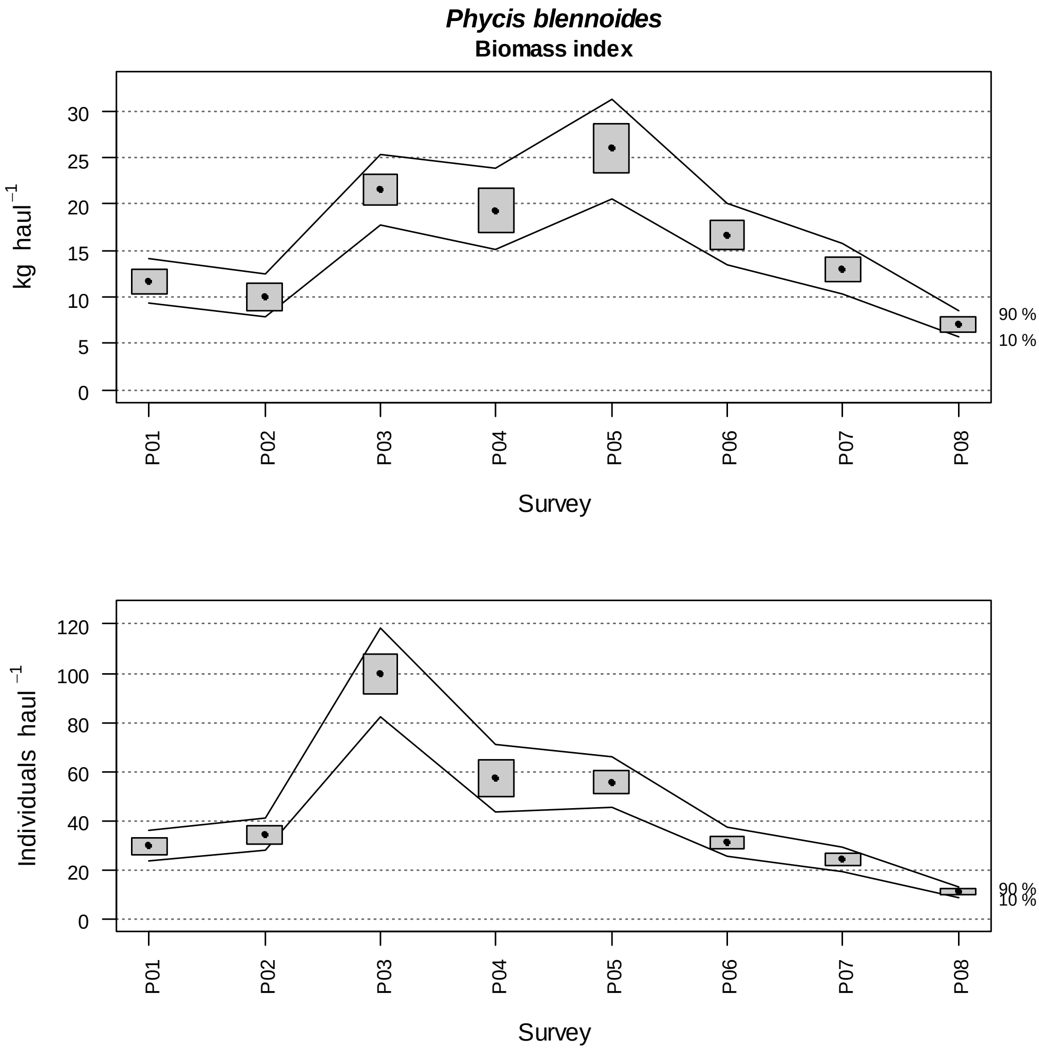


Figure 12.5. Changes in *Phycis blennoides* biomass and abundance indices during Porcupine Survey time-series (2001–2008). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000).

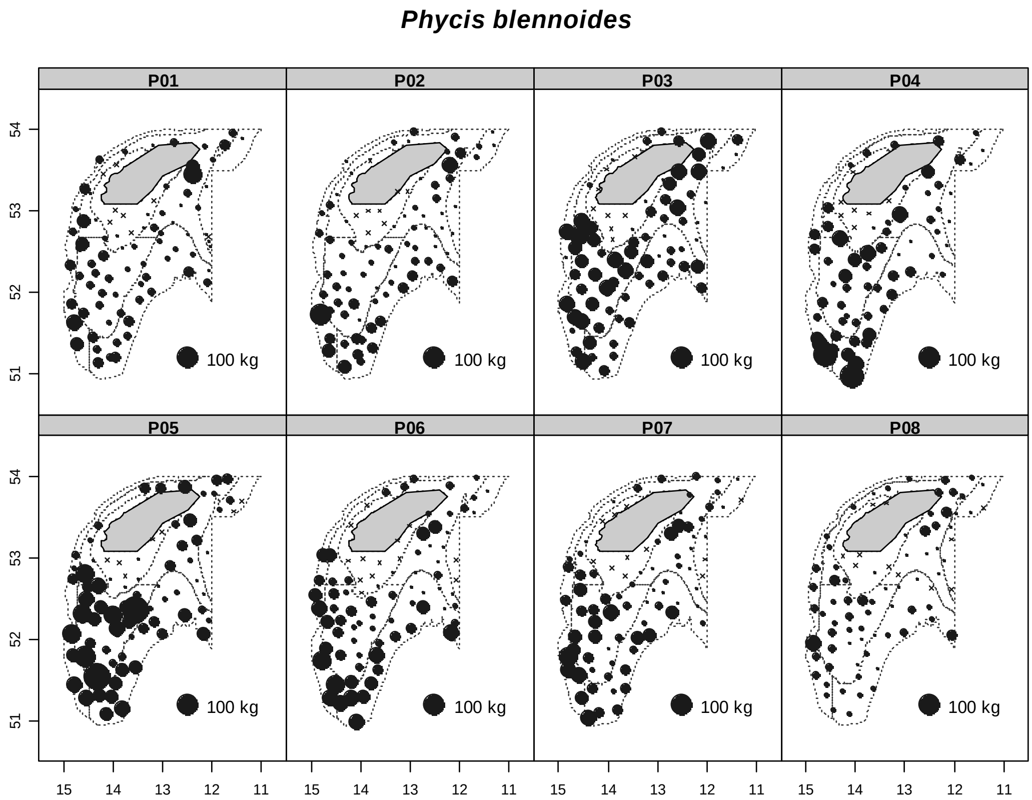


Figure 12.6. Geographic distribution of *Phycis blennoides* catches (kg/30 min haul) in Porcupine surveys between 2001 and 2008.

13 Alfonsinos/Golden Eye Perch (*Beryx* Spp.) in all Eco-Regions

13.1 The fishery

Alfonsinos, *Beryx splendens* and *Beryx decadactylus*, are generally considered as by-catch species in the demersal trawl and longline mixed fisheries targeting deep-water species. For most of the fisheries, the catches of alfonsinos are reported under a single category, as *Beryx spp*.

The proportions of each species in the catches are not well known. Detailed landings data by species are available only for the Portuguese longline fishery in Division Xa, where the landings of *B. decadactylus* averaged 18% of the catches of both species in the last 10 years, and for the Russian trawl fishery that targeted *B. splendens*.

Portuguese, Spanish and French trawlers and longliners are the main fleets involved in this fishery.

From 1988 to 1993 almost only the Azores (Division Xa) was involved on the fishery (representing 94% of the landings), duplicating the landings at the final of this period. Russian trawlers were responsible for high catches in Area Xb during 1994 to 2000. Other areas with important catches are VI+VII, with an average contribution of around 15% of the total catch from 1996 onwards and Areas VIII+IX, which catches averaged around 31% of the total from 1996 onward. In all the Areas the catches present a high interannual variability, with a general decreasing trend. The Azores deep-water fishery is a multispecies (up to 20 or more) and multigear fishery dominated by the main target species *Pagellus bogaraveo*. Target species can change seasonally according to abundance and market prices, and landings of *Beryx* represent 5 to 10% of the total deep-water species caught in the region.

Catches data for alfonsinos in 2006 and 2007 aggregated at the level of statistical rectangle were provided to the Working Group by France, Ireland, the UK (England and Wales and Scotland), Iceland and Faroes. These are shown in Figures 13.1.1 and 13.1.2.

13.1.1 Landings trends

The available landings data for Alfonsinos, (*Beryx spp*), by ICES Subareas/Divisions as officially reported to ICES or to the Working Group, are presented in Tables 13.1, 13.2 and 13.3 and Figure 13.2. Data presented here are working group estimates and may differ from official landings for some countries. No data on discards have been presented. In most cases the statistics refer to both species combined (*B. splendens* and *B. decadactylus*). In general, it is not known if the annual variations in landings are as a result of changes in fish abundance, changes in the targeting of the fisheries or to more accurate reporting or monitoring of the landings. Alfonsinos are often a bycatch of demersal fisheries targeting other species.

The general trend of the total landings follows the Azorean trend (increase until 1996 and decrease thereafter). Landings increase from 225 t in 1988 to 729 t in 1993 mainly because of the contribution of the Azores. From 1994 to 2000 the total landings fluctuate considerably because of the catches of the Russian trawlers fishery from the Division Xb, with a peak in 1994 (837 t) and 1996 (960 t). In 2001 the total landings become at the same level of 1993 but with a decrease trend from 607 t in 2001 to 330 t in 2008.

Landings reported from Subareas IV–V are very small and most were taken by French and Spanish vessels.

The reported landings from Subareas VI–VII, were small and variable until 1995, ranging from 1 to 12 t. In 1996, landings increased to 178 t, taken mainly by longline fisheries in Subarea VII, but decreased in the following years. The higher catch was observed in 2001 (180 t), but decreased in the following years.

In Subareas VIII–IX, the reported landings were very small (1–2 t) and scattered until 1994, but they have increased continuously until 1998 and maintained thereafter around 200 t, mainly because of the Spanish landings, with a drop from 2004 (287 t) to 2008 (50 t). Most of these landings can be regarded as bycatches of the Spanish and Portuguese demersal fisheries in these Subareas. Overall, most of the *Beryx spp*. landings are taken in Subarea X. They are mainly from longliners fishing within the Azorean EEZ and by trawlers fishing north of that area. Landings from the Azores increased steadily from 225 t in 1988 to 644 t in 1994, the highest value in the catch series, then decreased to 175 t in 1999. In the following years they fluctuate around 200 t. Landings of *B. splendens* by Russian trawlers were estimated to be around 3028 t during 1994–2000. From 2000 no catches were reported by Russia for the Subarea X.

Detailed information by species is available only for Divisions Xa and Xb. Both species, *B. splendens* and *B. decadactylus* present a decreasing trend in Azores landings, which is partly explained by a change in target species in the fishery. The landings series in the period 1988–2008 for both species separately is presented in Table 13.3 and in Figure 133. Russian catches consisted of *B. splendens* (100%) during whole fishing period.

13.1.2 ICES Advice

The Advice for 2009 and 2010 is the same as the Advice given in 2006: As a consequence of their spatial distribution associated with seamounts, their life-history and their aggregation behaviour, alfonsinos are easily overexploited by trawl fishing; they can only sustain low rates of exploitation. Fisheries on such species should not be allowed to expand above current levels unless it can be demonstrated that such expansion is sustainable. To prevent wiping out entire subpopulations that have not yet been mapped and assessed the exploitation of new seamounts should not be allowed.

13.1.3 Management

Fishing with trawl gears was forbidden in the Azores region (EC. Reg. 1568/2005). A box of 100 miles limiting the deep-water fishing to vessels registered in the Azores was created in 2003 under the management of fishing effort of the common fishery policy for deep-water species (EC. Reg. 1954/2003). An EU TAC of 328 t for EC vessels is in force for 2009–2010 (EC. Reg. 1359/2008).

There are NEAFC regulations of efforts in the fisheries for deep-water species and closed areas to protect vulnerable habitats.

13.2 Stock identity

The alfonsinos *Beryx spp*. are deep-water species that occur throughout the world's tropical and temperate waters, in depths from 25 to 1300 meters. The 2004 WGDEEP Report made reference to preliminary genetic results for *B. splendens* suggesting that significant genetic differentiation may occur between populations of the species within the North Atlantic, which may have some implications for future management of the fisheries. No further information is available. Because very little is known about stock structure of these species, the WG has assumed single-stocks of both *B. splendens* and *B. decadactylus* in the North Atlantic. This is contradictory conclusion with above information.

13.3 Data available

13.3.1 Landings and discards

Tables 13.1a–g describe the alfonsinos landings by subarea and country. No information about discards of *Beryx* species was available during the WGDEEP meeting.

13.3.2 Length compositions

No new fishery information was available to the Working Group. Length composition is available from survey and was updated this year (Pinho, WD13, 2009), Figures 13.4 and 13.5.

13.3.3 Age compositions

No information about age compositions of *Beryx* species was available during the WGDEEP meeting.

13.3.4 Weight-at-age

No information about weight-at-age of *Beryx* species was available during the WGDEEP meeting.

13.3.5 Maturity and natural mortality

No new information was presented to the Working Group this year.

13.3.6 Catch, effort and research vessel data

No new effort information was presented to the Working Group this year.

Updated (Pinho, WD13, 2009) annual bottom longline survey abundance index in number "Relative Population Number" (RPN) is available for the golden eye perch (*Beryx decadactylus*) (Figure 13.6) the alfonsinos (*Beryx splendens*) (Figure 13.7).

13.4 Data analyses

13.4.1 *Beryx decadactylus*

No data analyses were carried out this year.

13.4.2 *Beryx splendens*

No data analyses were carried out this year.

13.5 Comments on the assessment

No assessment was carried out this year.

13.6 Management considerations

No management advice is required for this stock in 2009.

Table 13.1a. Landings (tonnes) of *Beryx* spp. IV.

Year	France	TOTAL
1988	0	0
1989	0	0
1990	1	1
1991	0	0
1992	2	2
1993	0	0
1994	0	0
1995	0	0
1996	0	0
1997	0	0
1998	0	0
1999	0	0
2000	0	0
2001	0	0
2002	0	0
2003	0	0
2004	0	0
2005	0	0
2006	0	0
2007	0	0
2008*		

***Preliminary**

Table 13.1.b. Alfonsinos (*Beryx* spp.) Vb.

YEAR	FAROES	FRANCE	TOTAL
1988			0
1989			0
1990		5	5
1991		0	0
1992		4	4
1993		0	0
1994		0	0
1995	1	0	1
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
2004	0	0	0
2005	0	0	0
2006	0	0	0
2007	0	0	0
2008*			

***Preliminary**

Table 13.1.c. Alfonsinos (*Beryx* spp.) VI and VII.

YEAR	FRANCE	E & W	SPAIN	IRELAND	TOTAL
1988					0
1989	12				12
1990	8				8
1991					0
1992	3				3
1993	0		1		1
1994	0		5		5
1995	0		3		3
1996	0		178		178
1997	17	4	5		26
1998	10	0	71		81
1999	55	0	20		75
2000	31	2	100		133
2001	51	13	116		180
2002	35	15	45		95
2003	20	5	55	4	84
2004	15	3	46		64
2005	15	0	55	0	70
2006	27	0	51	0	78
2007	17	1	47	0	65
2008*	18	0	5	0	22

***Preliminary**

Table 13.1.d. Alfonsinos (*Beryx* spp.) VIII and IX.

YEAR	FRANCE	PORTUGAL	SPAIN	E & W	TOTAL
1988					0
1989					0
1990	1				1
1991					0
1992	1				1
1993	0				0
1994	0		2		2
1995	0	75	7		82
1996	0	43	45		88
1997	69	35	31		135
1998	1	9	258		268
1999	11	29	161		201
2000	7	40	117	4	168
2001	6	43	179	0	228
2002	13	60	151	14	238
2003	10	0	100	0	110
2004	21	53	213	0	287
2005	9	45	142	0	196
2006	9	20	64	3	97
2007	8	45	67	0	120
2008*	5	42	11	0	58

***Preliminary**

Table 13.1.e. Alfonsinos (*Beryx* spp.) X.

	XA	XB				
YEAR	PORTUGAL	FAROES	NORWAY	RUSSIA**	E & W	TOTAL
1988	225					225
1989	260					260
1990	338					338
1991	371					371
1992	450					450
1993	533		195			728
1994	644		0	837		1481
1995	529	0	0	200		729
1996	550	0	0	960		1510
1997	379	5	0			384
1998	229	0	0			229
1999	175	0	0	550		725
2000	203	0	0	266	15	484
2001	199	0	0		0	199
2002	243	0	0		0	243
2003	172	0	0		0	172
2004	139	0	0		0	139
2005	157	0	0		0	157
2006	192	0	0		0	192
2007	211	0	0		0	211
2008*	250	0	0	0	0	250

***Preliminary**

**** Not official data from ICES Area Xb.**

Table 13.1.f. Alfonsinos (*Beryx* spp.) XII.

YEAR	FAROES	TOTAL
1988		
1989		
1990		
1991		
1992		
1993		
1994		
1995	2	2
1996	0	0
1997	0	0
1998	0	0
1999	0	0
2000	0	0
2001	0	0
2002	0	0
2003	0	0
2004	0	0
2005	0	0
2006	0	0
2007	0	0
2008*	0	0

***Preliminary**

Table 13.1.g. Alfonsinos (*Beryx* spp.) in Madeira (Portugal).

Year	Portugal	TOTAL
1988		0
1989		0
1990		0
1991		0
1992		0
1993		0
1994		0
1995	1	1
1996	11	11
1997	4	4
1998	3	3
1999	2	2
2000		
2001		
2002		
2003		
2004		
2005		
2006		
2007		
2008*		

Table 13.2. Reported landings for the Alfonsinos, (*Beryx* spp), by ICES Subareas/Divisions.

YEAR	IV	VB	VI+VII	VIII+IX	XA	XB	XII	TOTAL
1988				0	225	0		225
1989			12	0	260	0		272
1990	1	5	8	1	338	0		353
1991			0	0	371	0		371
1992	2	4	3	1	450	0		460
1993			1	0	533	195		729
1994			5	2	644	837		1488
1995		1	3	82	529	200	2	817
1996			178	88	550	960		1776
1997			25	135	379	5		544
1998			81	269	229	0		579
1999			75	201	175	550		1001
2000			133	167	203	281		784
2001			186	229	199	0		614
2002			94	237	243	0		574
2003			82	109	172	0		363
2004			62	280	139	0		481
2005			70	191	157	0		418
2006			104	105	192	0		402
2007			36	70	211	0		317
2008*	0	0	22	58	250	0		330

***Preliminary**

Table 13.3. Reported landings of *Beryx splendens* and *B. decadactylus* in Azores (ICES Division Xa).

YEAR	B. SPLENDENS	B. DECADACTYLUS	TOTAL
1988	122	103	225
1989	113	147	260
1990	137	201	338
1991	203	168	371
1992	274	176	450
1993	316	217	533
1994	410	234	644
1995	335	194	529
1996	379	171	550
1997	268	111	379
1998	161	68	229
1999	119	56	175
2000	168	35	203
2001	182	17	199
2002	223	20	243
2003	150	22	172
2004	110	29	139
2005	134	23	157
2006	152	40	192
2007	165	46	211
2008	187	63	250

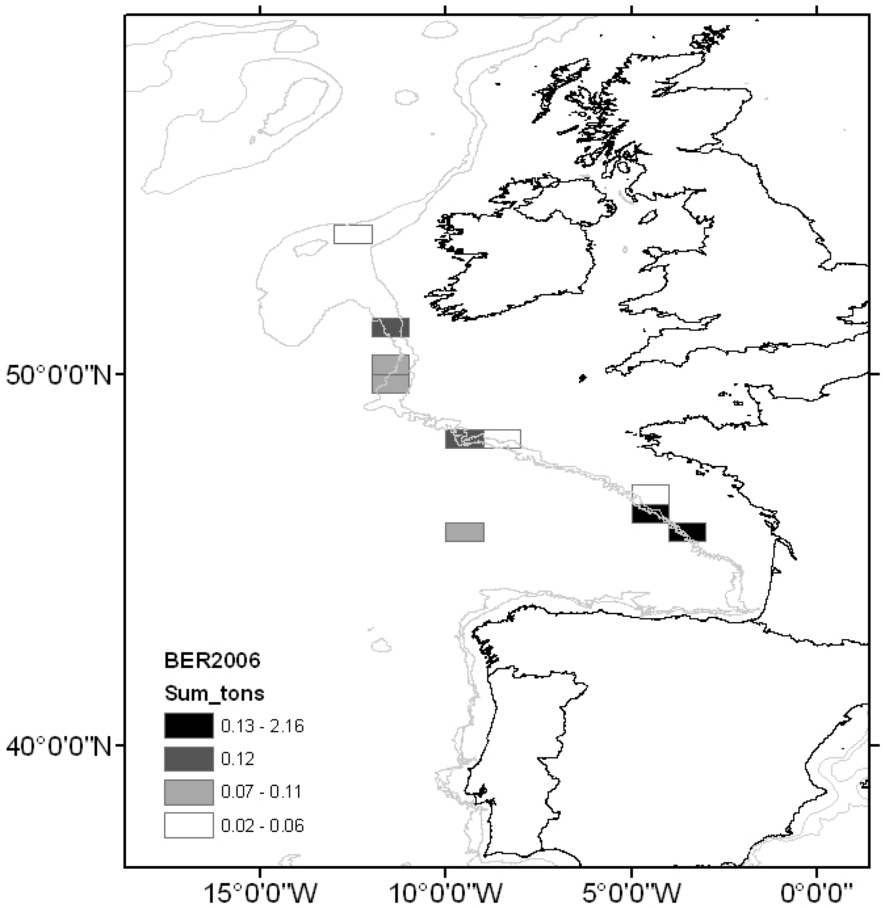


Figure 13.1. Catches of alfonsinos by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2006.

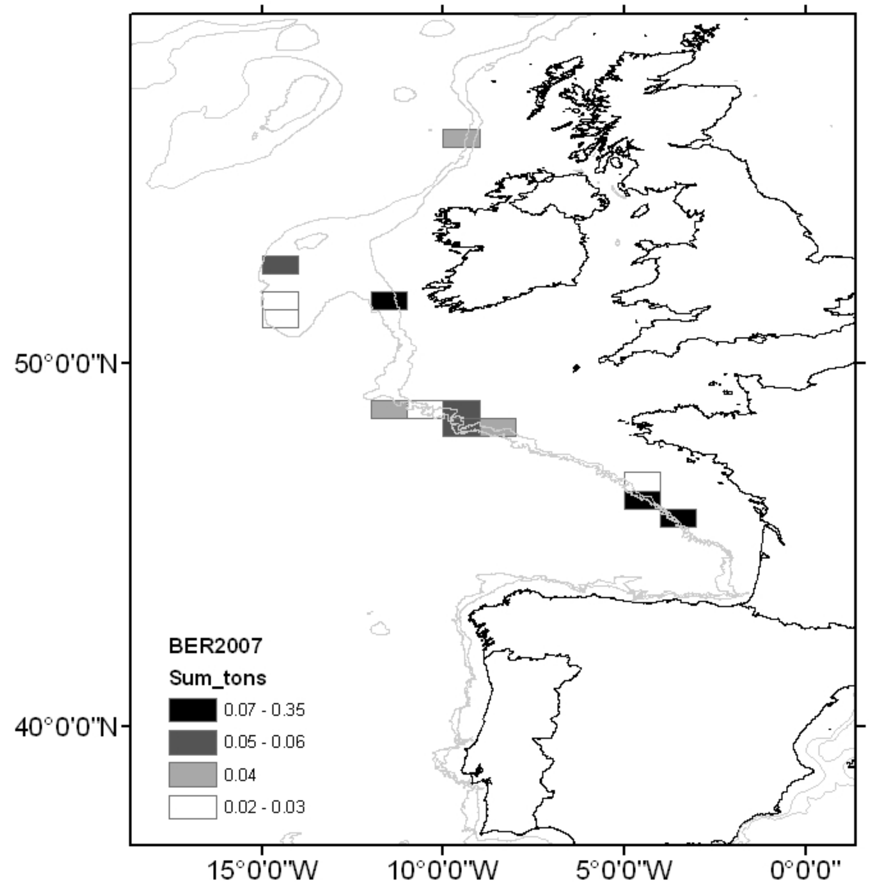


Figure 13.2. Catches of alfonsinos by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

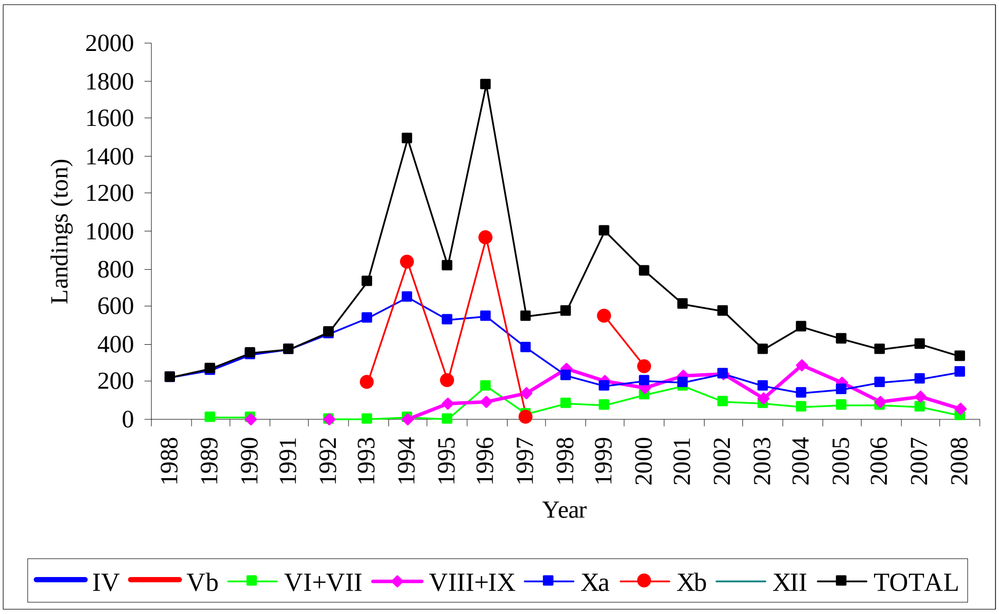


Figure 13.2. Reported landings for the alfonsinos, (*Beryx* spp), by ICES Subareas/Divisions.

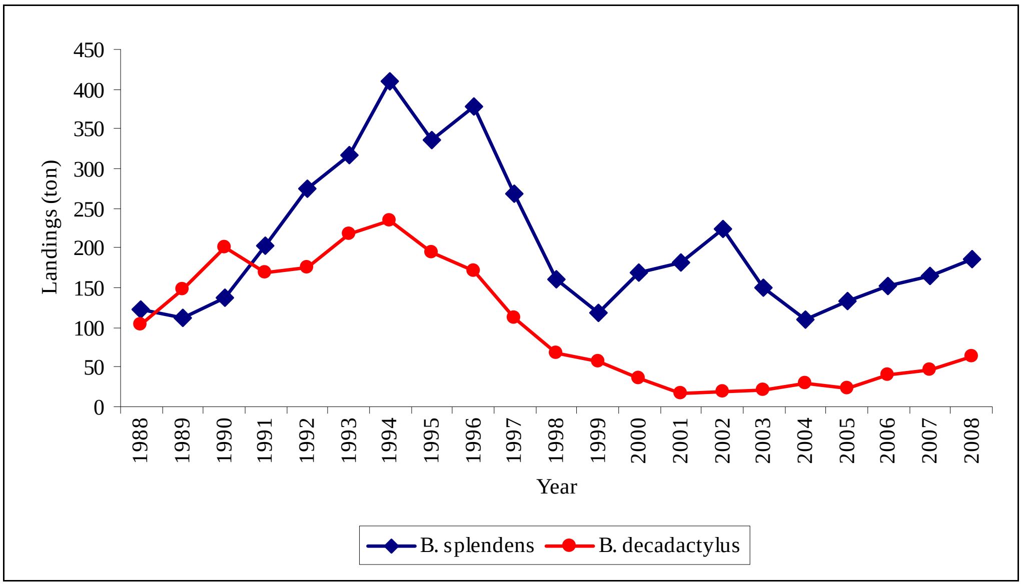


Figure 13.3. Landings of *Beryx splendens* and *B. decadactylus* in Azores (ICES Subarea X).

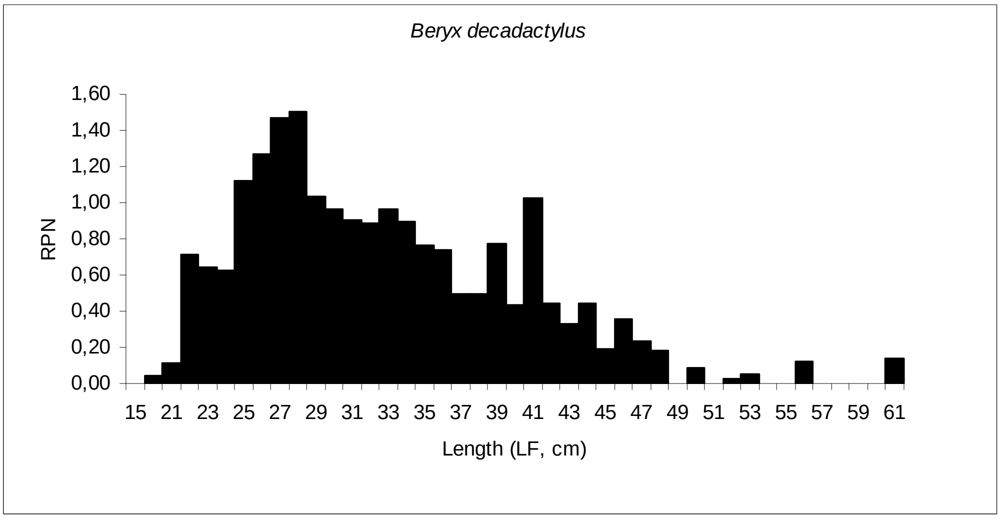


Figure 13.4. Mean annual length composition (1995–2008) from spring bottom longline surveys in Azores (ICES Subarea X) for *Beryx decadactylus*.

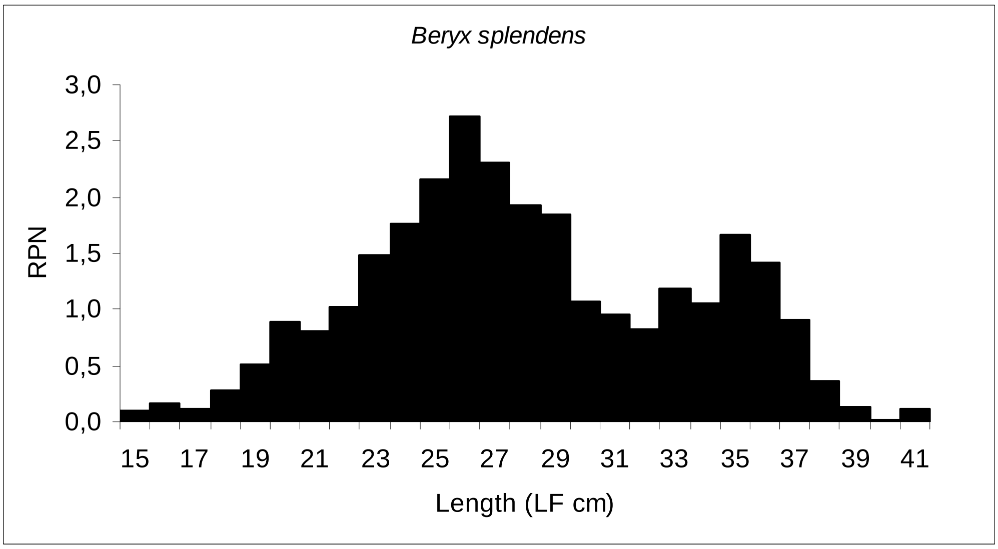


Figure 13.5. Mean annual length composition (1995–2008) from spring bottom longline surveys in Azores (ICES Subarea X) for *Beryx splendens*.

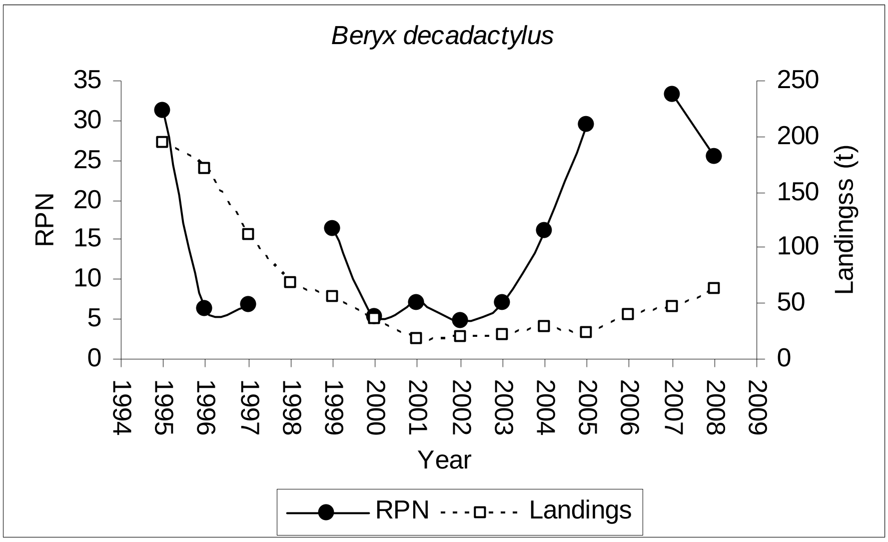


Figure 13.6. Annual bottom longline survey abundance index in number "Relative Population Number" (RPN) available for the golden eye perch (*B. decadactylus*) from the Azorean deep-water species surveys (ICES Subarea X). Annual landing are also presented in the graph for trend illustration.

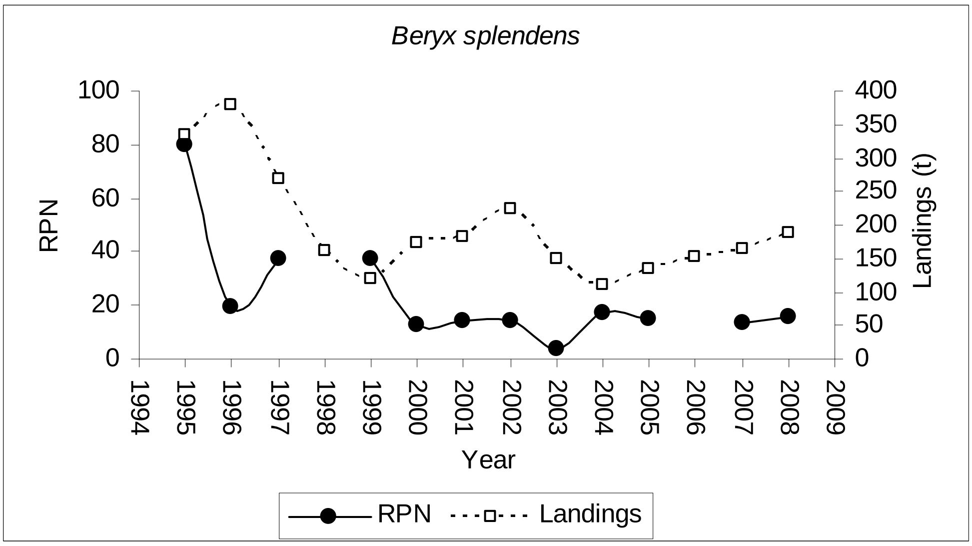


Figure 13.7. Annual bottom longline survey abundance index in number "Relative Population Number" (RPN) available for the Alfonsinos (*Beryx splendens*) from the Azorean deep-water species surveys (ICES Subarea X). Annual landing are also presented in the graph for trend illustration.

14 Red (black spot) sea bream (*Pagellus bogaraveo*)

14.1 Stock description and management units

ICES considered three different components for this species: a) Areas VI, VII, and VIII; b) Area IX, and c) Area X (Azores region), (ICES, 1996, 1998a). This separation does not pre-suppose that there are three different stocks of red (blackspot) sea bream, but it offers a better way of recording the available information.

The interrelationships of the (blackspot) sea bream from Areas VI, VII, and VIII, and the northern part of Area IXa, and their migratory movements within these areas have been observed by tagging methods (Gueguen, 1974). However, there is no evidence of movement to the southern part of IXa where the majority of the fishery occurs.

Recent studies demonstrate that there are no genetic differences between populations from different ecosystems within the Azores region (East, Central and West group of Islands, and Princesa Alice bank) but there are genetic differences between Azores (ICES Area Xa2) and mainland Portugal (ICES Area IXa) (Stockley *et al*., 2005). These results, combined with the known distribution of the species by depth, suggest that Area X component of this stock can effectively be considered as a separate assessment unit.

Available information, particularly genetics and tagging, seems to support the current assumption of three assessment units (VI–VIII, IX and X).

Catches data for red sea bream in 2006 and 2007 aggregated at the level of statistical rectangle were provided to the Working Group by France, Ireland, the UK (England and Wales and Scotland) and Iceland. These are shown in Figures 14.1.1 and 14.1.2.

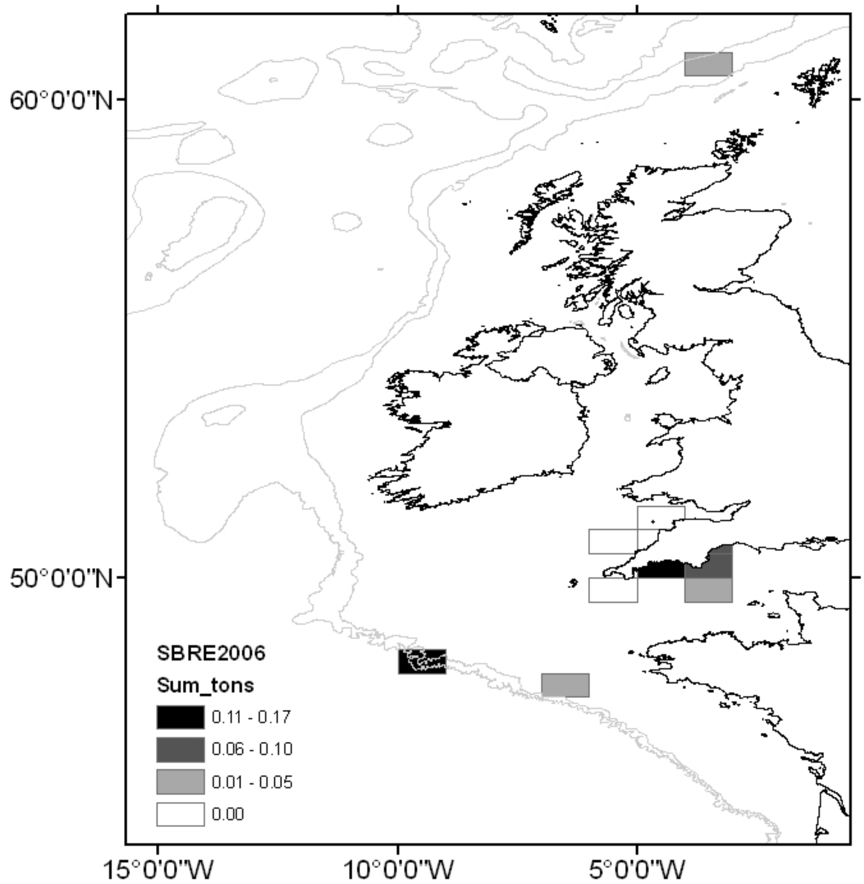


Figure 14.1.1. Catches of red sea bream by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2006.

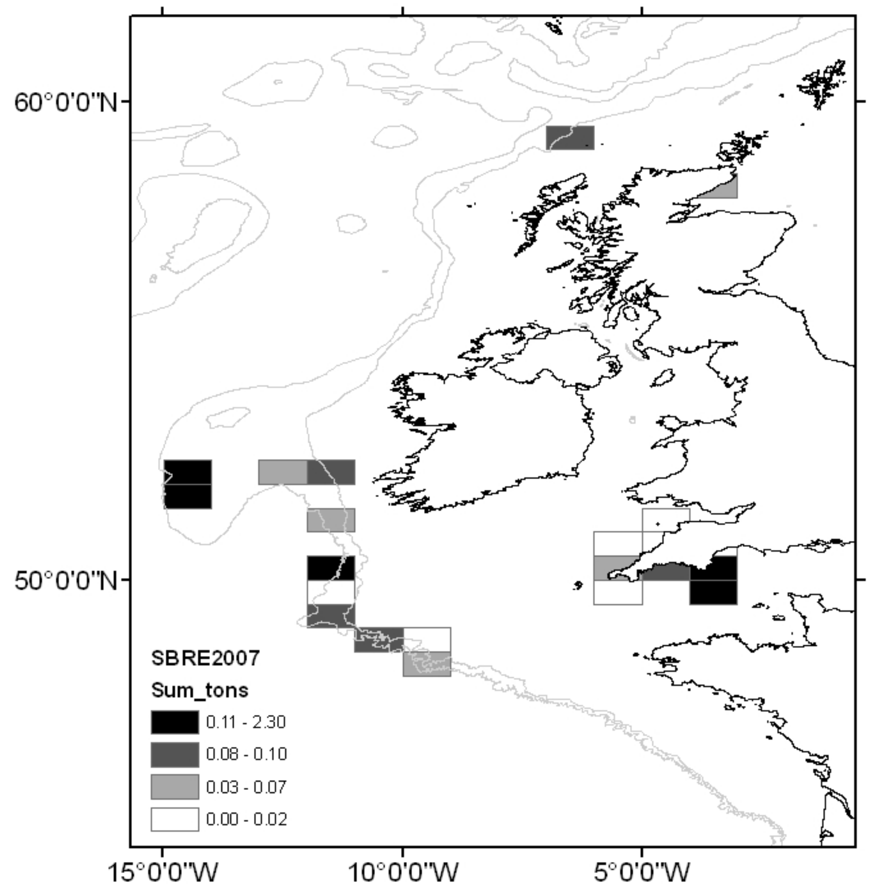


Figure 14.1.2. Catches of red sea bream by French, Irish, UK (England and Wales and Scotland) and Icelandic vessels, 2007.

14.2 Red Seabream (*Pagellus Bogaraveo*) in Subareas VI, VII and VIII

14.2.1 The fishery

This Section includes a description of the *Pagellus bogaraveo* in Subareas VI, VII, VIII by the Spanish, French, UK fleets and Portugal in CECAF.

They are no important changes in this fishery since the last WGDEEP Report. The fishery in Subareas VI, VII and VIII strongly declined in the mid 1970s, and the stock is seriously depleted. Since 1988 the landings from Subarea VIII represents the 62% and VI and VII the 28% of total accumulated landings. At present the Spanish red sea bream catches in this area, are almost all bycatches of longliner fleet and trawlers but there is also some landings from "other" unidentified fleets. The information reported from other areas is very scarce and only Portuguese fleet in CECAF reported significant landings in 2005.

It has been speculated that the collapse of this fishery has been the result of a combination of factors. Its peculiar reproductive biology makes red sea bream especially vulnerable by a fishery concentrated in the spawning season and focused on the bigger fish that are mainly females. Probably there was also an excessive increase of the fishing effort since the middle of the 1960s. There was no monitoring of the fishery. The effort and the fishing activity was not controlled or regulated nor in relation to the traditional and artisanal gears, such as the bottom longline, nor in relation to the new trawl gears such as the pelagic trawl. That was implemented precisely at the beginning of the 1980s above all in the Bay of Biscay and south of British Islands. And, finally, perhaps other oceanographic features and cyclic changes not yet identified, could have contributed decisively with some (or with all of the) factors above indicated to the sharp declining of this international fishery in the northeastern Atlantic (Lucio, 2002).

14.2.1.1 Landings trends

Landings data for red (blackspot) sea bream, *Pagellus bogaraveo*, by ICES Subareas/Divisions as reported to ICES or to the Working Group are demonstrated in Table 14.2.1. After a revision of French data since 1999 the landings of this country demonstrate an increase of 60% and 36% in the Areas VI, VII and VIII respectively. For these three Subareas combined landings fell from more than 461 t in 1989 to 52 t in 1996, then they increased until 2000 (237 t), and from 2001 to 2006 a slight decrease is observed. This trend seems to change after this year because the landings reported reached 322 t in 2007, the highest value since 1990. In the period considered (1988–2008), most of the estimated landings from the Subareas VI, VII and VIII were taken by Spain (66%), followed by France (16%), UK (15%) and Ireland (2%).

A Spanish, French and UK extended landing series in North East Atlantic have been improved from two sources, one of this from a table performed for P. Lucio in WGDEEP 2004 (S1) and the other from a compilation of statistic bulletins (S2). Some of the high historical catches could be included other species of *Pagellus* and/or other Sparidae, i.e. "sea bream", as some landings could be also misreported. Figure 14.2.1 tries to shows by means of these two sources the differences in the historical interpretation of the landings of red sea bream in Subareas VI, VII and VIII. Although the landings estimated by both sources since sixties onwards are very different, .the trend of both sources coincides in that period, giving a clear perspective of the important decline of this fishery in North East Atlantic in last 30 years.

In relation to this there is no information about French landings in most of the years between 1950 and 1975, and the great peaks observed in 1950, 1960, 1965, 1970 and 1975 just coincide with the only French reports in this period.

In any case, and taking into account the constraints of data collected (especially in the first decade) it's very clear the important and fast decline of the fishery since 1977 onwards. Looking at in last 30 years no landings higher than 1000 t are recorded after 1986 and in last 10 years the annual catches have been almost always below of 300 t.

14.2.1.2 ICES advice

In 2008, ICES advised; *Red sea bream in VI, VII, and VIII appears to be severely depleted based on historical catches.*

14.2.1.3 Management

In relation to 2007 and 2008 the TAC for 2009 and 2010 in the Subareas VI, VII, VIII, was reduced to 253 and 215 t respectively In the following table a summary of red sea bream international TACs since 2007 in Subareas VI, VII and VIII and 2007–2008 landings.

PAGELLUS BOGARAVEO	LANDINGS		TAC	TAC	TAC
Subarea	2007	2008	2007–2008	2009	2010
VI, VII, VIII	322	135	298	253	215

14.2.2 Data available

14.2.2.1 Landings and discards

Historical series of landings data available to the Working Group have been described in text and tables of Section 14.2.1. No discard data were available to the Working Group.

14.2.2.2 Length compositions

No length data were available to the Working Group.

14.2.2.3 Age compositions

No age data were available to the Working Group.

14.2.2.4 Weight-at-age

No weight-at-age data were available to the Working Group.

14.2.2.5 Maturity and natural mortality

No maturity and natural mortality-at-age data were available to the Working Group.

14.2.2.6 Catch, effort and research vessel data

No catch, effort and research vessel data were available to the Working Group.

14.2.3 Data analyses

No assessment was required for this stock in 2009.

14.2.4 Comments on the assessment

No assessment was required for this stock in 2009.

14.2.5 Management considerations

No advice was required for this stock in 2009.

Table 14.2.1a. Red sea bream in Subareas VI and VII; WG estimates of landings by country.

Year	France*	Ireland	Spain	UK (E & W)	Ch. Islands	TOTAL
1988	52	0	47	153	0	252
1989	44	0	69	76	0	189
1990	22	3	73	36	0	134
1991	13	10	30	56	14	123
1992	6	16	18	0	0	40
1993	5	7	10	0	0	22
1994	0	0	9	0	1	10
1995	0	6	5	0	0	11
1996	0	4	24	1	0	29
1997	0	20	0	36		56
1998	0	4	7	6		17
1999	2	8	0	15		25
2000	4	n.a.	3	13		20
2001	2	11	2	37		52
2002	4	0	9	13		25
2003	13	0	7	20		40
2004	33		4	18		55
2005	29		4	7		41
2006	36	0	8	19		63
2007	51	0	27	57		135
2008	32	0	2	22		57

Table 14.2.1b. Red sea bream in Subarea VIII; WG estimates of landings by country.

YEAR	FRANCE*	SPAIN	ENGLAND (1)	TOTAL
1988	37	91	9	137
1989	31	234	7	272
1990	15	280	17	312
1991	10	124	0	134
1992	5	119	0	124
1993	3	172	0	175
1994	0	131	0	131
1995	0	110	0	110
1996	0	23	0	23
1997	18	7	0	25
1998	18	86	0	104
1999	13	84	0	97
2000	11	189	0	200
2001	8	168	0	176
2002	10	111	0	121
2003	6	83	0	89
2004	37	82	8	128
2005	28	90	0	118
2006	20	57	0	77
2007	38	149	1	188
2008	37	40	0	78

Table 14.2.1c. Red sea bream in Subareas VI, VII and VIII; WG estimates of landings by subarea.

YEAR	VI+VII*	VIII*	TOTAL
1988	252	137	389
1989	189	272	461
1990	134	312	446
1991	123	134	257
1992	40	124	164
1993	22	175	197
1994	10	131	141
1995	11	110	121
1996	29	23	52
1997	56	25	81
1998	17	104	121
1999	25	97	122
2000	20	200	220
2001	52	176	227
2002	25	121	147
2003	40	89	129
2004	55	128	183
2005	41	118	158
2006	63	77	139
2007	135	188	322
2008	57	78	135

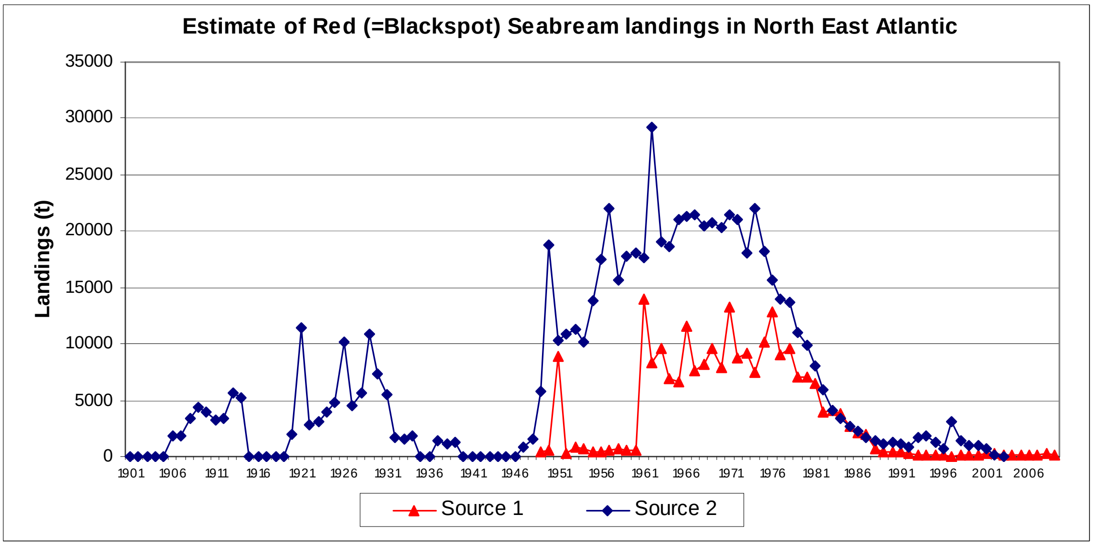


Figure 14.2.1. Historical series of Red Seabream landings since 1900 in North East Atlantic (Subareas VI, VII and VIII).

Source 1

1948–1978: Data extracted from Table 16.3 ICES WGDEEP 2004 (French landings in VI, VII and VIII Subareas, Spanish landings in North East Atlantic, E & W landings in VI, VII and VIII Subareas).

1979–1985: Data extracted from Table 14.2.1. ICES SGDeep 1996

1986–1987: Data extracted from Table 16.3 ICES WGDEEP 2004

1988–2008: ICES WGDEEP 2008 International landings of French, Spanish, E & W in VI, VII and VIII Subareas.

Source 2

Compilation of several statistic bulletins.

14.3 Red Seabream (*Pagellus bogaraveo*) in Subarea IX

14.3.1 The fishery

Although *Pagellus bogaraveo* is caught by Spanish and Portuguese fleets in Subarea IX, only a more complete description of one of the fisheries has been provided to the Working Group, the corresponding to the Spanish fishery in the southern part of Subarea IX, close to the Strait of Gibraltar.

The majority of landings on deep-water species at mainland Portugal are conducted by the artisanal fleet, mainly longline fisheries. These operated in the Portuguese continental slope and located in ports as Peniche, Sesimbra and Sagres. Red sea bream landings reflect a seasonal activity probably related with a larger availability of the species or market demands that lead fishers to spend some time targeting this species (I. Figueiredo, *pers. com.*).

In relation to the Spanish fishery in the southern ICES Subarea IXa, an updated description of it has been presented to the Working Group by Gil *et al.*, WD 8, 2009, that completes the information offered in the previous WGs (Gil *et al.*, 2000; 2003, 2005, 2006, 2007 and 2008; Gil and Sobrino, 2001, 2002 and 2004). This artisanal longline fishery targeted red sea bream has been developed along the Strait of Gibraltar area. Actually this fishery covers almost the 70% of the landings for the species in the Subarea IX. The "voracera", a particular mechanised hook and line baited with sardine, is the gear used by the fleet. The base and landing ports are two: Algeciras and mainly Tarifa (Cádiz, SW Spain). Fishing is carried out taking advantage of the turnover of the tides in bottoms from 200 to 400 fathoms. Usually landings are distributed in categories as a consequence of the wide range of sizes and to market reasons. These categories have varied in time.

In the beginning of the 1980s, there were 25 small boats engaged in this fishery. Thereafter the fleet has increased to more than a hundred since the 1990s. The mean technical characteristics of this fleet by port are 8.95 and 6.52 meters length and 5.84 and 4.0 tons G.T.R. for Tarifa and Algeciras, respectively (from Gil *et al.*, 2000).

From 2002 onwards artisanal boats from other port, Conil, have began to direct its fishing activity to *P. bogaraveo* in different fishing grounds than the boats of Tarifa and Algeciras.

14.3.1.1 Landing trends

In Subarea IX, catches, most of them taken by longliners, correspond to Spain (70%) and Portugal (30%). Spanish landings data from this area are available from 1983 and Portuguese from 1988 onwards. The maximum catch in this period was obtained in 1993–1994 and 1997 (about 1000 t) and the minimum in 2002 (359 t). Catches in 2008 amount to 601 t.

Almost all Spanish catches in this area are taken in waters close to the Gibraltar Strait. Until 2002 they were restricted to two ports (Tarifa and Algeciras), but from 2002 significant catches were obtained also by artisanal Spanish boats of a third port (Conil) in different fishing grounds of the same area. After arise its minimum value in 2002 an increasing trend was observed till the last years, but there is no evidence of its sustainability.

In the Portuguese landings no clear tendency is observed. The maximum values took place in 1988 (370 t) and in 1998 (357 t) and the minimum one in 2000 (83 t). In recent years there was a slightly increasing trend till 2007 (185 t).

14.3.1.2 ICES Advice

In 2008, ICES advised; *ICES recommends that catches in Areas IXa and Xa should be constrained to recent average catches (2003–2007) of 500 t in Area IXa and 1050 t in Area Xa and to collect information that can be used to evaluate a long-term sustainable level of exploitation.*

14.3.1.3 Management

Since 2003, a regime of TAC and Quotas has been applied also to the *P. bogaraveo* fishery in Subarea IX. The following table demonstrates a summary of *P. bogaraveo* TAC which is by far never reached in all these years.

P. BOGARAVEO	2003–2004		2005–2006		2007–2008	
ICES Subarea	TAC	Landings	TAC	Landings	TAC	Landings
IX	1271	471–480	1080	494–544	1080	592–601*

*** Preliminary**

Moreover, some technical measures have been set up by the Spanish Central Government, in 1998, and by the Regional Government of Andalucía since 1999, in order to regulate the fishing activity and to conserve the resource. Recently a Regional Recovery Plan of *P. bogaraveo* related to this Spanish fishery in the Strait of Gibraltar area has been implemented by the Regional Government of Andalucía for 2003–2008 Among the technical measures adopted by this Plan there are: closure of the fishing season during two and half months (15 January–31 March), minimum size of fish retained or landed (33 cm total length), authorized vessels list, hook size, maximum hooks per line (100), maximum number of lines per boat (30), and maximum number of automatic machines for hauling per boat (3), restricted ports for landing the red sea bream catches (only Tarifa and Algeciras).

14.3.2 Data available

14.3.2.1 Landings and discards

Historical series of landings data available to the Working Group have been described in text and tables of Section 14.3.1. No discard data were available to the Working Group, but for this species this could be considered minor. The full time-series are presented in Table 14.3.1.

14.3.2.2 Length compositions

Landing length frequencies data are only available for Spanish Red sea bream fishery in the Strait of Gibraltar (1990–2008). Figure 14.3.1 reflects the updated information regards the mean length of landings from the Strait of Gibraltar fishery (WD 8, 2009).

14.3.2.3 Age compositions

A combined ALK was obtained by 1497 three agreed readings from otoliths collected from 2003 to 2008 presented by Gil et al., WD 8, 2009. It covers lengths from 24 to 54 cm. and comprises ages between 3 and 10. Younger ages are well sampled while the older groups are susceptible to poorer estimates. Results are preliminary and are not validated yet. There is greater confidence for ages less than 6 years (partially validated by comparison with growth rates in captivity) while the aging of older fish may be unreliable and possible underestimated.

From ICES Subareas VI, VII and VIII, Gueguen, 1969 reported a maximum age of 20 years. In the Azores, ICES Subarea X, a maximum age of 15 years was observed in a 56 cm length fish (Krug, 1994). Whereas, from the available information the maximum years observed is 10 in Subarea IX. However, the ages of older fish may be underestimated and it is possible that this species may be slower growing and longer-lived than current studies indicate. In fact, from tagging experiences one recaptured sample was notified after more than 10 years at sea (J. Gil, *pers. com.*).

14.3.2.4 Weight-at-age

No new weight-at-age data were presented to the Working Group.

14.3.2.5 Maturity and natural mortality

No new data on maturity and natural mortality was presented to de Working Group.

14.3.2.6 Catch, effort and research vessel data

Figure 14.3.2 updated the catch and effort data available only for the Strait of Gibraltar fishery (WD 8, 2009). It is important to emphasize also that the effort unit chosen (number of sales) cannot be too appropriate as do not consider the missing effort. Thus, in the recent years this missing effort increases substantially (fishing vessels with no catches and no sale sheet to be recorded) and recent lpue values may be overestimated.

No research vessel data were available for the species in this Subarea.

14.3.3 Data analyses

No assessment was required for this stock in 2009.

14.3.4 Comments on the assessment

No assessment was required for this stock in 2009.

14.3.5 Management considerations

No Advice was required for this stock in 2009.

Table 14.3.1 Red sea bream (*Pagellus bogaraveo*) in Subarea IX: Working Group estimates of landings (tonnes).

Year	Portugal	Spain	TOTAL
1988	370	319	689
1989	260	416	676
1990	166	428	594
1991	109	423	532
1992	166	631	797
1993	235	765	1000
1994	150	854	1004
1995	204	625	829
1996	209	769	978
1997	203	808	1011
1998	357	520	877
1999	265	278	543
2000	83	338	421
2001	97	277	374
2002	111	248	359
2003	142	329	471
2004	183	297	480
2005	129	365	494
2006	104	440	544
2007	185	4071	592
2008*	158	443	601

***provisional**

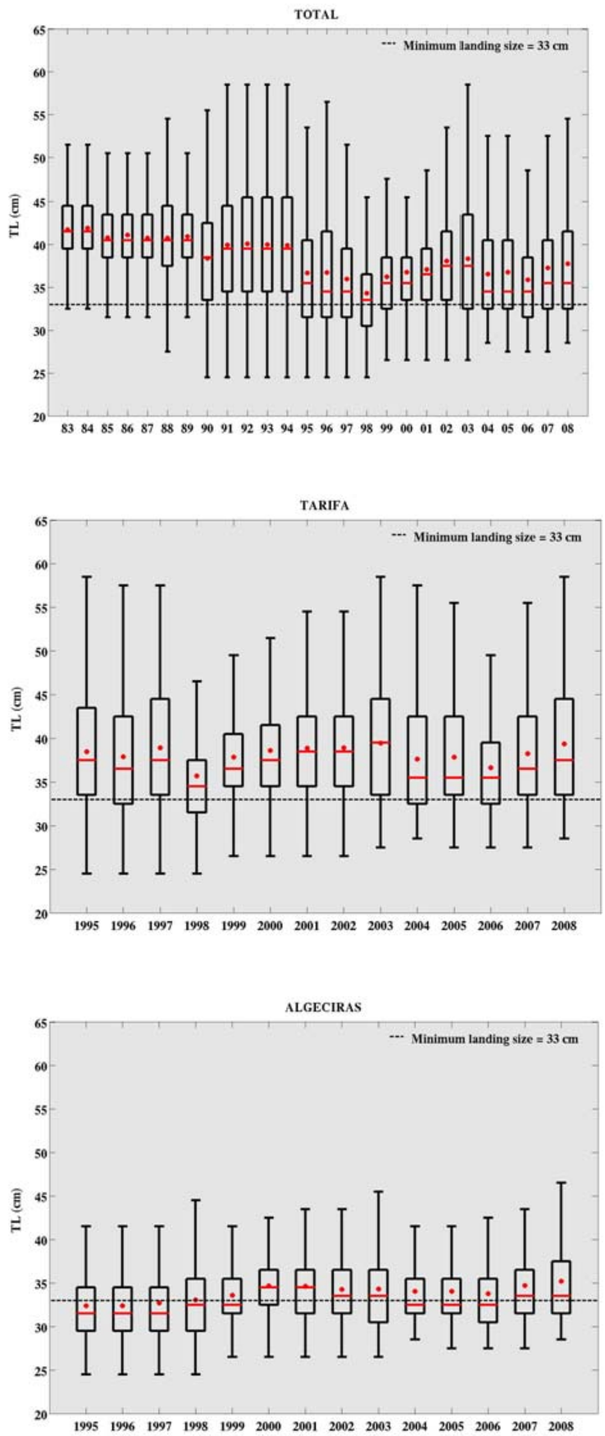


Figure 14.3.1. Red sea bream fishery of the Strait of Gibraltar (ICES Subarea IX): 1983–2008 landings mean length distribution (from Gil *et al.*, WD 8, 2009).

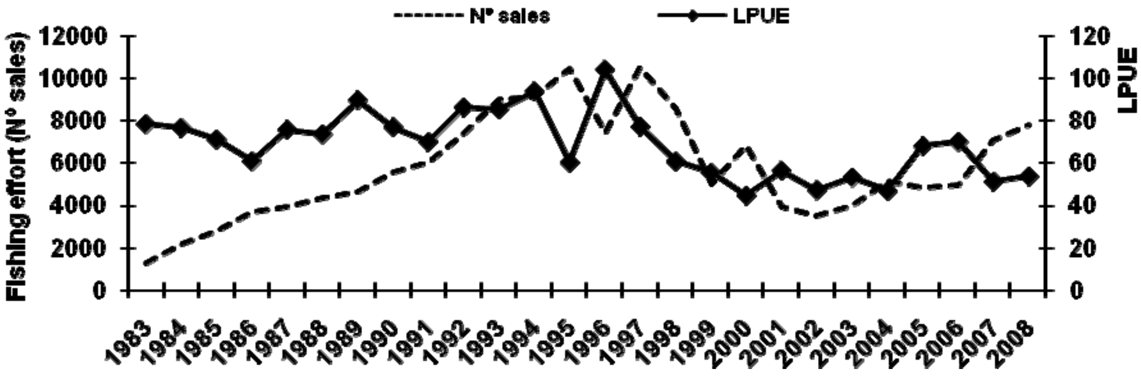


Figure 14.3.2. Red sea bream fishery of the Strait of Gibraltar (ICES Subarea IX): Evolution of effort and lpue in the period 1983–2008 (from Gil *et al.*, WD 8, 2009).

14.4 Red Seabream (*Pagellus Bogaraveo*) in Division Xa

14.4.1 The fishery

Blackspot sea bream has been exploited in the Azores (Area Xa2), at least, since the XVI century, as part of the demersal fishery, and is actually one of the most important Northeast Atlantic fisheries. The directed fishery is a hook and line fishery where two components of the fleet can be defined: the artisanal (handlines) and the longliners (Pinho *et al.*, 1999; Pinho, 2003). The artisanal fleet is composed of small open deck boats (<12 m) that operate on local areas near the coast of the islands using several types of handlines. Longliners are closed deck boats (>12 m) that operate in all areas, including banks and seamounts. The tuna fishery caught, until the end of the nineties, juveniles (age 0) of blackspot sea bream as live bait, but in a seasonal and irregular way because these catches depend on tuna abundance and on the occurrence of other preferred bait species like *Trachurus picturactus* (Pinho *et al.*, 1995).

The Azorean demersal fishery is a multispecies and multigear fishery where *P. bogaraveo* is considered the target species. The effect of these characteristics on the dynamic of the target fishery is not well understood.

14.4.1.1 Landings trends

Historically the landings increased from 400 t at the start of the eighties to proximally 1000 t at the start of the nineties (Figure 14.4.1), as a consequence of the development of new markets, increased fish value, entry of new and modern boats, better professional education of the fisher, and introduction of bottom longline gear, permitting the expansion of the exploitable area to deeper waters, banks, and seamounts as well as, the expansion of the fishing season (ICES 2006). During the last 17 years the landings fluctuated around the 1050 t.

14.4.1.2 ICES advice

In 2008, ICES advised; *catches in Areas IXa and Xa should be constrained to recent average catches (2003–2007) of 500 t in Area IXa and 1050 t in Area Xa and to collect information that can be used to evaluate a long-term sustainable level of exploitation.*

14.4.1.3 Management

Under the European Union Common Fisheries policy an analytical TAC of 1116 mt was introduced in 2003 (EC. Reg. 2340/2002) and maintained in 2004 (EC. Reg. 2270/2004), 2006 (EC. Reg. 2015/2006) and 2008 (EC. Reg. 1359/2008).

P. BOGARAVEO	2005		2006		2007		2008	
ICES Subarea	TAC	Landing	TAC	Landing	TAC	Landing	TAC	Landing
Xa2	1136	1113	1136	958	1136	1070	1136	1089

For the 2006 the Regional Government introduced a quota system by Island and vessel. A specific access requirements and conditions applicable to fishing for deep-water stocks was established (EC. Reg 2347/2002). Fishing with trawl gears was forbidden in the Azores region. A box of 100 miles limiting the deep-water fishing to vessels registered in the Azores was created in 2003 under the management of fishing effort of the common fishery policy for deep-water species (EC. Reg. 1954/2003).

For 2009 the Regional Government will introduce new technical measures, including the minimum landing size (30 cm total length), area restrictions by vessel size and gear, and gear restrictions (hook size and maximum hooks per skate (120) on the longline gear).

14.4.2 Data available

14.4.2.1 Landings and discards

Total landings are available since 1980. However, detailed and precise landing data are available for the assessment since 1990 (ICES, 2006). Landings from Area Xa2 are presented in the Table 14.4.1. A recent study reveals that almost no blackspot sea bream is discarded on the target demersal fishery (Catarino, 2006).

14.4.2.2 Length compositions

No new fishery length composition was presented to the Working Group.

Length composition from the survey is presented in Figure 14.4.3. No trends are observed in these data.

14.4.2.3 Age compositions

No new information was presented to the Working Group.

14.4.2.4 Weight-at-age

No new information was presented to the Group.

14.4.2.5 Maturity, Sex-ratio and natural mortality

No new information was presented to Working Group.

14.4.2.6 Catch, effort and research vessel data

No new fishery effort data were presented to the Working Group this year.

Abundance indices from surveys are available since 1995 (Pinho, WD13 2009) (Figure 14.4.2). Survey indices presented an increase trend with a high value every three years. These high values may be related with some sort of catchability variability (fish is more available to the gear in some years) as a function of the feeding behaviour (bentho-pelagic) and reproduction (protandric forming spawning aggregations) of the species.

14.4.3 Data analyses

No assessment was required for this stock in 2009.

14.4.4 Comments on the assessment

No assessment was required for this stock in 2009.

14.4.5 Management considerations

No advice was required for this stock in 2009.

Table 14.4.1. Pagellus bogaraveo landings in ICES Division Xa2 since 1980.

YEAR	AZORES (XA2)	TOTAL
1980	415	415
1981	407	407
1982	369	369
1983	520	520
1984	700	700
1985	672	672
1986	730	730
1987	631	631
1988	637	637
1989	924	924
1990	889	889
1991	874	874
1992	1090	1090
1993	830	830
1994	989	989
1995	1115	1115
1996	1052	1052
1997	1012	1012
1998	1119	1119
1999	1222	1222
2000	924	924
2001	1034	1034
2002	1193	1193
2003	1068	1068
2004	1075	1075
2005	1113	1113
2006	958	958
2007	1070	1070
2008	1089	1089

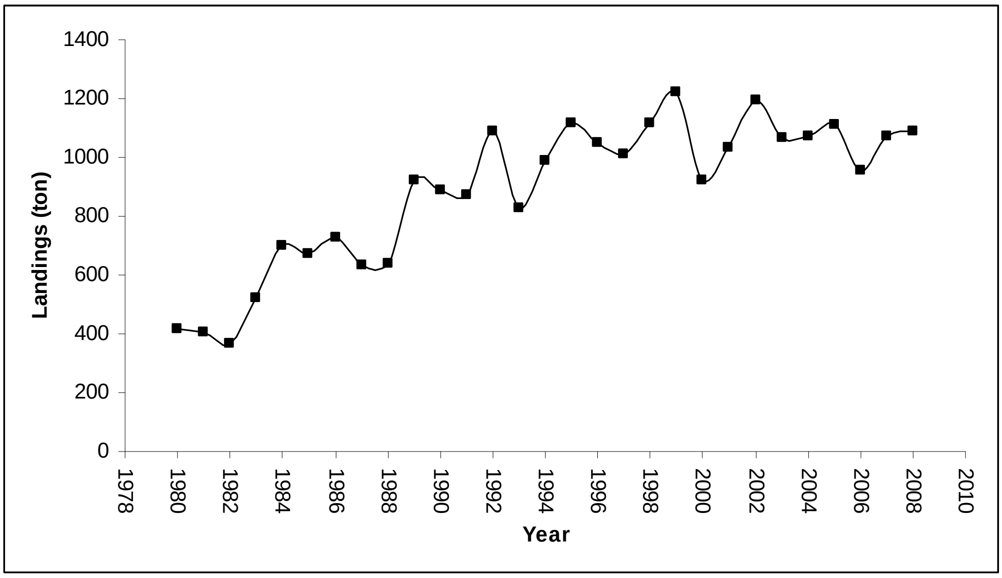


Figure 14.4.1. Historical landings of *Pagellus bogaraveo* from the Azores (ICES Area Xa2).

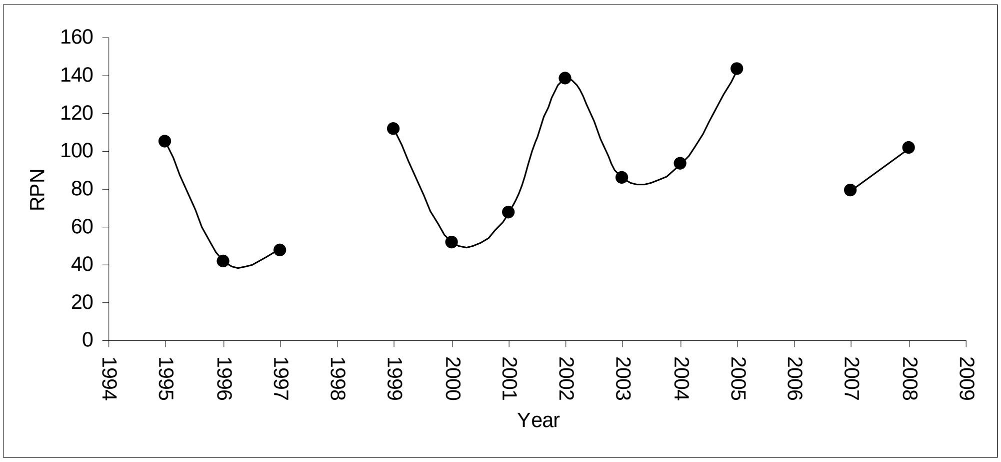


Figure 14.4.2. Annual abundance in number (Relative Population Number) and in weight (Relative Population Weight) of *Pagellus bogaraveo* from surveys for the ICES Area Xa2.

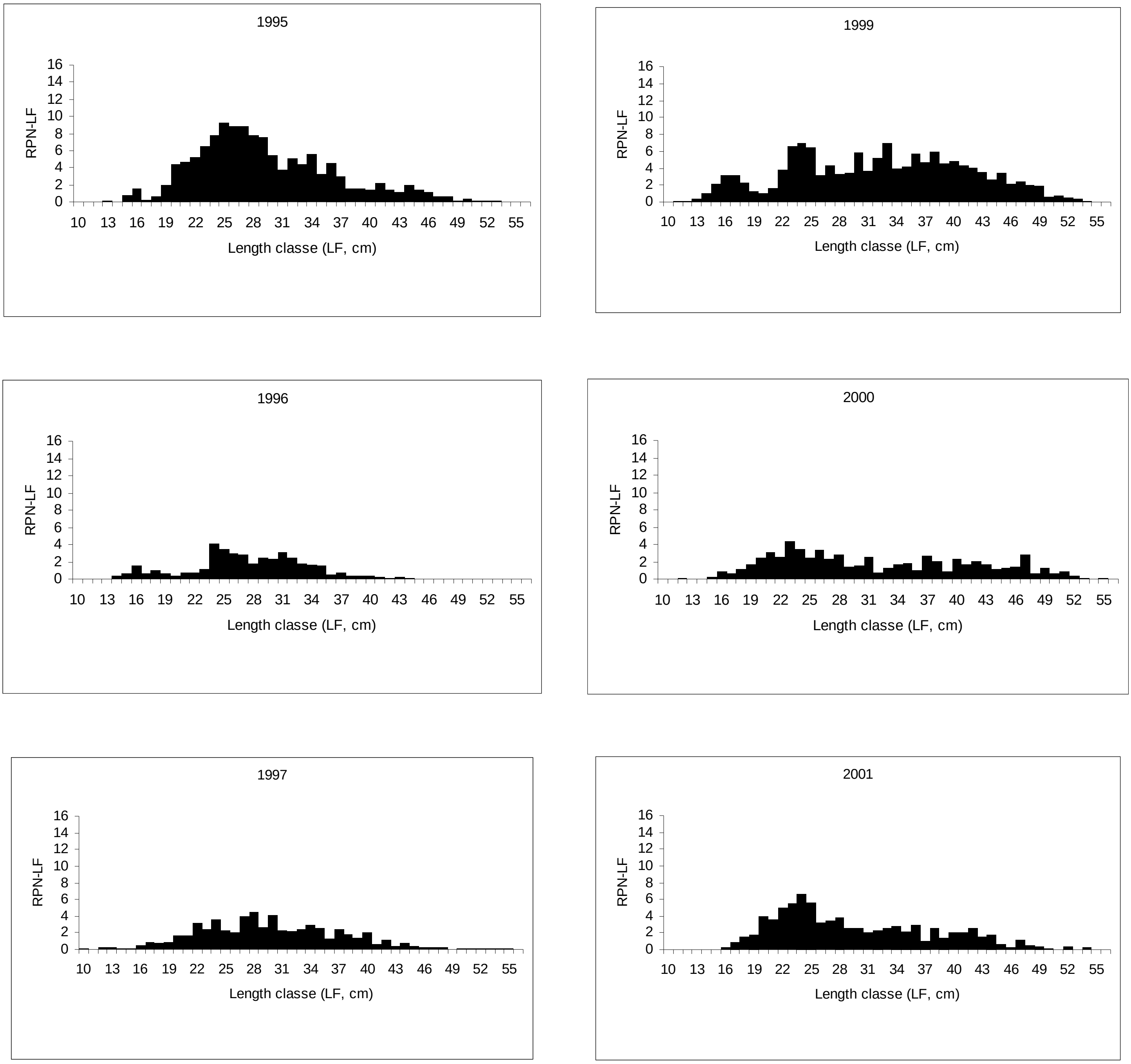


Figure 14.4.3. Annual length composition of *Pagellus bogaraveo* from the Azorean spring bottom longline survey for the period 1995–2008 (ICES Area Xa2).

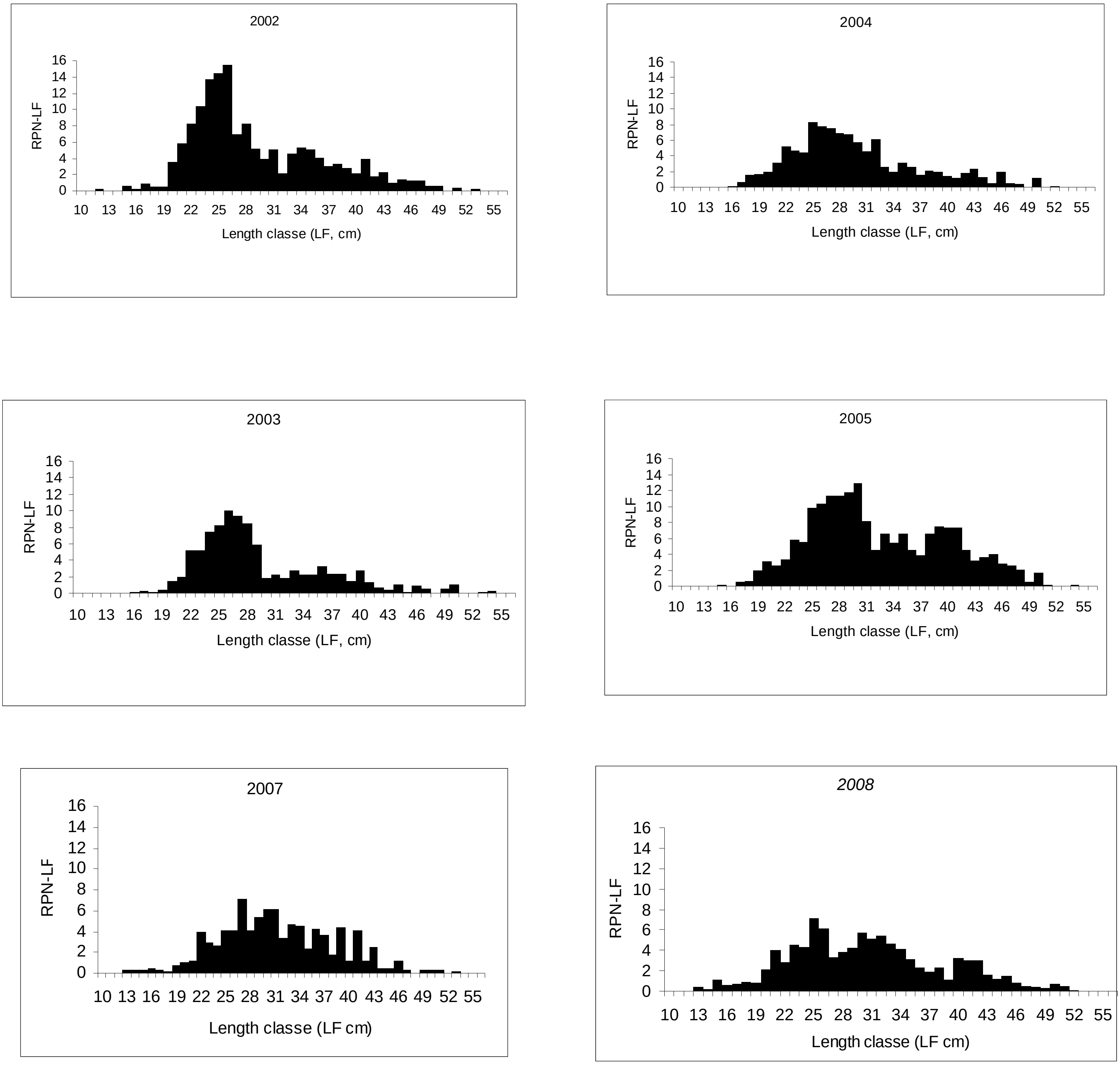


Figure 14.4.3. Cont. Annual length composition of *Pagellus bogaraveo* from the Azorean spring bottom longline survey for the period 1995–2008 (ICES Area Xa2).

15 Other Deep-Water species in the Northeast Atlantic

15.1 The fisheries

Building on information presented in previous Working Group reports, the following species are considered in this chapter: roughhead grenadier (*Macrourus berglax*), common Mora (*Mora moro*) and Moridae, rabbit fish (*Chimaera monstrosa* and *Hydrolagus* spp), Baird's smoothhead (*Alepocephalus bairdii*) and Risso's smoothhead (*A. rostratus*), wreckfish (*Polyprion americanus*), bluemouth (*Helicolenus dactylopterus*), silver scabbard fish (*Lepidopus caudatus*), deep-water cardinal fish (*Epigonus telescopus*) and deep-water red crab (*Chaceon affinis*).

Roughhead grenadiers are predominantly taken as bycatch in trawl and longline fisheries targeting Greenland halibut in Subareas I and II. Mora, rabbitfish, smoothheads, bluemouth and deep-water cardinal fish are taken as bycatch in mixed-species demersal trawl fisheries in Subareas VI, VII and XII and to a lesser extent, II, IV and V. Rabbitfish and smoothheads have low market value and, in some fisheries, the entire catch is usually discarded. Landings data therefore do not reflect the entire catch of these species and more data are needed on levels of discarding. A small bycatch of rabbitfish was taken in the Roundnose grenadier fishery in Subarea III.

Mora, wreckfish, bluemouth and silver scabbardfish are caught in targeted and mixed species longline fisheries in Subareas VIII, IX and X.

Deep-water red crab are caught in directed tanglenet and trap fisheries and as a bycatch in net fisheries for deep-water sharks, principally in Subareas VI and VII but increasingly in other areas including Subarea IX.

15.1.1 Landings trends

Reported landings of roughhead grenadier increased dramatically from 433 tonnes in 2004 to 5295 tonnes in 2005. Prior to this increase, landings had remained more or less stable at less than 200 tonnes per annum. The increased landings came from the Spanish trawl fishery at Hatton Bank and were recorded as "*Macrourus berglax* and other grenadiers". If these data are accurate, it may indicate that effort has been reallocated to roughhead grenadier in response to more restrictive quotas on other species. It is however possible that these landings were not actually *M. berglax* and may result from misreporting of other species e.g. roundnose grenadier. Landings data from 2006–2008 does not confirm a trend concerning the increase reported in 2005 and landings again seems to be stable at a level prior to 2003.

Reported landings of Mora decreased between 2002 and 2005, both in the trawl fisheries in Subareas VI, VII and XII and in the longline fisheries in Subareas VIII, IX and X. Data from 2006 indicates that this trend has not continued, with 2006 landings similar to pre-2002 levels. Preliminary data from 2007 indicates no changes from the situation in 2006. Some problems with data still exist as at least one country still mixes this species with greater forkbeard in landings and it is possible that the apparent decrease in landings from the trawl fisheries result from inadequate reporting, however, the decrease in the longline fishery appears to be genuine.

Total landings of rabbitfish increased rapidly between 1995 and 2005. This may be a result of increasing market acceptance of this species which was formerly discarded by most fleets. Data from 2006 demonstrates a sharp decline and the preliminary data for 2008 demonstrates that landings in the period 2006–08 are reduced compared with the level in 2005.

Landings of smoothheads demonstrated a general increasing trend from the mid 1980s to 2002 as a result of increasing retention in the fisheries, however, more recent landings demonstrate no clear trend.

Landings of wreckfish increased during the early 1990s but have since returned to their level of the late 1980s. Since 1997 there has been no clear trend in landings until 2005. The fishery is primarily executed in Subareas VIII, IX and X. In 2006–2007 there was an increase in landings in Subareas VIII, IX and X. This increase seems to continue in 2008.

Bluemouth landings in Subareas VI and VII increased in the late 1990s, probably as a result of increased retention in the fisheries, however, since 2000, landings have fluctuated without any obvious trend. In Subarea X, landings increased in the 1990s but have since declined steadily; this may be partly attributed to a change in the fishery towards targeting other species. Landings in Subareas VIII and IX have been increasing since 2002.

Silver scabbardfish landings in Subarea X rose to a peak of 1180 tonnes in 1998 then declined very rapidly. Since 1999, landings in this area have remained at a low level of less than 100 tonnes per annum. Landings in Subareas VIII and IX declined from a peak of over 5000 tonnes in 1995 to 527 tonnes in 2005. For Subarea VIII and IX no change in catch trends appears in 2008 and the catches remain at a stable level from the four last years. In 2006 it was reported catches in Subareas VI and VII which led to an increase in the total catch this year only.

The largest catches of deep-water cardinal fish came from Subareas VI and VII and demonstrated an increasing trend until 2003. The landings then have decreased in recent years. This may reflect the general reduction of effort resulting from management measures aimed at other species.

A fishery for deep-water red crab (*Chaceon affinis*) using nets and traps began in Subareas V, VI and VII in 1995. This has recently been an increase in catches in other areas, including Subarea IX. Landings have fluctuated with an increasing trend. The increasing trend seems to continue in 2007. Many of the vessels involved in this fishery also target deep-water sharks and it is possible that changes in the spatial distribution of this fishery have been influenced by the current restrictions on deep-water gillnetting in Subareas VI and VII.

15.1.2 ICES Advice

ICES has not previously given specific advice on the management of any of the stocks considered in this chapter. General advice on the management of existing deep-water fisheries given in 2005 was … *the fishing pressure should be reduced considerably to low levels and should only be allowed to expand again very slowly if and when reliable assessments indicate that increased harvests are sustainable.*

15.1.3 Management

No quotas are set for any of these species in EC waters or in the NEAFC Regulatory Area. None of these species are included in Appendix I of Council Regulation (EC) No 2347/2002 meaning that vessels are not required to hold a Deepwater Fishing Permit in order to land them; they are therefore not necessarily affected by EC regulations governing deep-water fishing effort.

15.2 Stock identity

No new information has been made available to the Working Group on the stock identity of these species.

15.3 Data available

15.3.1 Landings and discards

Landings for all of these species are presented in Table 15.1–15.8

New discard data from the Portuguese longline fishery targeting black scabbardfish is presented to the Working Group. The data demonstrates that this targeted fishery continues to demonstrate low percentages of discards and that the target species constituted nearly 84% of catch in weight.

15.3.2 Length compositions

Last year new length data were provided to the Working Group for Spanish landings of silver scabbard fish from the Porcupine Bank. An update of Spanish survey data from the same area on bluemouth is given this year (Figure 15.1). New Russian data on bluemouth, common mora and rabbitfish from the Faroese Fishing Zone and the slope of Rockall Bank is also given. Further, new data on roughhead grenadier from the Norwegian waters and the Faroese Fishing Zone is presented. Russian bottom-trawl survey data on roughhead grenadier from East Greenland is updated from last year. (Figures 15.2–15.8). All new Russian data are from the longline fishery. This adds to data included in previous reports.

15.3.3 Age compositions

No new data on age compositions of any of these species were presented to WGDEEP in 2008.

15.3.4 Weight-at-age

No new data on weight-at-age for any of these species were presented to WGDEEP in 2008.

15.3.5 Maturity and natural mortality

New information was presented to the Working Group on maturities of male and female bluemouth, rabbitfish and common mora from Russian surveys in the Faroese Fishing Zone and the slope of Rockall Bank. New Russian data on roughhead grenadier in Norwegian waters and the Faroese Fishery Zone is also added. An update on Russian roughhead grenadier data from East Greenland is continued (Figures 15.9–15.15).

15.3.6 Catch, effort and research vessel data

Variation in abundance indices of bluemouth in the Spanish Porcupine Bank Survey from 2001 to 2008 is shown in Figure 15.16. Cpue has remained more or less stable throughout this period, but 2008 has the lowest value observed. The geographic distribution of catch rates are given in Figure 15.17. The bathymetric distribution is given in the 2008 Report.

An update on abundance indices of bluemouth, wreckfish and silver scabbard fish from Portuguese survey at the Azores are given in Figures 15.18–15.20. No clear trends could be seen for bluemouth which has been at the same stable level since

2003. The abundance seems to maximize in 2006 but data from this year is missing. However, the abundance is reduced recently and is now back to a level similar to 2004. There are no apparent changes for silver scabbard fish, which has been at a very low level since 2000.

New Russian data on prey composition from stomach contents analyses on rabbitfish is given in Figure 15.21. Similar Russian data on roughhead grenadier are given in last year's report.

15.3.7 Data analyses

No assessment was required for these stocks in 2009.

15.3.8 Comments on the assessment

No assessment was required for these stocks in 2009.

15.3.9 Management considerations

No advice was required for these stocks in 2009.

Table 15.1 Working Group estimates of landings of roughhead grenadier (t). Data from 2008 are provisional.

YEAR	I AND II	III/IV	VA	VB	VI/VII	VIII	X	XII	XIV	TOTAL
1988										
1989										
1990	589									589
1991	829									829
1992	424	7								431
1993	136				18				52	206
1994					5				5	10
1995	1				4				2	7
1996	3	4	15		13					35
1997	21	5	4	6	12					48
1998	55	1	1	9	10				6	82
1999				58	34		3		14	109
2000	48	4	2	1	10			7		72
2001	94	10	1	4	44			10	26	189
2002	29	3	4	3	19			7	53	118
2003	77	2	33	12	12			324	665	1125
2004	79	1	3	9	13			28	300	433
2005	77	39	5	5	2582			2547	40	5295
2006	78		7		76	1		8	9	179
2007	50		2	5	39				10	108
2008	55			4	6				9	70

Table 15.2 Working Group estimates of landings of Mora moro and Moridae (t). Data from 2008 are provisional.

YEAR	VB	VI/VII	VIII/ IX	X*	XII	XIVB	TOTAL
1988				18			18
1989				17			17
1990				23			23
1991	5	1		36			42
1992		25		31			56
1993				33			33
1994				42			42
1995			83				83
1996			52				52
1997			88				88
1998							
1999	1	20					21
2000		156	26		1		183
2001	100	194	20	1	87		402
2002	19	159	8	100	13		299
2003	8	327	12	125	15	6	493
2004	1	71	11	87	4		174
2005	1	63	54	69			187
2006	4	428	51	127	1		560
2007	4	251	4	86	20		365
2008							

*** source of data 1988 to 1994 unknown, may be unreliable**

Table 15.3 Working Group estimates of landings of rabbitfish (t) (Chimaera monstrosa and Hydrolagus spp.) Data from 2008 are provisional.

YEAR	I/II	III/IV	VA	VB	VI/VII	VIII	XII	XIV	TOTAL
1991			499						499
1992		122	106						228
1993		8	3						11
1994		167	60		2				229
1995			106	1					107
1996		14	21						35
1997		38	15				32		85
1998		56	29		2		42		129
1999	1	45	2	3	236	2	115		404
2000	6	33	5	54	358	2	48		506
2001	5	20		96	729	7	79		936
2002	15	24		64	573	6	98	1	781
2003	57	25		61	474	2	81	4	704
2004	21	40		96	433	6	128	5	729
2005	66	171		57	571	14	249	1	1129
2006	28	14	1	10	282	5		5	345
2007	63	18	1	77	389	3			551
2008	82	20	21	50	333	3			508

Table 15.4 Working Group estimates of landings of Wreckfish (t). Data from 2008 are provisional.

YEAR	VI/VII	VIII/IX	X	TOTAL
1988	7	198	191	396
1989		284	235	519
1990	2	163	224	389
1991	10	194	170	374
1992	15	270	241	526
1993		350	314	664
1994		410	429	839
1995		394	240	634
1996	83	294	240	617
1997		222	177	399
1998	12	238	139	389
1999	14	144	133	291
2000	14	123	268	405
2001	17	167	229	413
2002	9	156	283	448
2003	2	243	270	515
2004	2	141	189	332
2005		195	279	474
2006		338	497	835
2007	2	554	664	1221
2008	3	307	513	824

Table 15.5 Working Group estimates of landings of bluemouth (t). Data from 2008 are provisional.

Year	III/IV	Vb	VI	VI*	VII	VII*	VIII/IX	X	TOTAL
1989			79		48		2	481	610
1990	4		69		31		5	480	589
1991	5		99		29		12	483	628
1992	3		112		47		11	575	748
1993	1		87		65		8	650	811
1994	2		62		55		4	708	831
1995	2		62		9			589	662
1996	2		77	47	10	2		483	572
1997	1		78	41	10	11	1	410	500
1998			53	79	92	4	3	381	529
1999	8	64	194	1	160	0	29	340	795
2000		16	213	191	119	3	33	452	833
2001			177	224	102	12	34	301	614
2002			81	91	115	1	18	280	494
2003			184		213		124	338	859
2004	2	3	142		291		135	282	855
2005			103		204		206	190	703
2006		12	50		167		288	209	726
2007			57		235		397	275	964
2008		1	69**		31		213	281	595

***: No landings of bluemouth were reported in Spanish landings prior to 2003. Only landings from Basque Country were available for the WG.**

****: Landings include data from Spain.**

Table 15.6 Working Group estimates of landings of silver scabbardfish (t). Data from 2008 are provisional.

YEAR	VI/VII	VIII/IX	X	XII	TOTAL
1988		2666	70		2736
1989		1385	91	102	1578
1990		584	120	20	724
1991		808	166		974
1992		1374	2160		3534
1993	2	2397	1722	19	4140
1994		1054	373		1427
1995		5672	789		6461
1996		1237	815		2052
1997		1725	1115		2840
1998		966	1186		2152
1999	18	3069	86		3173
2000	15	16	28		59
2001		706	14		720
2002	1	1832	10		1843
2003		1681	25		1706
2004		854	29		883
2005		527	31		558
2006	342	624	35		1001
2007	67	655	55		778
2008		845	63		908

Table 15.7 Working group estimates of landings of deep-water cardinal fish (t). Data from 2008 are provisional

YEAR	VB	VI	VII	VIII/IX	X	XII	TOTAL
1993		15	15				30
1994	4	35	182				221
1995	3	20	71				94
1996	8	13	32				53
1997	8	27	22				57
1998		86	29				115
1999	8	52	206	3			269
2000	2	108	179	5	3		297
2001	7	103	282	4			396
2002		90	884	8	14		996
2003	2	45	1030	5	15	1	1098
2004	1	28	841	10	21		901
2005		50	638	8	4		700
2006		1	14	7	10		32
2007		6	8	20	7		41
2008		19	3	6	7		35

Table 15.8 Working Group estimates of landings of deep-water red crab (t). Data from 2008 are provisional.

YEAR	IV/V	VI	VII	VIII/IX	XII	TOTAL
1995		6	4			12
1996	20	1288	77	2	17	1413
1997	58	139	48	11	4	437
1998	35	313	34	188	2	384
1999	642	289	46		3	980
2000	38	580	108			726
2001	13	335	20			368
2002	29	972	21		6	1028
2003	26	960	123		92	1201
2004	21	546	115		13	695
2005	94	626	184		15	1230
2006	16	185	19	310		530
2007	11	732	104	85	24	957
2008	2	124	1			127

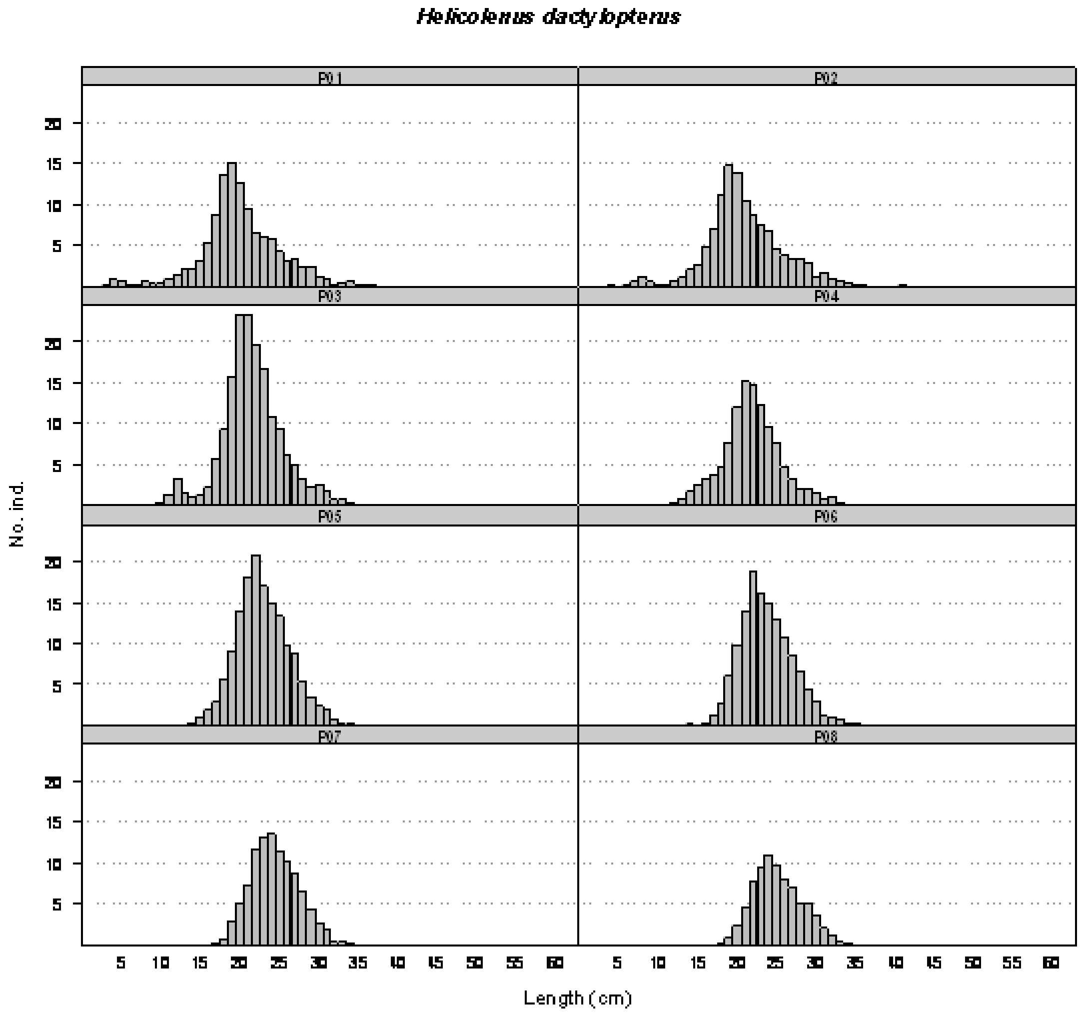


Figure 15.1. Mean stratified length distributions of *Helicolenus dactylopterus* in Porcupine surveys (2001–2008).

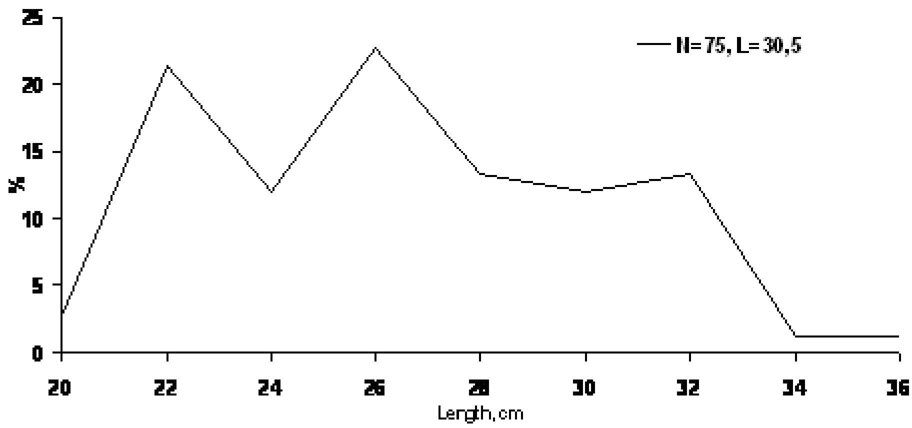


Figure 15.2. Length composition of bluemouth in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in May-August 2008.

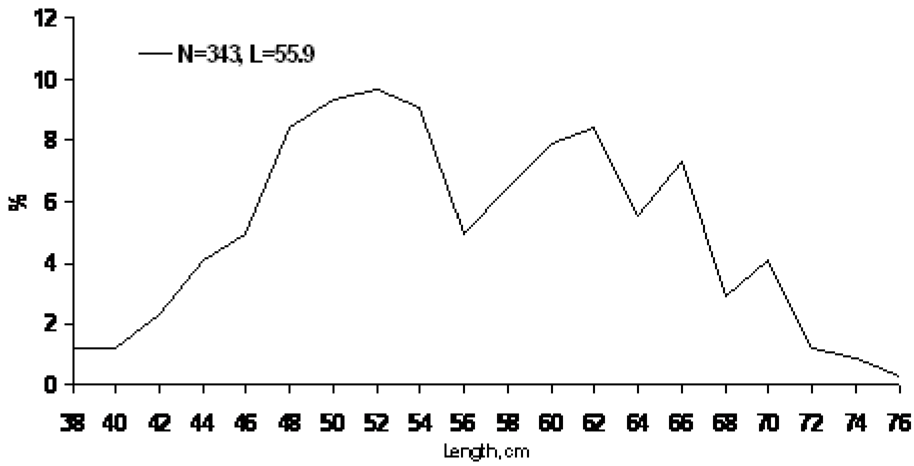


Figure 15.3. Length composition of mora in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in June–August 2008.

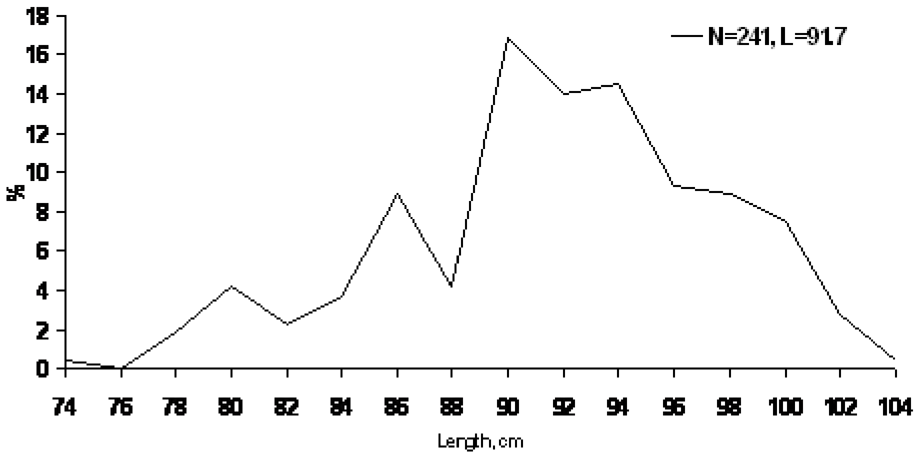


Figure 15.4. Length composition of rabbitfish in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in May–August 2008.

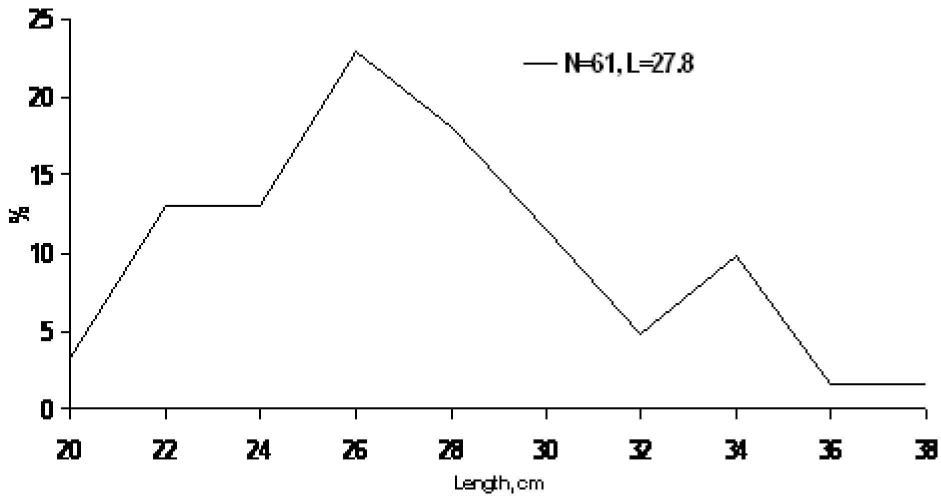


Figure 15.5. Length composition of bluemouth in longline catches on southwestern slope of Rockall Bank (Subdivision VIb1) in June 2008.

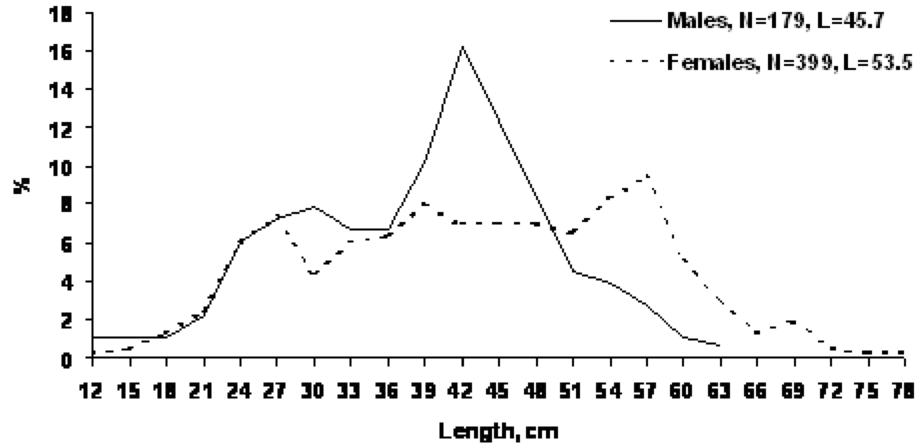


Figure 15.6. Length composition of roughhead grenadier in longline catches in Norwegian Sea (Subarea II) in February–May 2008.

Figure 15.7. Length composition of roughhead grenadier in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in August 2008.

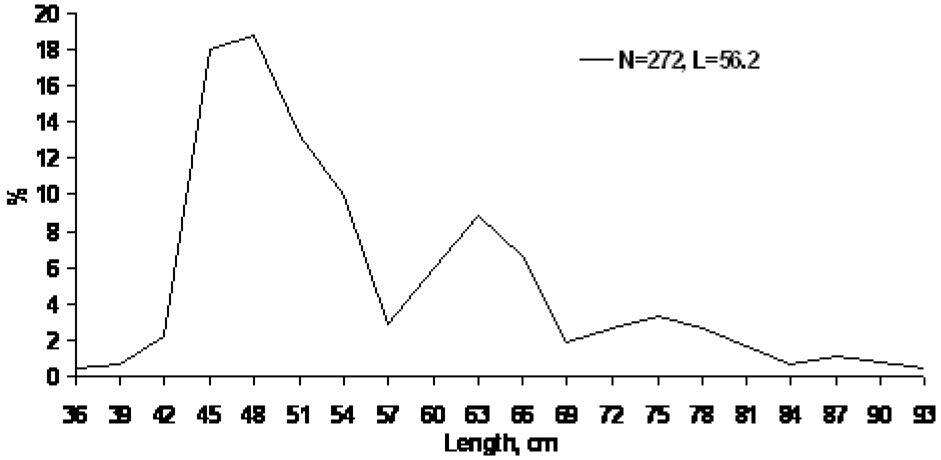


Figure 15.8. Length composition of roughhead grenadier in trawl catches in near the East Greenland (Subdivision XIVb2) in September–December 2008.

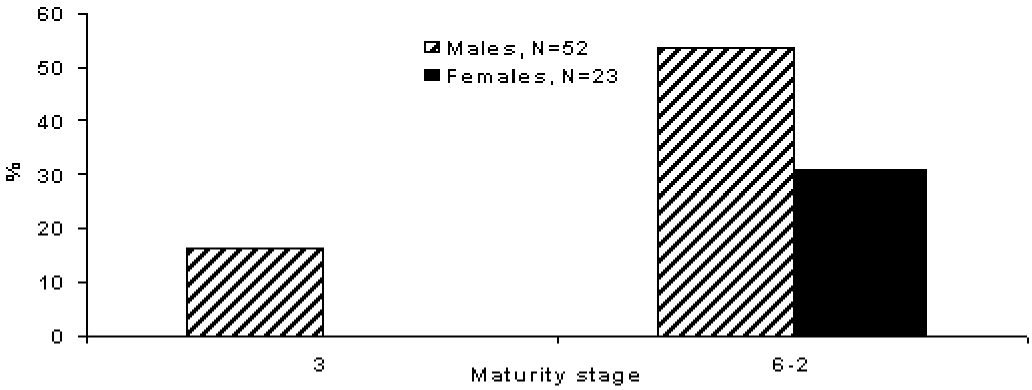


Figure 15.9. Maturity of bluemouth in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in May–August 2008.

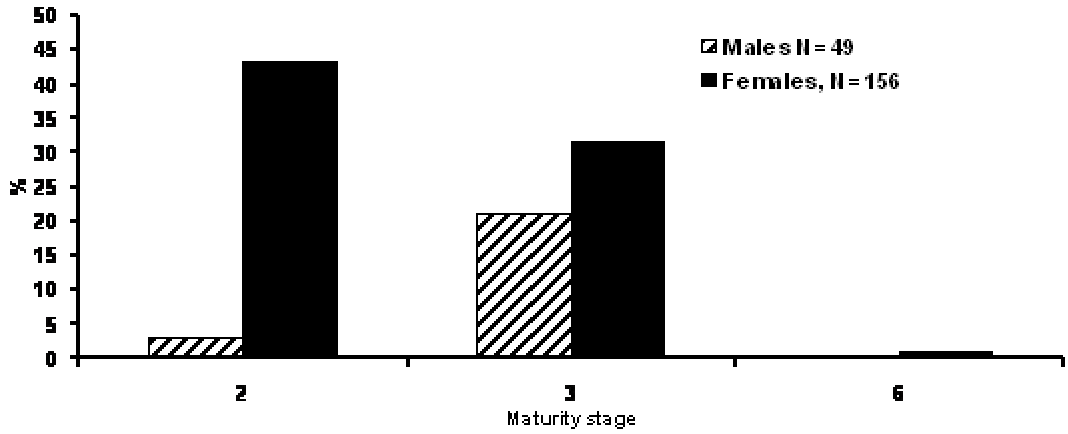


Figure 15.10. Maturity of rabbitfish in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in May–August 2008.

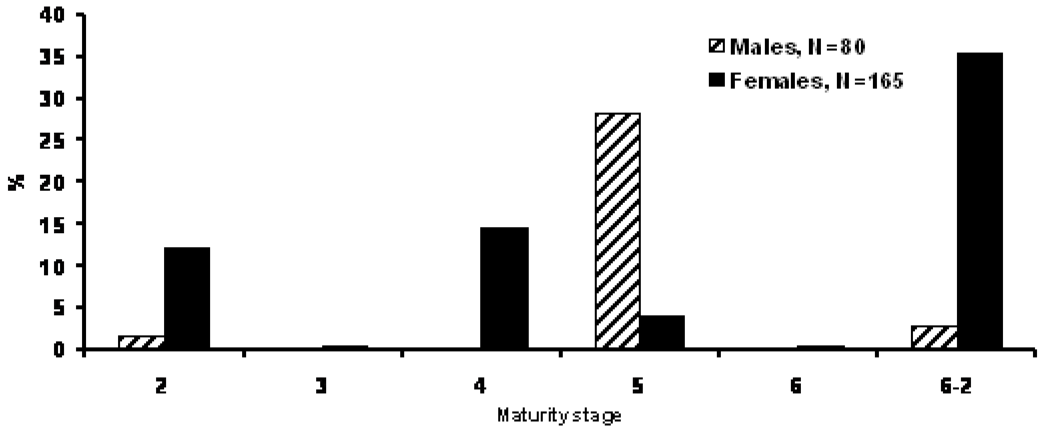


Figure 15.11. Maturity of mora in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in June–August 2008.

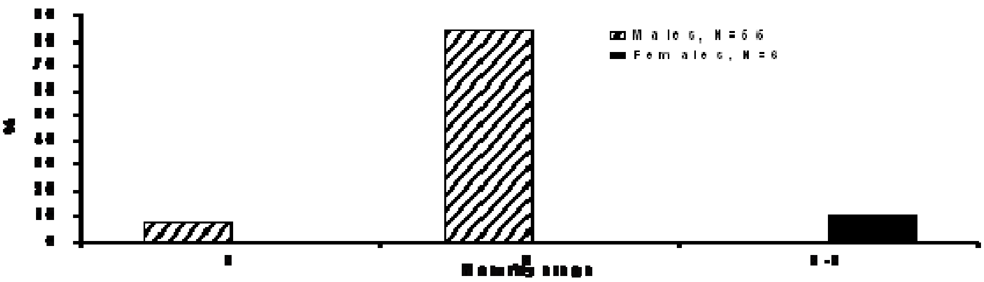


Figure 15.12. Maturity of bluemouth in longline catches on southwestern slope of Rockall Bank (Subdivision VIb1) in June 2008.

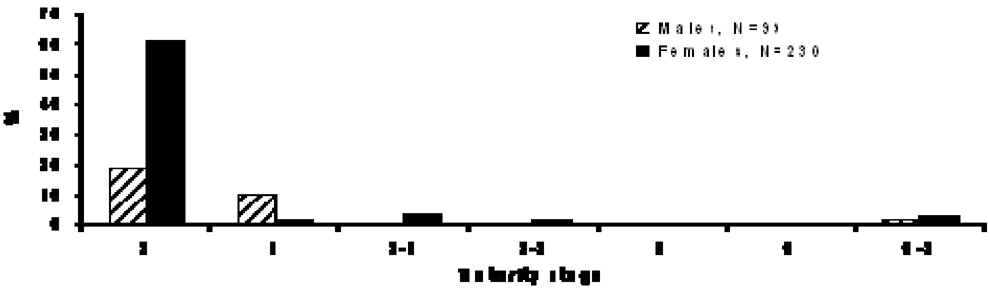


Figure 15.13. Maturity of roughhead grenadier in longline catches in Norwegian Sea (Subarea II) in February–May 2008.

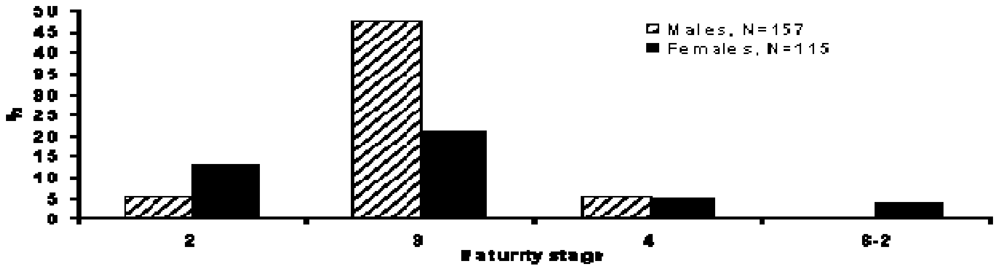


Figure 15.14. Maturity of roughhead grenadier in trawl catches near the East Greenland (Subdivision XIVb2) in September–December 2008.

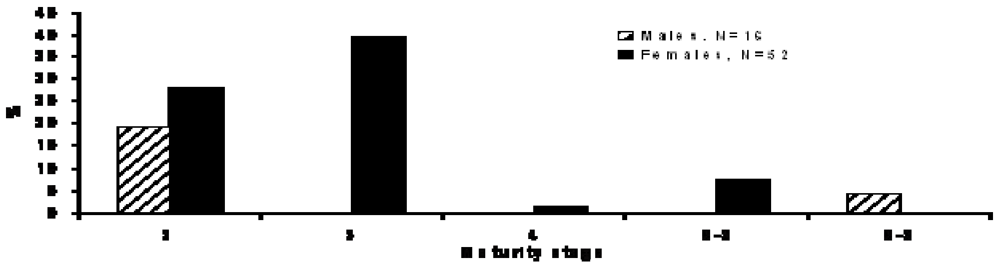


Figure 15.15. Maturity of roughhead grenadier in longline in the southern part of Faroes Fishing Zone (Division Vb) in August 2008.

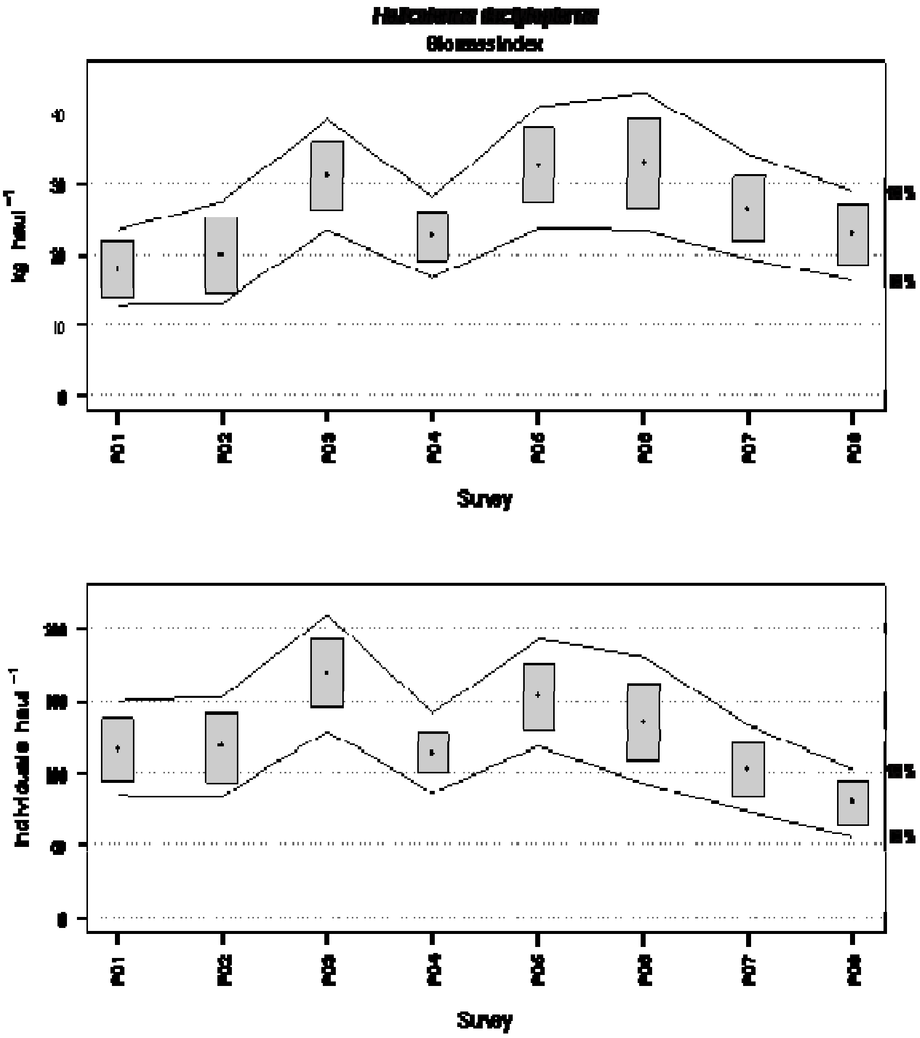


Figure 15.6. Changes in *Helicolenus dactylopterus* biomass and abundance indices during Porcupine Survey time-series (2001–2008). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000).

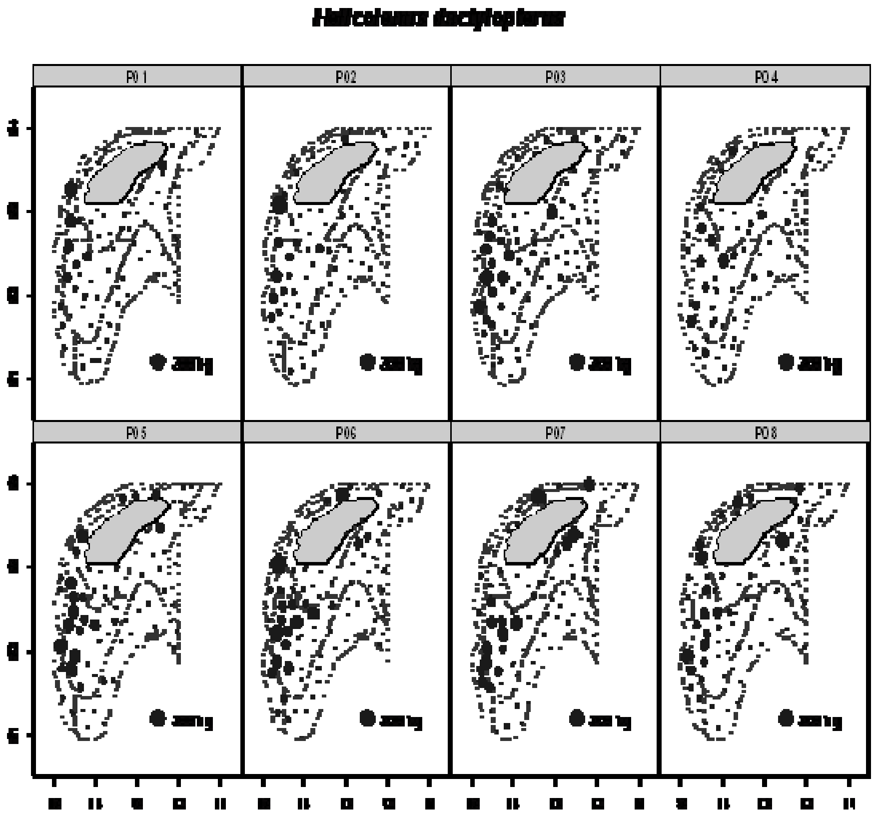


Figure 15.17. Geographic distribution of *Helicolenus dactylopterus* catches (kg/30 min haul) in Porcupine surveys (2001–2008).

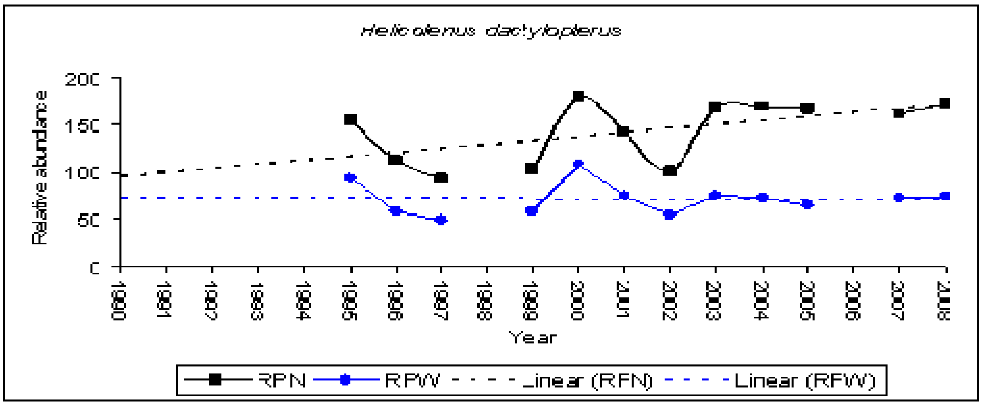


Figure 15.18. Relative indices of abundance (RPN) and weight (RPW) of bluemouth fish from Portuguese survey at the Azores.

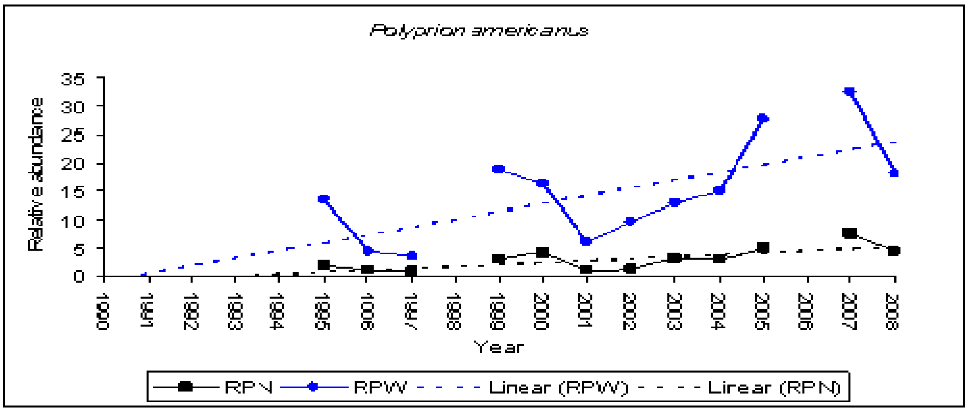


Figure 15.19. Relative indices of abundance (RPN) and weight (RPW) of wreckfish from Portuguese survey at the Azores.

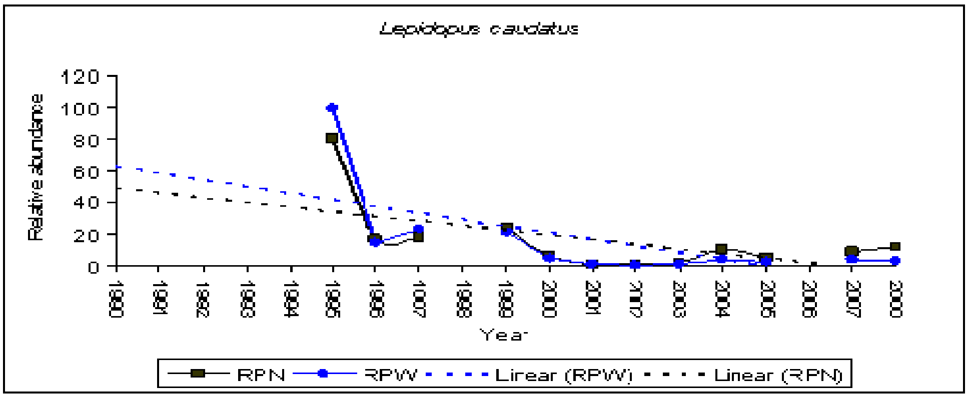


Figure 15.20. Relative indices of abundance (RPN) and weight (RPW) of silver scabbard fish from Portuguese survey at the Azores.

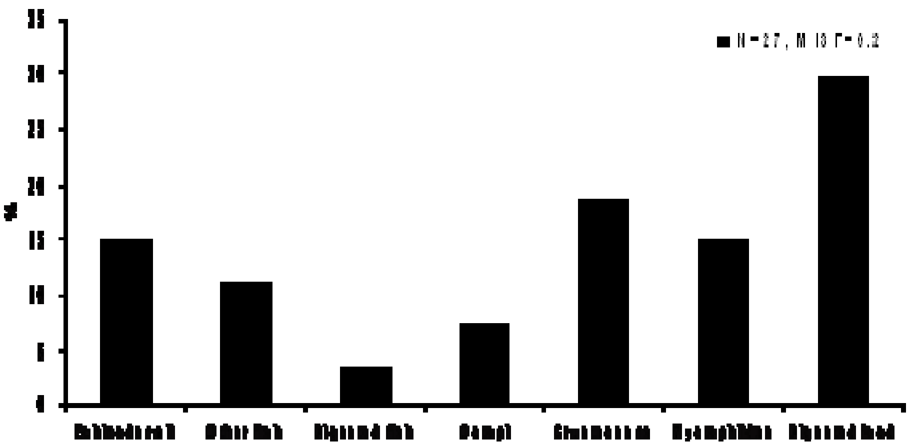


Figure 15.21. Diet composition of rabbitfish in longline catches in the southern part of Faroes Fishing Zone (Division Vb) in May–August 2008.

16 TOR c) review and consider recent research into unaccounted mortality in commercial fisheries (in conjunction with WGDEC)

16.1 Introduction

The Study Group on Unaccounted Mortality in Fisheries (ICES, 1995) defined Fishing Mortality (F) as "The sum of all fishing induced mortalities occurring directly as a result of catch or indirectly as a result of contact with or avoidance of the fishing gear". They further recognized the following definable subcomponents of F:

- Landed Catch (Fc): Catch mortality should include all reported or estimated commercial fishing landings, plus landings from recreational fisheries and subsistence fisheries.
- Illegal, misreported and unreported landings (Fb): is the mortality of fish that should be accounted for in Fc but is not because the records of landings are: not reported: underestimated; or misreported with respect to area and/or species.
- Discard mortality (Fd): is the mortality of fish actively released by fishers after capture.
- Escape mortality (Fe): is defined as the mortality of fish that actively escape from a fishing gear, prior to the catch being landed on deck.
- Drop out mortality (Fo): is the mortality as a consequence of captured fish dying and dropping out of the gear, prior to the catch being landed on deck. Examples include fish washed out of a codend during trawling or haulback, or fish lost from hooks and gillnets.
- Ghost fishing mortality (Fg): is the death of fish being caught in ghost fishing gear. Where ghost fishing gear is lost or discarded gear that continues to fish for an indefinite period after its initial loss or discarding.
- Avoidance Mortality (Fa): is the mortality directly or indirectly associated with the stress, fatigue and injuries of fish actively avoiding fishing gear.
- Habitat degradation mortality (Fh): is any mortality associated with the degradation of an aquatic environment as a direct result of fishing activity.

Of these, SGUFM (ICES 2005) identified four that were of particular relevance to the management of the stocks for which ICES provides advice:

- Illegal, Unreported and Unregulated Fishing
- Discards
- Escape mortality
- Ghost Fishing

16.2 Illegal, Unreported and Unregulated (IUU) fishing

The FAO International Plan of Action on IUU fishing (IPOA-IUU) defines the various IUU activities with respect to their legal status, which are summarized here:

- Illegal fishing is conducted by national or foreign vessels in waters under the jurisdiction of a State (or of a Regional Fisheries Management Organisation [RFMO] to which that state is party), without the permission of that State (or RFMO), or in contravention of its laws and regulations.

- Unreported fishing are fishing activities which have not been reported, or have been misreported, to the relevant national authority (or RFMO), in contravention of relevant laws and regulations.
- Unregulated fishing is conducted on stocks for which no state (or RFMO) has taken responsibility for their management and conservation; or by vessels without nationality (or flying the flag of a State not party to any relevant RFMO) and who therefore do not consider themselves bound by the relevant national laws (or RFMO regulations).

There is anecdotal evidence that IUU fishing is an important source of unaccounted fisheries mortality in some deep-water fisheries.

A number of approaches to quantifying IUU fishing have been developed;

- Comparison of trade based estimates and reported catch. This method has been used to quantify unreported catches of orange roughy in Australia (Lack *et al*., 2003).
- Estimating the number of unregulated fishing vessels and extrapolating estimates of catch rates, using data from licensed fisheries.
- use of modelling outputs to estimate the overall unaccounted mortality in a stock. (However, these do not necessarily equate only to unreported catches; they could equally result from inaccurate estimates of natural mortality, etc.)
- quasi-quantitative Monte-Carlo integration in which all available data on underreporting (and other sources of unaccounted fisheries mortality) in different regulatory regimes is combined in a single analysis.
- models of IUU behaviour and surveillance encounter probabilities.

These approaches were summarized and reviewed by MRAG 2005 and ICES Study Group on Unaccounted Fishing Mortality (ICES 2005).

A number of further sources of information on IUU fishing were identified by WGDEEP which may potentially be used to quantify IUU catches in deep-water fisheries.

16.2.1 Time series information on the numbers of identified IUU vessels

RFMOs maintain lists of fishing vessels known or suspected to have been involved in IUU operations worldwide. Changes in numbers of identified vessels could give an indication of changes in levels of IUU fishing.

16.2.2 Tally book schemes

Some countries have negotiated access by scientists to data contained in fishers' private catch records. Data obtained this way has previously been used by ICES to quantify unreported and misreported catches of the northern stock of anglerfish. A tally book scheme for deep-water fisheries is currently run in cooperation between IFREMER and the French fishing industry. The purpose of this scheme was not to quantify unreported catches; it is purely a scientific programme which relies on voluntary reporting of catches. Tally book schemes rely heavily on trust between fishers and scientists and it is essential to this trust that data are used only for the purpose for which they are provided.

16.2.3 Satellite imagery vessel detection system (VDS)

Between 2002 and 2005 an EU FP5 project, Improving fisheries monitoring through integrating passive and active satellite-based technologies (IMPAST), developed methodology and tools to allow near real time access to space borne synthetic aperture radar (SAR) imagery and the integration and comparison of this information with VMS position reports.

Two studies were conducted by the EC Joint Research Centre using a VDS to detect fishing vessels in the NEAFC regulated redfish fishery, southwest of Iceland. Eight images were acquired throughout June 2002 and June 2003. All available VMS positions for the areas being imaged on the image dates were requested from NEAFC in order to compare the number of reporting vessels with the number of vessels identifiable on the images, potentially giving an indication of the number of non-reporting vessels. It was demonstrated that approx. 27% more vessels were found in the area than were reporting to NEAFC.

The discrepancy revealed between these two sources of information indicates that the unreported effort might be of significant amount and the exercise indicates that during the observation days in June 2002 and 2003 the effort could be more than 25% higher than reported to NEAFC.

16.2.4 Anecdotal reports

Anecdotal information on IUU fishing has occasionally been reported to WGDEEP. This has been mentioned in Working Group reports and advice sheets but has not been included in Working Group estimates of landings.

Following discussions with the European Commission (EC), the Annual Meeting of Assessment Working Group Chairs (AMAWGC; ICES 2005a) advised that it is no longer acceptable to make estimates of mis- and non-reporting and make corrections to catch data without revealing the sources of both the data and the problems. This may create problems for working groups wishing to use such data which could be highly sensitive to the countries or individual fishers providing the data.

16.2.5 Discarding

A considerable number studies to quantify discards in deep-water fisheries have been undertaken during recent years in particular since 2003 when observer programmes were implemented by several EU Member States to satisfy the requirement of EU deep-water fishing regulations. Some data from this programme were made available to WGDEEP; however the underlying sampling plans are not available to ICES.

Available data on discards in from scientific projects in deep-water fisheries during the period of 1993–2001 were presented in the 2002 WGDEEP report (ICES CM 2002/ACFM:16).

A summary of discard data presented to WGDEEP in the period 2000–2009 is presented in Table 16.2.1.

Table 16.2.1 Summary of the data on discards in deep-sea fisheries presented to WGDEEP in 2000–2009.

Period	Country	Survey/Fishery/Gear	Area	Summary source
1993–1997	Norway	Ling and tusk longline fishery	IVa, VIa, Norwegian Deep	ICES CM 2000/ACFM:8
1998	Norway	Experimental trawl fishery	Hatton Bank	ICES CM 2000/ACFM:8
1999	Norway	Exploratory longline fishery	Hatton Bank	ICES CM 2000/ACFM:8
1997	Ireland	Commercial deep-water rock-hopper trawl	Rockall Trough	ICES CM 2000/ACFM:8
1998–1999	Ireland	Trawl multispecies fishery	Faroe-Shetland Channel	ICES CM 2000/ACFM:8
1997, 1999	Ireland	Longline survey	Porcupine Bank	ICES CM 2000/ACFM:8
2000	Spain	Commercial bottom-trawl fishery	Hatton Bank, Reykjanes Ridge	ICES CM 2001/ACFM:23
2000	Russia	Bottom trawl and longline fisheries	I, II	ICES CM 2001/ACFM:23
2000	Ireland	Longline survey	Hatton, Rockall, Porcupine Banks	ICES CM 2001/ACFM:23
2001	France	Deepwater bottom-trawl fishery	VI, VII	ICES CM 2002/ACFM:16
2001	Spain	Bottom trawl commercial fishery	Hatton Bank	ICES CM 2002/ACFM:16
1999, 2000	Spain	Bottom otter trawl, pair trawl and high vertical trawl fisheries	VI, VII, VIII, IXa	ICES CM 2002/ACFM:16
1996–2001	UK-Scotland	French and Scottish deep-water trawl fisheries	West off British Isles	ICES CM 2002/ACFM:16
2001–2003	France	Deepwater bottom-trawl fishery	VI, VII	ICES CM 2004/ACFM:15
2002–2003	Spain	Commercial bottom-trawl fishery	Hatton Bank	ICES CM 2004/ACFM:15
2002–2004	Spain	Commercial bottom-trawl fishery	Hatton Bank	ICES CM 2005/ACFM:07
2004	Ireland	Bottom trawl fisheries for orange roughy and black scabbardfish	VIIck	ICES CM 2005/ACFM:07
2005	Portugal	Black scabbardfish longline fishery	IXa	ICES CM 2006/ACFM:28
2004–2005	France	Deepwater bottom-trawl fishery	VI, VII	ICES CM 2006/ACFM:28
2002–2006	Spain	Commercial bottom-trawl fishery	Hatton Bank	ICES CM 2006/ACFM:28
2005–2007	Portugal	Black scabbardfish longline fishery	IXa	ICES CM 2008/ACOM:14
2005–2008	Portugal	Black scabbardfish longline fishery	IXa	ICES CM 2009/ACOM:?
1990–2007	France	Roundnose grenadier discards in French trawl fisheries	Vb, VI, VII	ICES CM 2009/ACOM:?

16.2.6 Current discard sampling programmes

Portugal

The on-board discard sampling for Portuguese set longlines commercial fleet for deep-water species, targeting black scabbardfish, started in mid 2005 and is integrating the Portuguese Discard Sampling programme, included in the EU DCR/NP. The methodology was described in previous WGDEEP report (ICES CM 2008/ACOM:14).

The data available allow analysing and comparing two sets of data: one from 2005–2007, with 12 trips sampled and another one from 2008, with 4 trips sampled. Percentages of total discarded and landed species in weight and number in relation to total catches were calculated for each trip.

Portuguese black scabbardfish longline fishery continues to demonstrate very low percentages of discards, usually less than 10% by number and 5% by weight.

France

The French observer programme is carried out on the fleet of deep-water fishing vessel holding a license for deep-water fishing according to council regulation (EC) No 2347/2002. In the current programme for 2008–2009, more than 300 days at sea are due to be observed on this fleet. An additional number of fishing days is due to be observed as a complementary sampling plan. The programme mainly covers the French mixed trawl fishery to the West of the British Isles. However a small number of observation days is also allocated to the smaller fleet of gillnetters fishing for deep-water species.

The French fleet holding a deep-water fishing license includes altogether about 50 vessels. However, a number of these hold the license only because they land a by-catch of greater forkbeard in excess of 10 tonnes per year caught on the Celtic sea and Bay of Biscay shelves. These vessels are not covered by the deep-water fisheries observations programme.

Spain

The Basque Country's trawler fleet operates in ICES Subdivisions VI, VII, and VIIIabd. In most trips, deep-water species are considered as bycatch and discarded as a consequence of the small size of individuals caught and especially because of the their lower commercial value at local fish markets in Basque Country as compared with the target species. The data on discards during these fisheries were obtained in the period 2003–2008. The estimations of discards in each ICES subdivision were made by observers aboard based on subsamples of total discard amounts for each haul. The weight of discarded species in the subsample was then extrapolated to the whole discards taken during particular trip and subsequently to the total catch caught by entire fleet in each year.

Considerable interannual variations of discard values were observed. Despite significant decreasing of total landings of deep-water species from 2003 to 2008, maximum discards/landings ratio (71.4%) was registered in 2008, whereas minimum one (7.9%) in 2004. At species level, maximum discards were characteristic of greater silver smelt in Subdivisions VI and VIII over the entire period of observations.

UK England and Wales

Data from the UK England and Wales observer programme commencing 2004 is currently being analysed and a working document will be presented in 2010.

16.3 Escape mortality

Escape mortality can occur as a direct result of stress and injuries or indirectly as a consequence of disease and predation associated with gear damage (Chopin and Arimoto, 1995). Most studies have been carried out on shelf species in trawls and it is estimated that for some of the common gadoid species the mortality experienced by fish escaping trawl codends as a direct result of stress is between 10% and 30% (Ryer, 2004). Many deep-water species are susceptible to damage by trawls because their skin is not covered in mucus. Thus, it is highly probable that a large proportion of fish entering trawls and subsequently escaping through meshes will die (Connolly and Kelly, 1996, Koslow *et al.*, 2000). However there are very little experimental and observational data on the escape behaviour of deep-water fish that confirm these assumptions. Summarising the findings of unpublished reports, Gordon, 2003 estimated that escapees from commercial trawls in the deep-water fishery in the Rockall Trough could be as high as 66–86% in terms of numbers and 10–45% in terms of weight depending on fishing depth. In summary the source of unaccounted mortality of deep-water fish escaping from trawl gear can be potentially high, however the number of studies that focus on particularly on deep-water fish are not sufficient to make assumptions.

16.4 Ghost fishing

Studies on ghost fishing in deep water in the NE Atlantic have focused on deep-water gillnet fisheries. If gillnets are lost, discarded, or abandoned, they can have a harmful effect on the marine environment by continuing to "ghost fish", defined as causing mortality of fish and other taxa after all control of the fishing gear is lost by a fisher (Matsuoka *et al.*, 2005; Brown and Macfadyen, 2007). Research into ghost fishing in European waters was carried out between 1995 and 2002 through two projects funded by the European Commission (EC): "FANTARED" (EC Project No.94/095) and "FANTARED 2" (EC Contract FAIR-PL98-4338). The outcome was that ghost fishing in depths >200 m was not a significant problem because lost, discarded, and abandoned nets have a limited fishing life owing to their high rate of biofouling and, in some areas, their tangling by tidal scouring (Carr *et al.*,1992; Erzini *et al.*, 1997; Pawson, 2003; Revill and Dunlin, 2003). No notable long-term research has been conducted on the effect of ghost fishing in deeper water (Davies *et al.*, 2007), but catches from nets lost there are expected to stabilize to around 20% of the catch from actively fished nets after 45 days (Humborstad *et al.*, 2003). Such nets may continue to "fish" for periods of at least 2–3 years, and perhaps even longer (D. M. Furevik and J. E. Fosseidengen, unpublished data), largely as a result of lesser rates of biofouling and tidal scouring in deep water.

A more recent study entitled "DEEPNET" (Hareide *et al.*, 2005) reported evidence of ghost fishing by lost and abandoned gillnets from the anglerfish fishery on the continental slope west and northwest of the British Isles. The reported high incidence of lost, discarded, and abandoned nets was attributed to unsustainable practices, including excessive length of nets deployed, long soak times, and abandonment and dumping of old nets.

Following on from the results presented in the DEEPNET report, BIM in Ireland carried out two gillnet retrieval surveys (Rihan and Mulligan, 2005; 2006), and Cefas in the completed two retrieval surveys under its Fisheries Science Partnership (FSP; Armstrong *et al.*, 2008) of England and Wales (Large *et al.*, 2005, 2006). The results from these surveys should be interpreted with caution, because of the EC gillnetting regulations restricting the length on nets used and soak-times introduced in 2005. Notwithstanding, the results from the four surveys, suggest that the scale of lost and abandoned gillnets and the related incidence of ghost fishing, particularly of fish species, may have been low in the directed deep-water shark fishery (which is now closed because of a EC ban on directed fisheries for deep-water sharks), but higher in the deep-water anglerfish fishery around Ireland and the British Isles. However, no firm conclusions can be drawn until the efficiency of the gillnet retrieval gear used is evaluated and more extensive surveys and mitigation exercises are carried out (Large *et al.*, 2009).

The EC has funded a 2-year project (2007–2009) entitled "Recuperation of fishing nets lost or abandoned at sea" (EC Contract SI2.466030), or "DEEPCLEAN". The two principal objectives are to conduct (i) a targeted retrieval exercise of lost, discarded, and abandoned nets in deep-water gillnet fisheries in the NE Atlantic at depths >200 m, and (ii) structured surveys to estimate the quantity and range of lost and abandoned nets found and any ghost catches present in the nets at the time they were retrieved. A report of this work will be published later in 2009.

16.5 Problems incorporating unaccounted fishing mortality into stock assessments

The incorporation of discards into stock assessment is a complex issue in many fisheries as discards contribute to fishing mortalities and should be integrated for management purpose.

For some deep-water stocks such as roundnose grenadier, data (length distribution, weight) are scarce. These data are generally provided as short and discontinuous time-series.

Recent on-board observer programmes (in particular those set in application of Council Regulation (EC) No 2347/2002 of 16 December 2002) provide information on catches (landings and discards). However, the discard rates at the beginning of the fisheries (the late 1980s for roundnose grenadier) are generally poorly known, undermining estimates of unexploited biomass (used to calculate biological reference points).

The lack of time-series of discards is a problem because the biomass of some, such as roundnose grenadier, has rapidly declined over a relatively short period. Changes in fishing practices (target species, engine power, gears, fishing grounds) have occurred in reaction to fish abundance changes and regulation. These may have affected discard rates but the effect of those changes on discards has not been quantified.

In terms of data processing, discards are combined with landings statistics to rebuild catch information. Catch data are then input into stock assessment routines rather than treating landings as substitutes of catch. However, where gaps exist in discards time-series, assumptions are required to fill missing years. For example, for a fishery with stable fishing practices and length distributions, it can be assumed that the discard rate was stable. However, if length distribution for the landings changed over time, the use of a constant discard rate is unlikely to be realistic.

Although some techniques to rebuild time-series of catch involve simple recombination and assumptions on discards and landings data such as those tested through the exploratory assessments of roundnose grenadier in Vb, VI and VII carried out by WGDEEP in 2009, others involve more complex approaches like Bayesian modelling (e.g. Punt *et al.*, 2006 on blue grenadier *Macruronus novaezelandiae* in Australia). In all cases, testing of the assumptions of those methods ideally requires discards data and knowledge of the population dynamics (e.g. life history and continued time-series of recruitment) and covering the different periods of the exploitation of the stock.

The precision of discard estimates for the deep-water stocks may be improved by increasing the sampling coverage with appropriate stratification by fleet (Allain *et al.*, 2003). Proper depth coverage is essential to observation of deep-water fisheries as species composition varies much over the fished depth range.

This implies the use of depth-stratified catch and effort data, which are not available in national fisheries statistics. A partnership between Ifremer and the French industry involved in deep-water fisheries provided new information through a haul by haul database including vessel type, tow duration, statistical rectangle, landings per species and fishing depth. Exploratory assessment runs were carried for Roundnose grenadier this year (see Section 10 of this report and Pawlowski and Lorance, WD 15, WGDEEP 2009). Discards were extrapolated back in time. Another method used catch rebuilt from the vertical distribution of fishing effort derived from the haul by haul database and length distributions of the stock by depth from scientific surveys (Mauchline and Gordon, 1984). The different assessment runs demonstrated that the lack of information on discards is a critical issue to roundnose grenadier stock assessment.

17 Term of Reference f) evaluation of the impact of deep-water fisheries in areas for which information has not been analysed to date, using VMS and historic data. (In conjunction with WGDEC)

17.1 Term of reference

f) Consider the impact of deep-water fisheries in areas for which information has not been analysed to date, for example the orange roughy fishery on the shelf slope of the Porcupine bank and the roundnose grenadier fishery to the north of Hatton bank by using VMS and historic data. (In conjunction with WGDEC);

The impact of deep-water fisheries is understood to refer to impacts on benthic habitats rather than on exploited stocks. The approach take to analysing this has been in two parts. First, by mapping spatial distribution of landings at the finest scale possible (ICES rectangle) and secondly, at a higher spatial resolution, by using VMS positions linked to logbook data.

17.2 Examination of historic catch data by statistical rectangle

Data sets used and limitations of the data

In order to investigate the change in spatial patterns of different deep-water fisheries west of the British Isles, i.e. in Vb and VI to VIII, WGDEEP provided historical landings per statistical rectangle for a number of countries (Spain, France, Ireland, and UK Scotland, England and Wales) from 2001 to 2008. This is the oldest landings data that is has been analysed by WGDEEP with this degree of spatial resolution to date but it should be possible to extend the dataseries backwards for most countries. This data provides an overview of the main fishing areas for some stocks and changes in the quantity and location of catches over time. There are some limitations to the dataset as it does not cover the whole fishery, but only the fisheries of countries that provided the landings data by rectangle. Furthermore as the data are from logbooks, their quality reflects the “quality of reporting”. Apparent catch locations of deep-water species in shallow waters are considered to be errors in the data, it can also not be ascertained that the location and/or quantities of landings recorded in deeper waters are correct. However with these limitations in mind, the concentration of the fisheries is relatively well presented in the data and this can provide initial information on spatial distribution of the fisheries. Distribution of landings from 2001 to 2008 is presented for Blue Ling, Roundnose Grenadier, Black Scabbard fish and Orange Roughy in Figure 17.1.

Spatial pattern of deep-water fishery in Vb to VIII

There is a mixed deep-water trawl fishery operating mainly in the area extending from Vb to VII which is primarily targeting Roundnose Grenadier, Blue Ling and Black Scabbard. Further south in Subarea VIII, there are lesser catches of some species along the slope of the Bay of Biscay. The overall landings for these species have drastically declined in the last 10 years. Landings have been concentrated around the Hebridean and the Faroese slopes and across the Wyville Thomson Ridge. This seems to have persisted as the main area throughout the years although overall landings have declined and the area from which the landings are taken has contracted. This is also true for concentrated landings along the Hatton Bank, which appear to have declined and reduced in area throughout the last years. Further landings have occurred along the whole shelf edge in area VI along the Scottish Shelf south of the Hebrides, in VII along the Porcupine Bank and the Celtic Shelf slope and the slope along the

Bay of Biscay (VIII). However it seems that fisheries in this area may have spatially contracted in time.

Orange Roughy is caught in two different types of fisheries and the spatial distribution of catches depends on the fishery in which it is exploited. Although it can be caught as a bycatch in the mixed deep-water fishery which is described above, a large proportion of landings derive from a directed fishery which targets Orange Roughy spawning aggregation. This fishery is closely associated with seamounts and other elevated bathymetric features and may reflect the fishing isolated subpopulations. This fishery is very much a boom and bust fishery where catch rates decline when isolated aggregations have been fished out and increase when new aggregations are targeted. The distribution of catches by statistical rectangles reflects, to some degree, this highly mobile fishery where concentrated catches were taken from particular locations around the Porcupine Bank in 2002 and 2003 with catches up to 1200 tons being recorded from single rectangles in one year. Subsequently the fishery appears to have moved location with higher concentrations of catches occurring further south. Management areas were introduced for Orange Roughy protection in 2005 along the slope of the Porcupine Bank and there are only small catches reported from the rectangles that overlap with the restricted areas once this management measure was introduced.

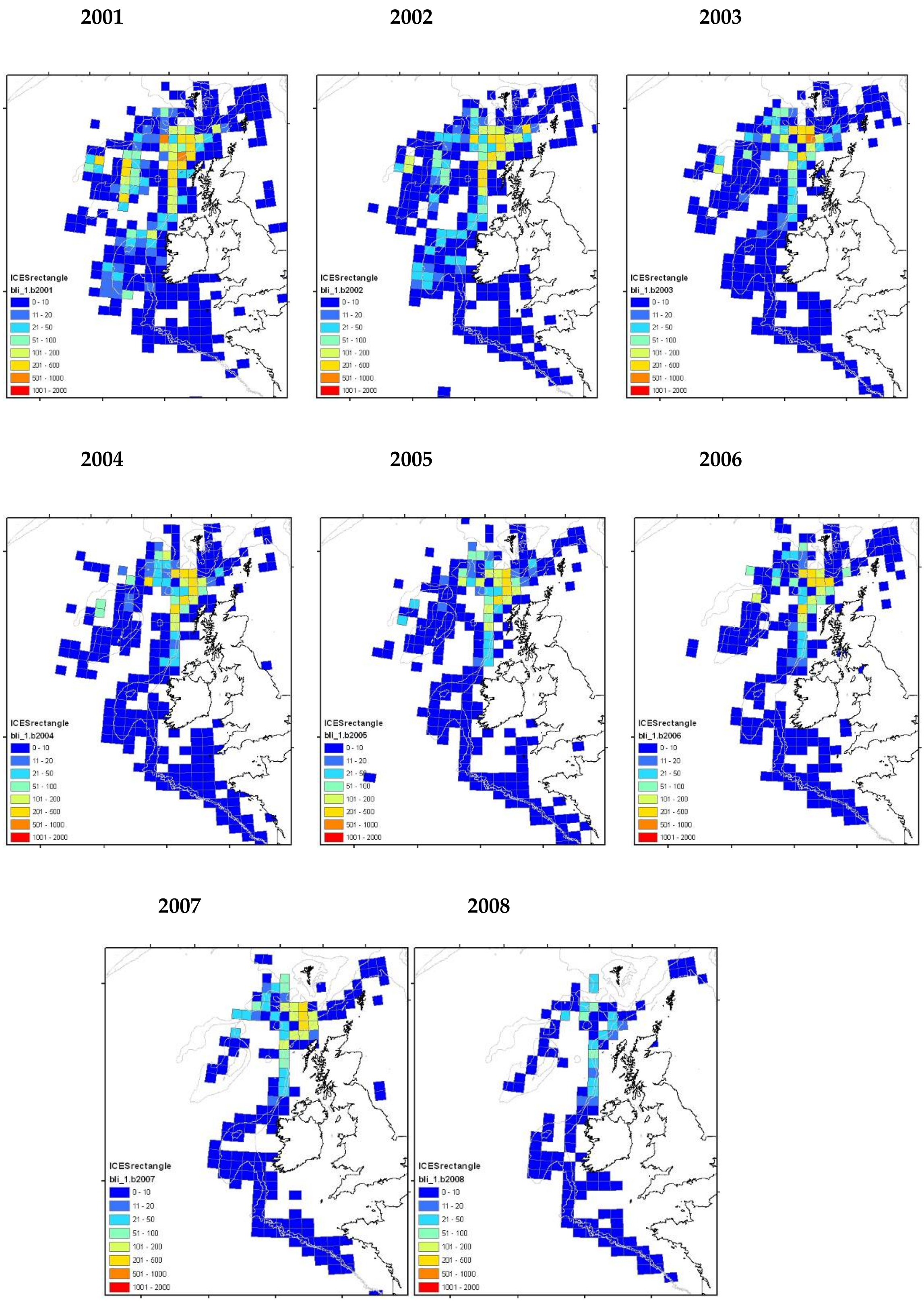


Figure 17.1 b) Landings of blue ling by statistical rectangles 2001 to 2008. Data include only those countries for which data were available at this lever (Spain, France, Ireland, and UK Scotland, England and Wales).

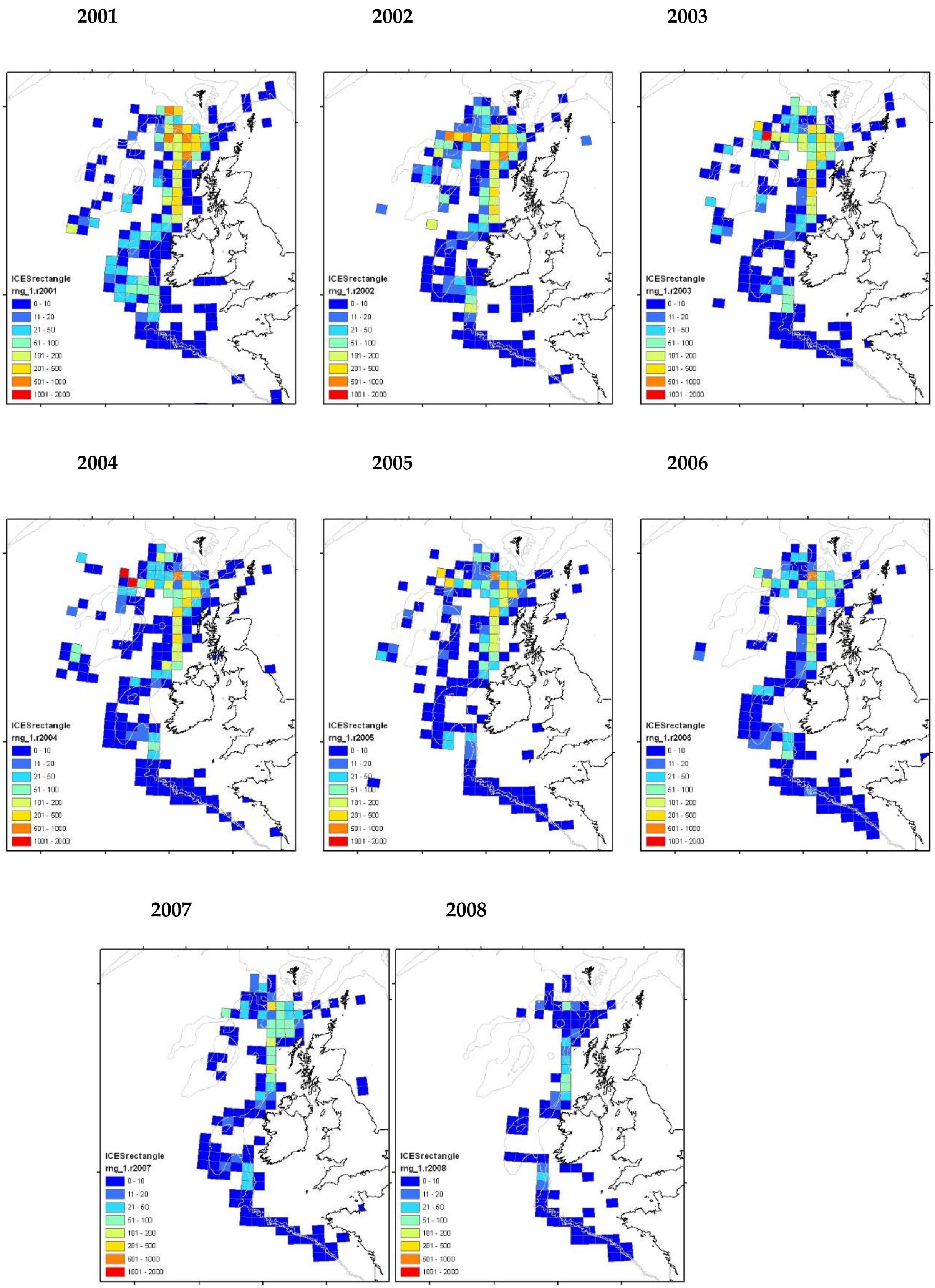


Figure 17.1 b) Landings of Roundnose Grenadier by statistical rectangles 2001 to 2008. Data include only those countries for which data were available at this lever (Spain, France, Ireland, and UK Scotland, England and Wales).

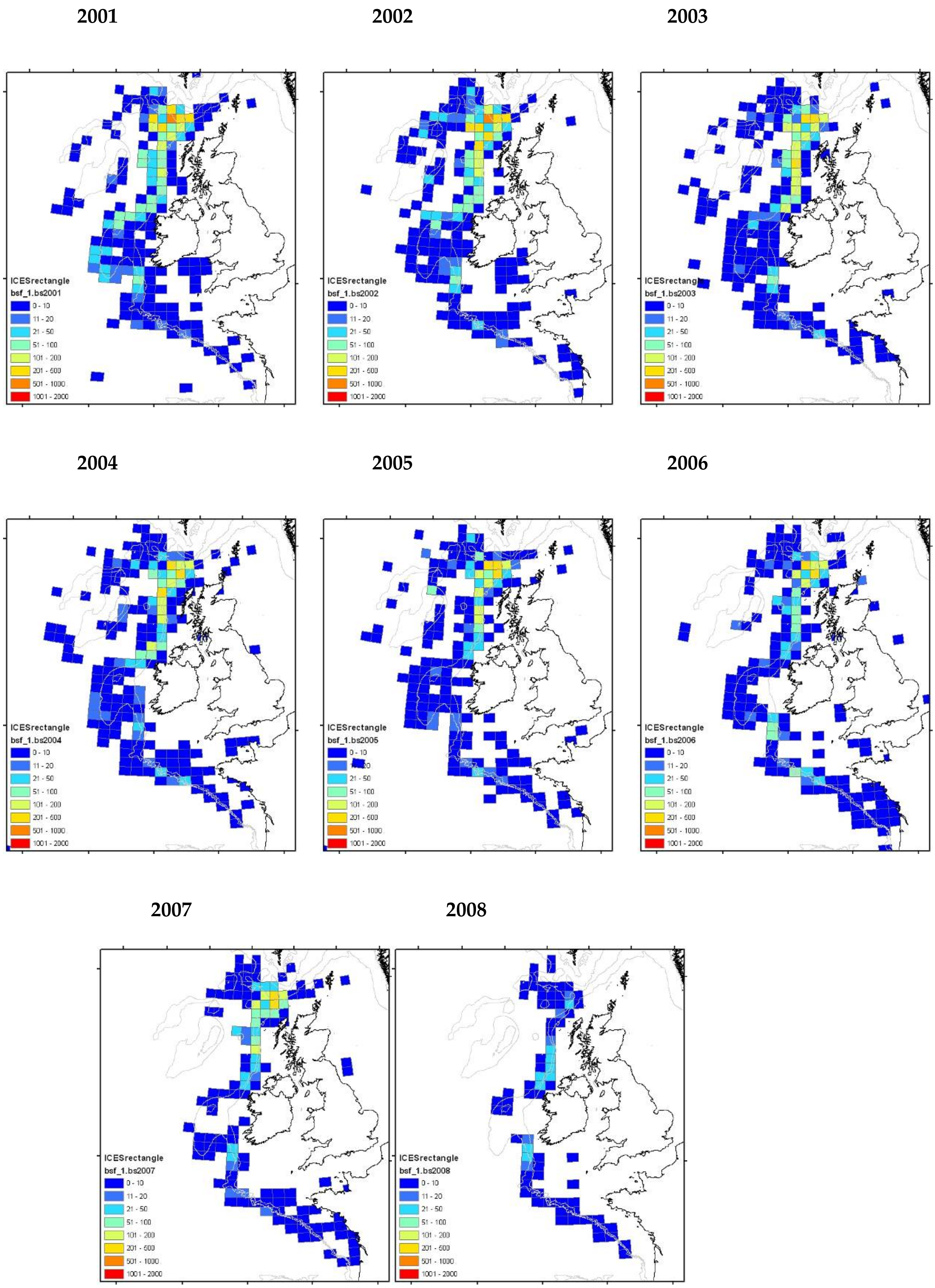


Figure 17.1 c) Landings of black scabbard fish by statistical rectangles 2001 to 2008. Data include only those countries for which data were available at this lever (Spain, France, Ireland, and UK Scotland, England and Wales).

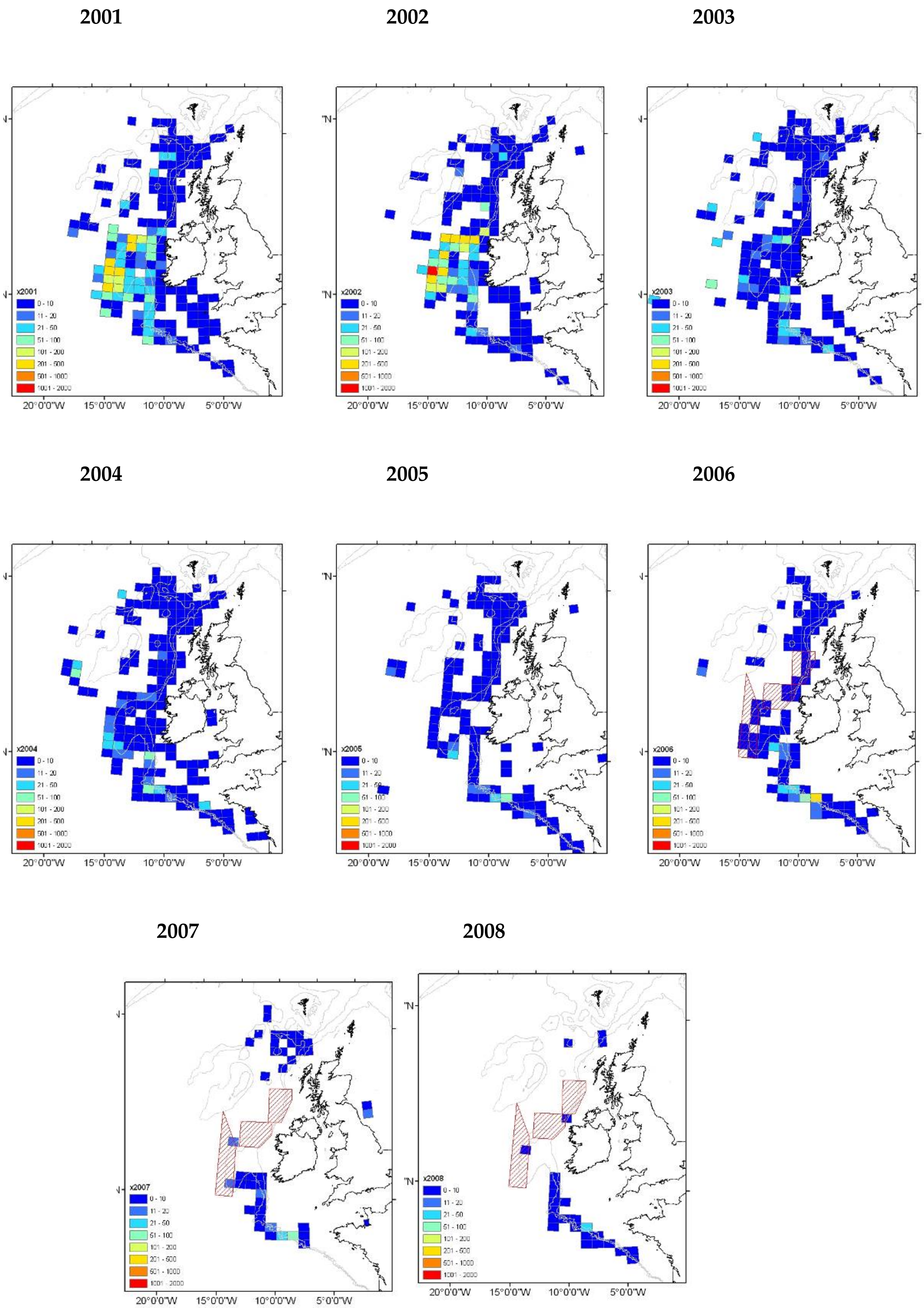


Figure 17.1 d) Landings of orange roughy by statistical rectangles 2001 to 2008. Data include only those countries for which data were available at this lever (Spain, France, Ireland, and UK Scotland, England and Wales).

17.3 VMS analysis

A fishing vessel monitoring system (VMS) is a programme of fisheries surveillance, in which equipment that is installed on fishing vessels provides information about the vessels' position and activity. Most shipboard VMS equipment types use satellite communications systems that have an integrated Global Positioning System (GPS). VMS data in the NEAFC area are transmitted at an interval of every two hours. VMS data can be mapped to generate detailed spatial and temporal views of fisheries activity. VMS data retains information about the nationality of the vessel, but does provide the identity of the vessel. Fishing activity is usually inferred by filtering of vessel speed to determine whether fishing activity is taking place as opposed to travelling, dodging in poor weather or other activities. Different fishing activities generate different speed profiles, for example bottom trawlers are predicted to demonstrate a peak in speed at around 3.5 knots. However this approach has limitations and it is not possible to infer which species were being targeted. Species specific information is necessary to address this ToR.

17.3.1 NEAFC VMS data

WGDEC has in the past used NEAFC VMS data to assess potential impacts of fishing on sensitive marine habitats, but this has never been linked to catch statistics from catch reports. Within the NEAFC VMS dataset there is a much smaller fraction for which catch report data on catch composition is available and for which captured species can be assigned to a fishing trip. Until now the information from the logbooks has not been explicitly linked to the VMS data. This does have some problems because although most logbooks reported only catching a single species in a single trip, approximately 25% reported more than 1 species captured (Figure 17.2). If different species are captured in different locations, there is a risk of erroneous allocation of a species to a location. Therefore care needs to be taken to cross check the data with historic knowledge and knowledge regarding the species distribution and depth preferences. Nevertheless better quality information should allow a much greater level of confidence to be attached to the inference of potential fishing impacts. From the NEAFC data a subset was extracted reflecting all demersal bottom trawling (determined by speed filtering) that had matching logbooks (approximately 650 000 VMS positions). From this, individual species further extractions were made for any quantity of benthic and or bentho-pelagic fish species within 1 week of the report being made.

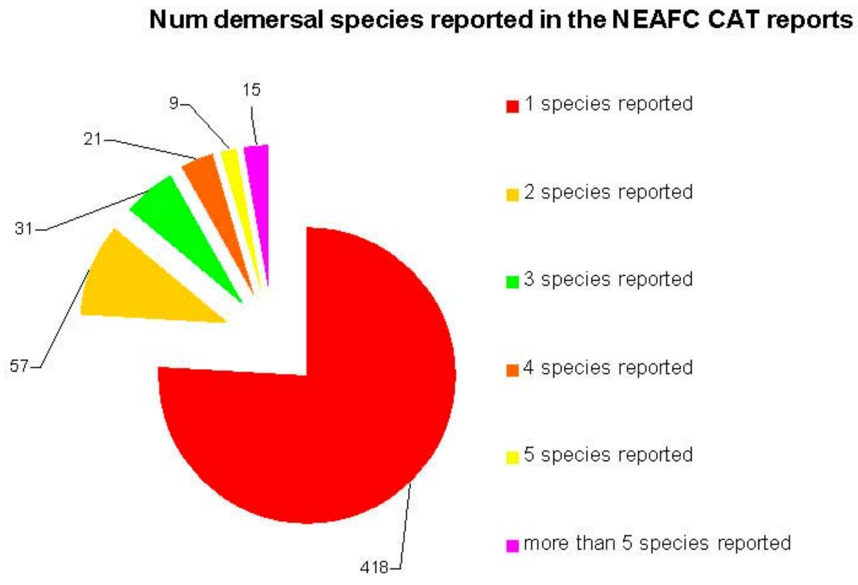


Figure 17.2. Number of demersal species captured per trip in NEAFC catch reports with corresponding VMS data..

At species level, this represents a fraction of the original data and inevitably underestimates the amount of bottom-trawling activity. However, these data are about as robust an indication of bottom trawling that the NEAFC data can offer in its present state. Despite the relatively low sample numbers, the data do point toward areas where trawling activity has occurred such as the Mid-Atlantic Ridge and the Rockall-Hatton area. Individual species can then be looked at on a trip-by-trip basis. We have extracted the data for several key commercial deep-water species including blue ling, black scabbard fish, tusk, roundnose grenadier and orange roughy. It must be emphasized that this represents only a very small fraction of the total fishing effort in the area and at this stage the data contains no information on catch quantity. In some cases the number of species being reported will confound the allocation of species to areas. It should also be noted that the spatial resolution that can be achieved using data transmitted at a frequency of two hours may be inadequate to detect all trawling activities.

Blue Ling in NEAFC waters

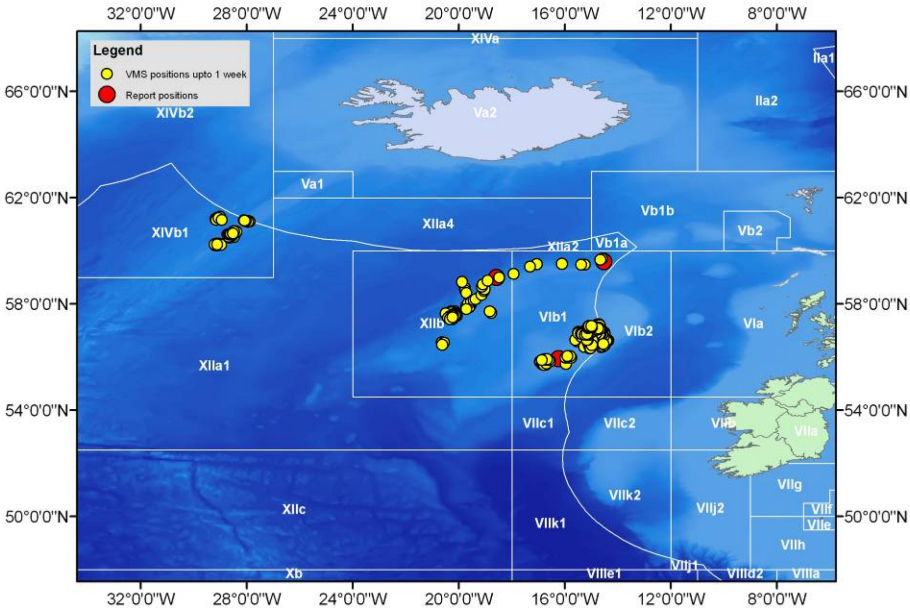


Figure 17.3. Catch reporting positions of Blue Ling in the NEAFC area and associated VMS positions in the preceding week.

In all, 828 VMS positions could be linked to 36 catch reports of blue ling catch (Figure 17.3). Three clear areas stand out; the Reykjanes ridge, the western slope of Hatton bank and the western slope of Rockall bank. The area west of Rockall was not expected and it maybe that this reflects more the inadequacies of the data than a true representation of blue ling catches.

Black scabbard fish in NEAFC waters

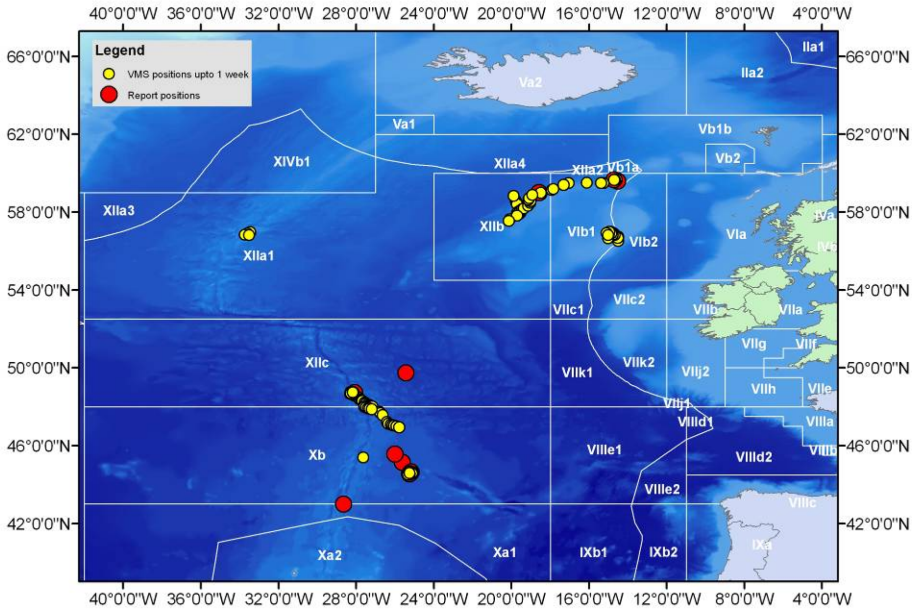


Figure 17.4. Catch reporting positions of black scabbard fish in the NEAFC area and associated VMS positions in the preceding week.

In all, 165 VMS positions could be linked to 12 reports of black scabbard fish catch (Figure 17.4). Three areas stand out, Hatton bank, Rockall bank and the Mid-Atlantic Ridge. Although Rockall and Hatton are well known areas for black scabbard fish, the occurrence of VMS record associated with catches of black scabbard fish on the MAR is interesting because there is debate about the presence of this species here.

Tusk in NEAFC waters

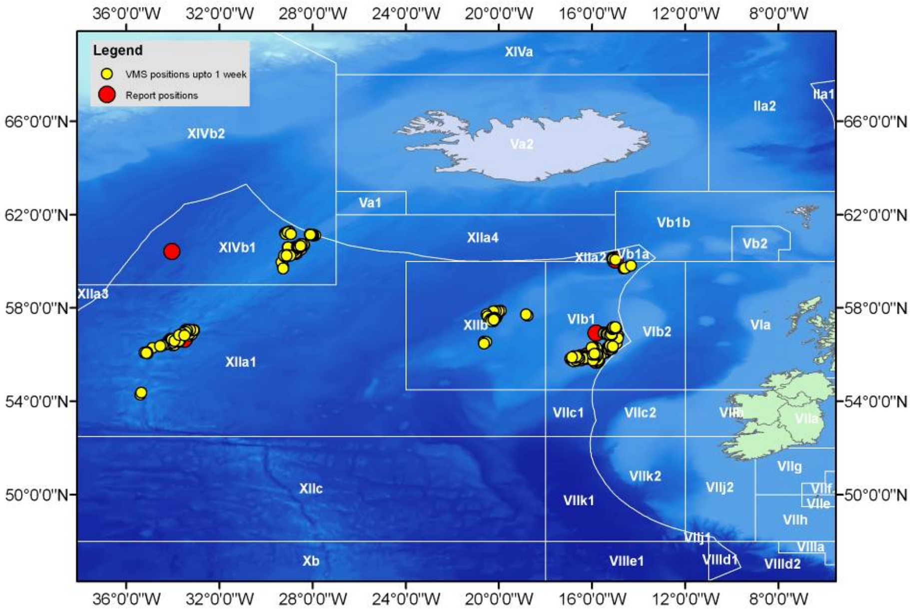


Figure 17.5. Catch reporting positions of tusk in the NEAFC area and associated VMS positions in the preceding week.

In all, 513 VMS positions could be linked to 38 reports of tusk catch (Figure 17.5). Concentrations of VMS positions associated with catches of this species occur on the Reykjanes ridge, northern MAR, Hatton Bank and Rockall. This corresponds to what was previously known about this fishery.

Roundnose grenadier in NEAFC waters

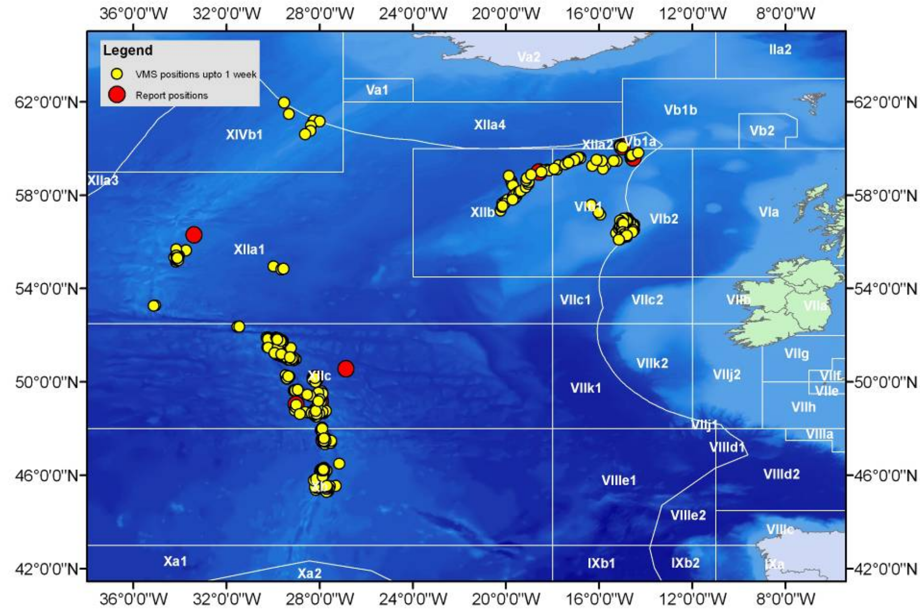


Figure 17.6. Catch reporting positions of roundnose grenadier in the NEAFC area and associated VMS positions in the preceding week.

In all, 518 VMS positions could be linked to 31 reports of roundnose grenadier catch (Figure 17.6). Concentrations of VMS positions associated with catches of this species occur on Hatton Bank, Reykjanes Ridge, Rockall and the MAR. This corresponds to what was previously known about this fishery.

Greenland Halibut in NEAFC waters

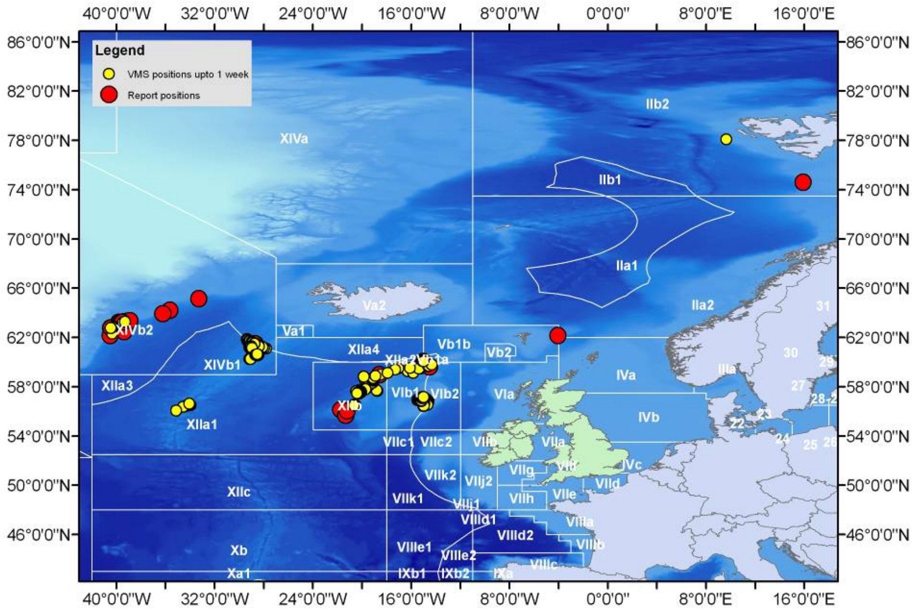


Figure 17.7. Catch reporting positions of Greenland halibut in the NEAFC area and associated VMS positions in the preceding week.

In all, 314 VMS positions could be linked to 43 reports of Greenland halibut catch (Figure 17.7). VMS positions associated with catches of this species occur at Hatton bank, Reykjanes ridge, Greenland, Svalbard, and Rockall. The records from Rockall are likely to reflect confounded allocation by other species captured. Other areas correspond to what was previously known about this fishery.

Orange Roughy in NEAFC waters

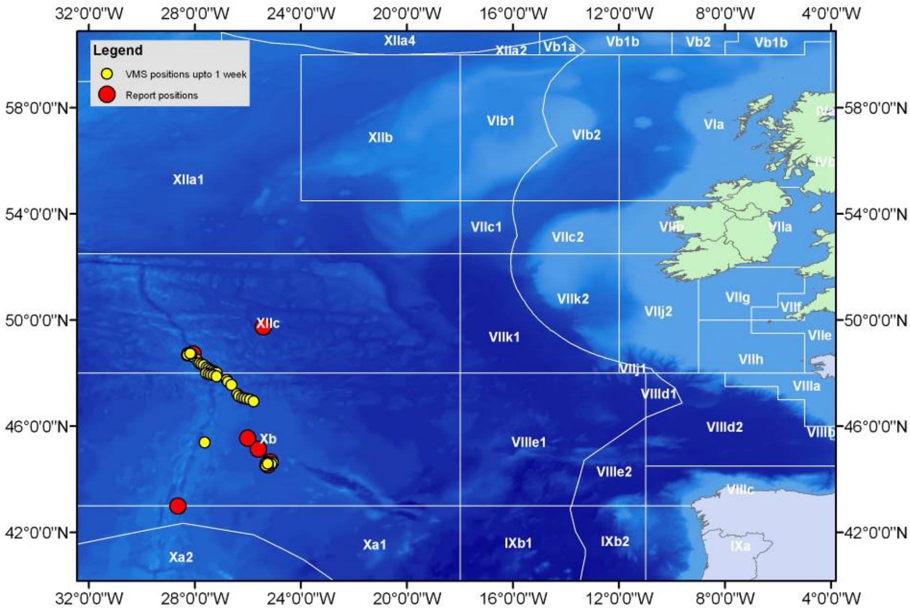


Figure 17.8 Catch reporting positions of orange roughy in the NEAFC area and associated VMS positions in the preceding week.

In all, 51 VMS positions could be linked to 7 reports of orange roughy catch (Figure 17.8). VMS positions associated with catches of this species occur on the Mid-Atlantic Ridge. This roughly corresponds to what was previously known about this fishery in NEAFC waters.

Conclusions on NEAFC data

Although there are numerous caveats associates with using the NEAFC data, it has been valuable in addressing this ToR. The data largely reaffirm the occurrences of commercial deep-water species in known areas. However, they also indicate the location of some fisheries for which information was previously poor such as the black scabbard fish fishery on the Mid-Atlantic Ridge. This analysis highlights the problem that the position from which the catch report is made is often geographically distant from the areas in which the vessels actually made the catch.

17.3.2 Scottish VMS data

In 2009 WGDEC had access to Scottish VMS data (vessels of all nationalities operating in Scottish waters between 2007 and 2008). For vessels landing in Scotland and all Scottish vessels, it is possible to link all VMS records with trip landings declaration. Furthermore because information on gear type is provided it is now possible to directly compare the speed profiles of different fishing operations. The temporal resolution of the data are also more finely resolved than NEAFC VMS data (in some cases positional data are every 20 minutes).

From the Scottish data subsets were extracted that reflected catches of individual species such as blue ling, orange roughy and roundnose grenadier. In most cases the data give more accurate representation of fisheries than has previously landings data. Again, care should be taken in interpreting these data as they take no account of quantities caught and vessels may have engaged in several distinct fisheries during a fishing trip.

Blue Ling

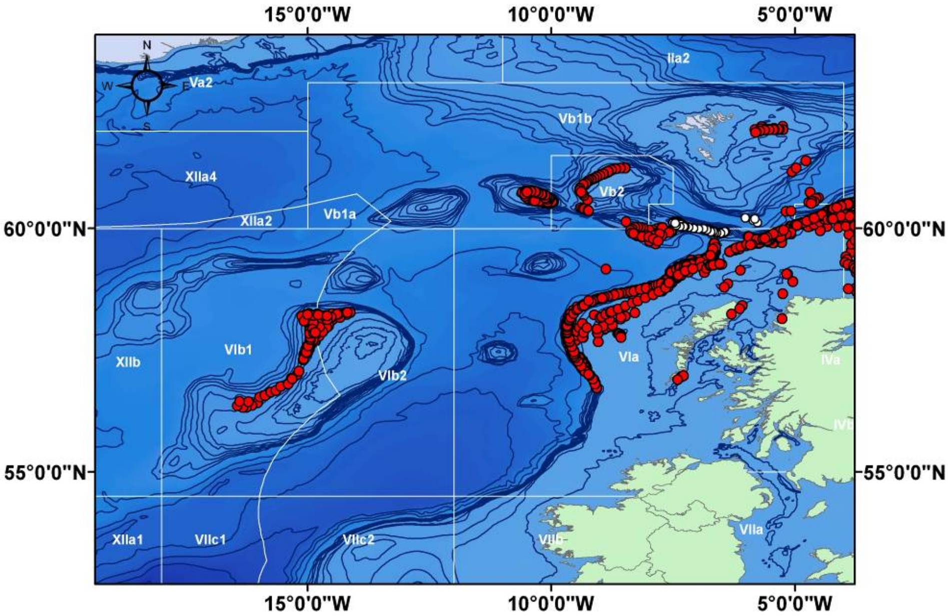


Figure 17.9. VMS positions from vessels that landed into Scotland and reported catching blue ling in 2007 and 2008. Red circles are 2007, white circles are 2008.

VMS positions associated with catches of this species occur West of Rockall, on the shelf slope north of 57 N, Wyville Thomspon ridge, Bill Bailey's bank, Faroe Bank and West Shetland slope (Figure 17.9). This roughly corresponds to what was previously known about this fishery.

Black scabbard fish

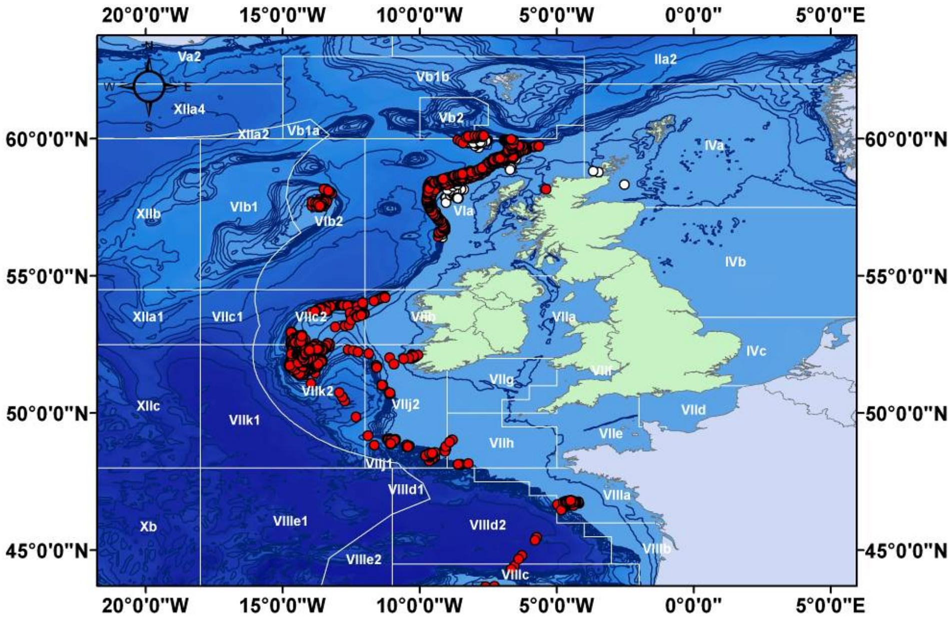


Figure 17.10. VMS positions from vessels that landed into Scotland and reported catching black scabbard fish in 2007 and 2008. Red circles are 2007, white circles are 2008.

Black scabbard fish are reported from most of the length of the continental slope, the Wyville Thomspon ridge area and Rockall (Figure 17.10). This roughly corresponds to what was previously known about this fishery.

Roundnose grenadier

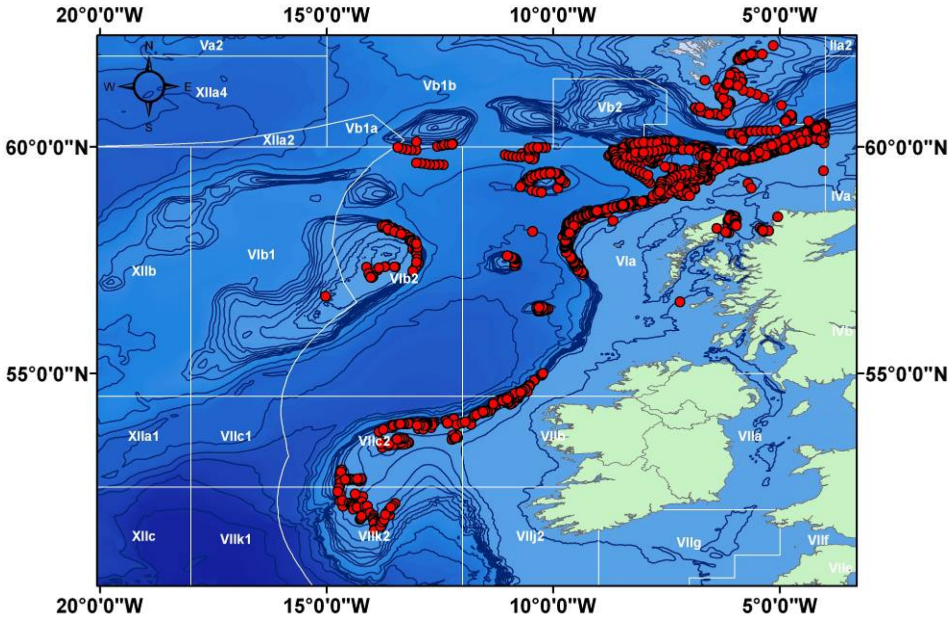


Figure 17.11. VMS positions from vessels that landed into Scotland and reported catching roundnose grenadier in 2007 and 2008. Red circles are 2007, white circles are 2008.

Roundnose grenadier catches appear to come several main areas including the continental slope, the Wyville Thomson ridge, the northeast slope of Rockall bank and the seamounts in the Rockall trough (Figure 17.11).

Orange Roughy

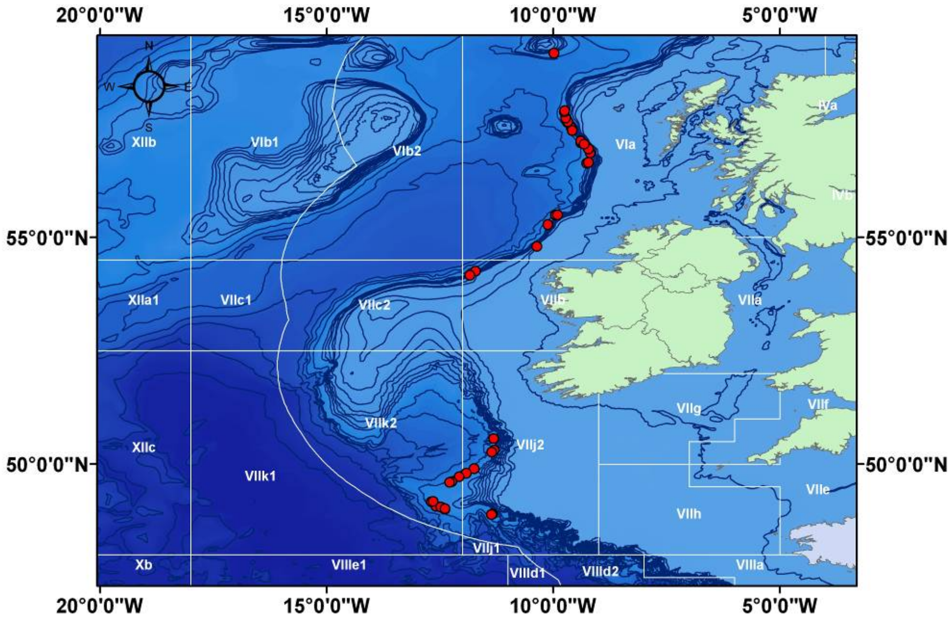


Figure 17.12. VMS positions from vessels that landed into Scotland and reported catching orange roughy in 2007 and 2008.

There are few records of orange roughy but these generally correspond to what is known about the fishery (Figure 17.12). Interestingly, there is a single record from rosemary bank. The points on the hebridean shelf may be confounded by catches of other species within the trip as adults of this species have not been recorded in surveys of the Hebridean slope in the past 10 years (FRS survey data).

17.4 Discussion

The spatial pattern of landings are presented by rectangle for all gears combined and while a high percentage of the landings are by bottom trawlers, other gears have been used and may make a significant proportion in Subareas VII and VIII. The landings data available to WGDEEP does not at this time permit a full analysis by gear type. Therefore at the present time information on the impact of fishing is heavily dependent on available VMS and associated landings declaration/NEAFC catch reports data. From this it can be seen that certain areas have been subjected to considerable fishing effort by bottom trawlers and it is possible to study these areas at a greater spatial resolution.

However, for both VMS datasets, it is not possible to link VMS data with real time catch information and this can lead to spurious interpretations of fishing activity by species when different types of fisheries operated during reporting period whether this is weekly catch reports in NEAFC or trip landings in Scottish data. This can be illustrated on the example of fisheries on the Rockall Bank which appear from the VMS plots to be fishing deep-water species in shallow waters. It is more likely that vessels that have engaged in a deep-water fishery have also executed a demersal fishery e.g. for Haddock on the Bank. Robust analysis will only be possible when real time catch information is available.

With regards to areas that do not appear to have received high fishing impact as inferred by VMS and catches by statistical rectangle, cautions should be issued when datasets are incomplete. The impact in these areas cannot be fully assessed if important fisheries have been omitted from the datasets. This can be illustrated at the example of the Grenadier fishery further offshore along the western slopes of the Hatton Bank, where significant landings by Spanish trawlers were not available for inclusion in the catch by rectangle figures and fisheries are not demonstrated in the filtered VMS/catch report data presented.

There is little doubt that some of the areas in which these VMS data suggest there are active deep-water fisheries also contain vulnerable marine ecosystems or sensitive deep-water habitats such as coral reefs. In particular these include Rockall bank, the Wyville Thompson ridge and the Mid-Atlantic Ridge. In order to assess the potential impact of such fisheries is necessary to focus at the appropriate scale. This is an issue directly dealt with in the report of WGDEC 2009, ToR I (Section 11).

18 ToR h) review the biological parameters that should be collected on the NEACS survey by stock in addition to those specified by PGNEACS

The main aim of the Northeast Atlantic Continental Slope survey is to provide fisheries independent abundance indices for the deep-water species assessed in WGDEEP and WGEF such as roundnose grenadier, black scabbardfish, deep-water sharks, bluemouth redfish and greater forkbeard and other species to be confirmed pending on the inclusion of the northern surveys. For this survey, PGNEACS has proposed to combine the existing deep-water bottom-trawl surveys from Scotland and Ireland, VI west of Scotland to the south of the Porcupine Bank (VIIk) and add a deep-water component of the French IBTS survey which will sample depths between 500 and 1800 m at three sampling regions in the Bay of Biscay between the Goban Spur and the Landes Plateau which are suitable for deep-water trawling. For the extension of the survey into Division IXa, a longline survey is proposed as trawl gears are not appropriate to sampling in this area. North of Subarea VI there are several annual deep-water bottom-trawl surveys currently being conducted by the Nordic countries and others. This includes surveys in Subareas II, V and XIV as well as the North Sea and Skagerrak. Their inclusion into the survey and coordination by PGNEACS is currently being explored.

In terms of the data collection, the trawl survey is proposed to operate at selected sites of the Northeast Atlantic continental slope and carry out depth transect at four different depth strata (500, 1000, 1500 and 1800 m) to obtain fish catches. For the longline survey, fishing hauls will be randomly set within each cell of a regular grid established for the Portuguese continental slope.

For the fisheries data collection, it was decided that there will be an agreed core programme for which all participating countries will collect data. In addition countries may wish to develop more detailed programmes according to national priorities in terms of weight measures, maturity stage determination and collection of otoliths, scales etc for age determination.

- For the core sampling programme, fish catches are sorted and identified to species level. Consistent species identification will be ensured through species ID workshops and common identification keys. Length measurements will be carried out on all or random subsamples (at species level) with specific measurement procedures for different taxonomic groups to take the various body shapes into account. Although length measurements are the minimum biological parameters that are collected for all species, this is extended to length measurements by sex for chimeras), length by weight and sex elasmobranchs and by length, weight and maturity for the key species. Furthermore there should be a collection of calcified structures from the key species for future ageing studies with defined sampling effort and agreed protocols.
- Additionally, material for stock identity studies should be collected as required.
- for other species, a biological sampling programme will be designed so that a minimum set of biological data will be collected.

Overall, WGDEEP gave to consideration, that in order to produce appropriate abundance indicators, a survey needs to cover the whole distribution area of the stock(s) in question. Therefore the working group recommends that the spatial distribution of the main stocks for which the survey aims to provide abundance indicators is reviewed. Based on this review the design of the survey should be adjusted to ensure adequate stock coverage while at the same time making a realistic proposal in terms of costs and logistics.

Considering that the highest level of concentration for some of the main stock assessment units considered by PGNEACS is Vb, VI, VII and XIIb (see ToR g.) a geographical wider survey may be appropriate as the abundance indices generated would cover their full spatial distribution.

The inclusion of the Nordic Surveys into PGNEACS would be beneficial, as a joint approach would provide survey coverage of widely dispersed stocks such as ling and greater silver smelt. Additionally, an international coordination of the existing Nordic surveys (from Norway, Faroe Islands, Iceland and Greenland) would be highly beneficial for assessment in the Nordic areas. It would ease joint research on important commercial deep-water species that are common for the Nordic areas as e.g. Greenland halibut, the redfish species and greater silver smelt, and commercially less important species as elasmobranchs. Consistency between countries in data sampling would be ensured and new research with a broader ecosystem perspective would be encouraged.

PGNEACS has inclusion of the Nordic surveys in the ToR for the coming meeting in June 2009, and it has pointed out that such coordination may either be done within a separate planning group (e.g. "Planning Group for Deep Nordic Seas Surveys") or by expanding ToR for the existing PGNEACS. If the former is chosen, it would imply coordination between the two planning groups, e.g. some concurrent or joint meetings. To thoroughly examine these matters it must be emphasized that the Nordic nations are represented at the next PGNEACS meeting, and in advance provide to the meeting adequate information on existing surveys such as gear, sampling strategy, targeted species and regularity.

19 NEAFC request to evaluate the use and quality of VMS data and records of catch and effort to be received from NEAFC in order to provide information on the spatial and temporal extent of current deep-water fisheries in the NE Atlantic

19.1 Background

ICES provided a response to this request in 2008 based on preliminary analysis by WGDEEP and WGDEC of the NEAFC catch and VMS data for the years 2002 to 2005. No new data have been received since 2008 and this response is based on further analysis of the same dataset. In 2008, ICES advised that;

"NEAFC could further improve the usefulness of the VMS data by:

a) requiring transmission of vessel speed and gear in use (if applicable);

b) increasing the transmission frequency;

c) increasing frequency of transmission (maybe to once per day) and completeness (substantially more than 27% of the fleet) of catch data."

19.2 ICES advice

ICES advises that;

> *The quality of the data is not yet sufficient to provide information on the spatial and temporal extent of current deep-water fisheries in the NE Atlantic.*

NEAFC could further improve the usefulness of the VMS and catch report data by:

a) including in catch reports the fishing gear used if available;

b) increasing frequency of transmission (ideally once a day and reported on haul by haul basis) and completeness of catch reports (covering all species in the catch);

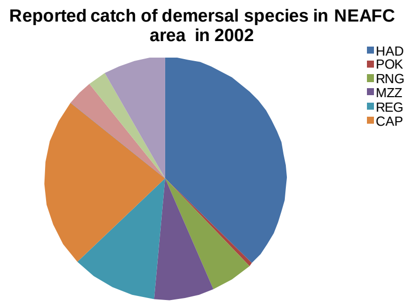
c) increasing the polling frequency of VMS data;

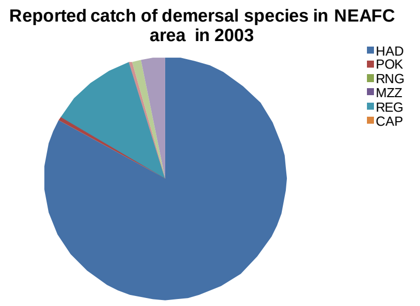
d) requiring transmission of vessel speed and heading;

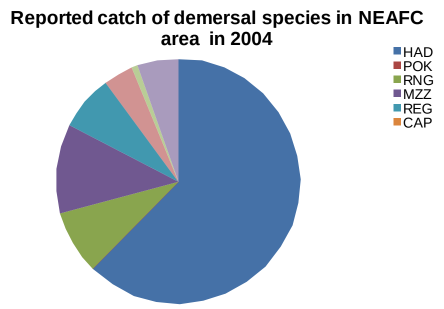
e) providing assistance in interpreting the datasets, preferably in the form of participation in Working groups of an expert from NEAFC with detailed knowledge of the database and NEAFC's reporting protocols.

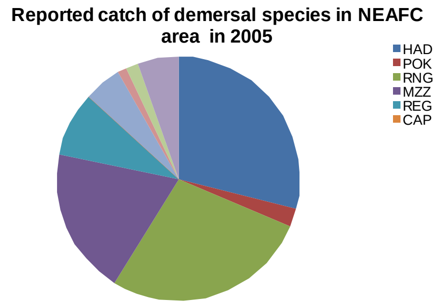
19.3 Basis for the advice

Continued analysis during the 2009 meeting of WGDEEP revealed further concerns concerning the quality of these data. In order to focus analysis on vessels engaged in deep-water fisheries, the catch data were filtered to remove records of pelagic species leaving only records of demersal species. The species composition of these data demonstrated very high interannual variation (Figure 19.1). This could be as a consequence of unexplained variation in exploitation patterns but may also indicate significant amounts of missing data and/or high levels of misreporting.









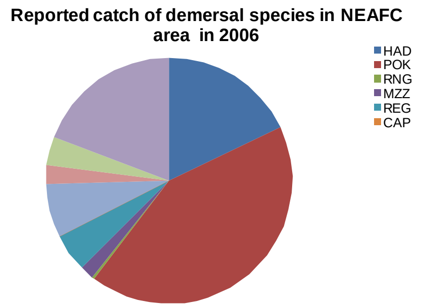


Figure 19.1. Catch composition of demersal landings in NEAFC logbook data 2002–2006.

Furthermore, 70% vessels reporting catches of demersal species reported only one species in a given reporting period (Figure 19.2). Because it is very unlikely that these species are caught in single species fisheries, this would suggest catch reports are incomplete, with vessels reporting only their target or most abundant species. This would clearly render the data unsuitable for differentiating between target and by-catch fisheries. This analysis also revealed the presence of an unknown number of duplicate records in the dataset.

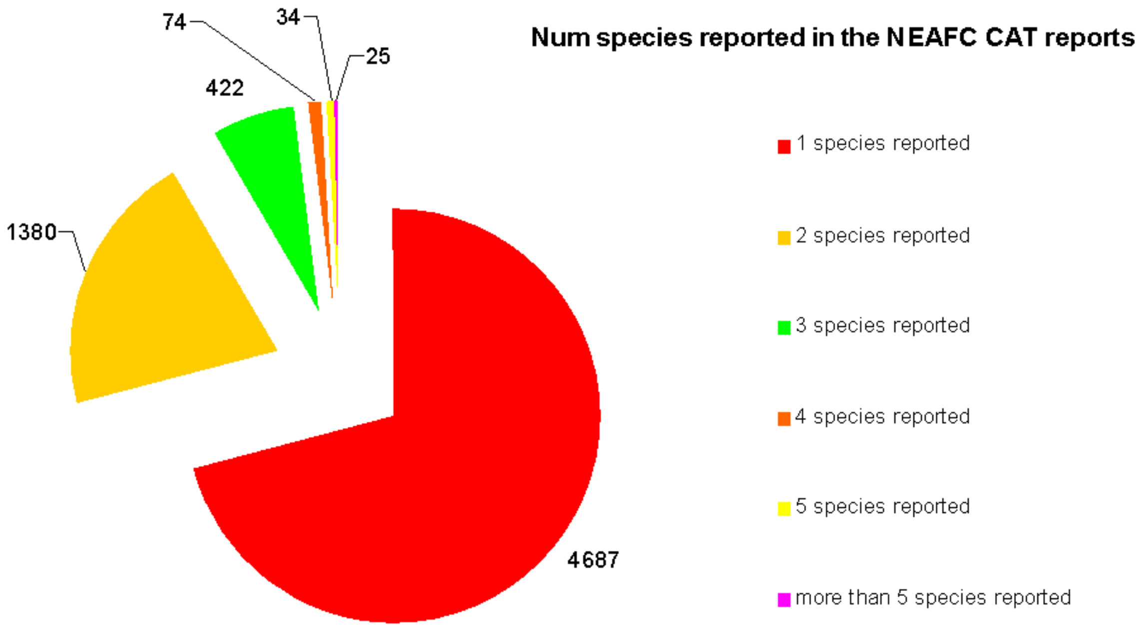


Figure 19.2. Numbers of species included in individual catch reports from all vessels reporting demersal species.

19.4 Preliminary analysis of available data

For the 27% of the dataset for which both catch and position data were available, it was possible to link individual catch reports to positional data for the reporting period during which the catches occurred. This was done for catch records of deep-water species as a group and for a number of individual deep-water species.

Figures 17.4 to 17.8 Show fishing positions associated with catch reports of deep-water species. Care should be taken in interpreting these data as they take no account of quantities caught and vessels may have engaged in several distinct fisheries during a reporting period. Because of the problems in data quality noted above, these outputs should only be seen as indicative of the type of analysis that could be made if better data were available.

20 NEAFC request to develop suitable criteria for differentiating fisheries into possible management types (e.g. directed deep-water fisheries, bycatch fisheries, etc.) and to apply these criteria to categorize individual fisheries in order to allow NEAFC to develop fishery-based management initiatives

Request

NEAFC request to develop suitable criteria for differentiating fisheries into possible management types (e.g. directed deep-water fisheries, bycatch fisheries, etc.) and to apply these criteria to categorize individual fisheries in order to allow NEAFC to develop fishery-based management initiatives.

20.1 Background

ICES provided preliminary advice on this request in 2007. Data available at the time were inadequate to provide a comprehensive answer but ICES was able to suggest an appropriate approach that could be taken if suitable data were to be made available;

"…The work will aim to categorize deep-sea fisheries based on cluster analysis of spatially and temporally resolved NEAFC catch data by gear… However, much of the analysis will depend on the success of being able to link aggregated catch records with the spatial data (the feasibility of this has yet to be determined)."

In 2008, VMS and catch data were made available to ICES in a form that made it possible to link catch and spatial data. In response to a separate request from NEAFC, ICES evaluated the quality and use of these VMS and logbook data and attempted to link catch records with corresponding VMS position data.

Preliminary analysis revealed that only 27% of the vessels that transmitted VMS data had ever reported catch. ICES advised that;

"Comprehensive analysis of these data is likely to require significantly greater amounts of time and resources than are available to ICES at present."

20.2 Advice

NEAFC could further improve the usefulness of the VMS and catch report data for the purpose of developing criteria to differentiate fisheries into management types by:

a) including in catch reports the fishing gear used if available;

b) increasing frequency of transmission (ideally once a day and reported on haul by haul basis) and completeness of catch reports (covering all species in the catch);

c) increasing the polling frequency of VMS data;

d) requiring transmission of vessel speed and heading.

20.3 Basis for the advice

Continued analysis during the 2009 meeting of WGDEEP revealed further shortcomings in the quality of these data. In order to focus analysis on the subset of the catch relating vessels engaged in deep-water fisheries, the catch data were filtered to remove records of pelagic species leaving only records of demersal species. The species composition of these data demonstrated very high interannual variation. This could be as a consequence of unexplained variation in exploitation patterns but may also indicate significant amounts of missing data and/or high levels of misreporting.

Furthermore, 70% vessels reporting catches of demersal species reported only one species in a given reporting period (Figure 20.1). Because it is very unlikely that these species are caught in single species fisheries, this would suggest catch reports are incomplete, with vessels reporting only their target or most abundant species. This would clearly render the data unsuitable for differentiating between target and bycatch fisheries. This analysis also revealed the presence of an unknown number of duplicate records in the dataset.

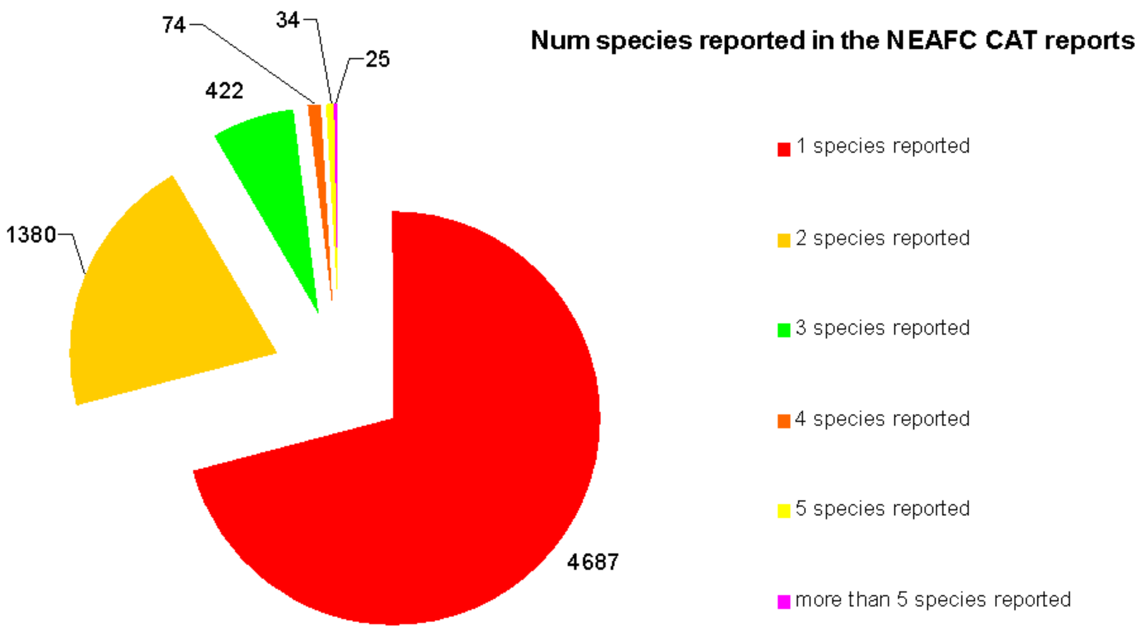


Figure 20.1. Numbers of species included in individual catch reports from vessels reporting demersal species.

ICES concludes that no further progress can be made towards differentiating fisheries through cluster analysis until these apparent problems with the data can be explained and accounted for. This could be facilitated by the attendance at future meetings of the Working Group of an expert from NEAFC with detailed knowledge of the fisheries, the database and NEAFC's reporting protocols. If cluster analysis can be performed on a more robust dataset, studies of the species composition within clusters may allow the development of suitable criteria for differentiating between fisheries.

21 Recommendations

WGDEEP 2009 recommends the following:

21.1 Benchmark Assessment meeting on deep-water stocks proposed for 2010

WGDEEP considers that a benchmarking workshop in 2010 would be beneficial for future work of WGDEEP and forthcoming ICES advice later in 2010, particularly if, in addition to experts from the ICES community, it is possible to involve experts in data-poor/deep-water stock and ecosystem assessments from other parts of the world (New Zealand, CCAMLR, etc.) and from Universities, etc. Historically, abundances indices based on commercial catch and effort data have been largely used as a basis for ICES advice and there is a need for more robust assessment methodologies to be identified and the integration of ecosystem considerations.

According to availability of WGDEEP members and available funding, a suitable date for this workshop would be in February 2010. The data should be made available well in advance of the meeting to allow time for fishers' data to be analysed.

Single stock assessment case studies will also be carried out in a new EU Project, DEEPFISHMAN, commencing April 2009 and completing in 2012. The aim of DEEPFISHMAN is to develop a monitoring, assessment and ecosystem management framework for deep-water stocks in the NE Atlantic. The project includes a dedicated work package to develop new assessment methods and to trial assessment methods used on deep-water stocks elsewhere in the world and on other species. This work will be carried out on a wide range of case study stocks including blue ling, redfish, orange roughy, red (blackspot) sea bream and black scabbard fish in the NE Atlantic. The project will involve scientists from Fishery Institutes and Universities from 8 countries and will also include case studies in the NAFO area (Greenland halibut) and the SE Atlantic (orange roughy off Namibia). The project will aim to attract and involve leading scientists from around the world and major stakeholders including NGOs.

From a single-stock assessment perspective, we recommend that, to maximize overall stock coverage, the Benchmark meeting exclude those stocks to be studied in DEEPFISHMAN. Notwithstanding, the Benchmark candidate stocks listed below reflect a wide range of likely assessment problems (largely driven by differences in biology, species distribution and fishery types) and data availability.

The approaches used for the candidate stocks below should take account of the need for ecosystem based management advice.

Given that the number of stocks covered in benchmark assessment meetings is limited (usually around 6), WGDEEP suggests that the following deep-water stocks be considered in 2010:

Roundnose grenadier in Division Vb and Subareas VI and VII-this species presents major assessment challenges largely driven by: life-history characteristics (long-lived (ca. 60 years) and slow growing), changes in exploitation pattern resulting from changes in the geographical and depth distribution of trawl fisheries in relation to stock distribution, a lack of fisheries-independent survey data, and discontinuity in the availability of time-series discard data (fisheries on this stock generate high discards) and of age data. Abundance indices based on French trawl catch and effort data are available but their use in assessments is problematic because of changes in spatial and depth distribution of fishing and also changes fleet composition/fishing power. Time-series length distribution data are available for French trawl landings. Time-series haul by haul data on catch and effort by French trawlers, collected in collaboration with the industry, is now available. Separable VPA was used for an exploratory assessment in 2009.

Greater Silver smelt in all areas-this species is also long-lived (ca. 40 years) and slow growing but is bentho-pelagic and targeted largely by pelagic trawlers. Time-series length and age data are available for some areas. Exploratory assessment methodologies used include acoustic surveys (in IIa) and, in 2009, XSA (Vb).

Tusk in Division Va-this is a gadoid species and as such is not particularly long-lived (20–30 years) or slow growing. It is caught largely as a bycatch in longline fisheries for other species. Age data are not available but there are survey data. Length distribution data are available from surveys and commercial landings. Gadget was used for an exploratory assessment in 2009.

Red (blackspot) sea bream in Subarea X-this sparid species is not particularly long-lived (15–20 years) or slow-growing but is a protandric hermaphrodite (changes sex as it grows). Fisheries are artisanal (longlines and handlines) and are mostly prosecuted on seamounts. Survey data are available as are length and age data. Separable VPA and XSA have been previously trialled; however an exploratory assessment was not attempted in 2009.

Deep-water squaliform sharks in all areas-these include the Portuguese dogfish and the leafscale gulper sharks, and are mostly long-lived (up 60 years). Length and age data are not available and historical landings data are not available by species (although in recent years the quality of landings data has improved). Haul by haul data from French trawlers fishing in Vb, VI and VII by species back to the mid-1990s were made available in 2008. Directed fisheries for these species are currently not permitted but they are still taken as a bycatch in other fisheries.

Greater forkbeard-this is a gadoid species and is considered likely to exhibit typical gadoid life-history characteristics, although these are not known with any accuracy. Commercial landings are significant but this almost entirely a bycatch species taken in other fisheries. Exploratory assessments have not yet been attempted.

Ecosystem approach to assessment in deep-water components of Celtic Seas (Subareas VI and VII) and Oceanic Northeast Atlantic ecoregions-To review data availability and to develop appropriate ecosystem indicators/assessment methods for use in integrated advice which may be subsequently used by WGDEEP and WGDEC in these and other ecoregions.

In addition to the above, we suggest that examples of data-poor stocks covered by WGNEW and WGEF also be addressed at the Benchmark meeting.

For the next benchmark WGDEEP recommends that the experts on the following scientific areas be invited:

- Cpue standardization procedures using linear models e.g. Generalized Linear Models (GLM), Generalized Additive Models (GAM);
- maturity ogives estimation to be applied to hermaphrodite species, like red sea bream;
- Methods to evaluate the status of stocks that are particularly data poor;
- Production stock assessment models with a Bayesian approach;
- Length-based stock assessment models for long-lived species;

- Fish population and community indicators to be used for assessment of population status and ecosystem impacts of fisheries;
- Evaluation of fishing and other human activities impact on vulnerable habitats particularly deep-water;
- The use of life tables and life-history characteristics to develop estimates of likely sustainable yield;
- Guidance on the general appropriateness of application of age based methods to long-lived species.

We propose that a further deep-water benchmark meeting be held in 2012 (by which time the DEEPFISHMAN project will have been completed), to evaluate and, where appropriate, integrate the outcomes of DEEPFISHMAN into the ICES framework.

21.2 WGDEEP work programme

WGDEEP should be held in April for the following reasons:

- Advice on fisheries in Icelandic waters is heavily dependent on surveys that take place annually in March.
- Data from fishers used in French and Norwegian cpue indices cannot be compiled in time for a March meeting.

If an April meeting at ICES HQ is not possible, the Group would be prepared to meet elsewhere.

In assessment years, WGDEEP terms of reference should be limited as far as possible to generic stock assessment ToR. In interim years, it would be more appropriate to address other ToR including joint ToR with WGDEC.

21.3 Improvement of data availability

ICES should negotiate with NEAFC to provide an annually updated copy of the NEAFC catch and VMS data. Catch data should be as complete as possible and disaggregated by gear and at the highest possible spatial resolution.

Given the problems encountered in interpreting data, NEAFC should be requested to provide an expert to attend WGDEEP and WGDEC to explain the NEAFC reporting protocols used to collect, collate and aggregate the data onto the NEAFC database. For example, clarification is needed on whether official NEAFC landings tables are based on position of reporting or on actual position of catches linked to VMS as there would appear to be large-scale geographical differences between these positions in many cases.

NEAFC should increase the polling frequency of VMS to allow for better identification of fishing activities e.g. In relation to potential VME areas and existing closed areas. Data on vessels speed should be included in VMS reporting to allow post-processing of data to differentiate between mobile and static gears and to exclude steaming.

VMS data from all countries should be made available to ICES for spatial analysis.

Data from the Spanish fishery at Hatton Bank (Divisions VIb and XIIb) has not been available to ICES since 2006. This is an important component of stocks occurring in Vb, VI, VII and XIIb and impacts on the assessment of number of stocks in this ecoregion. This data should be made available to ICES.

It is possible that some deep-water stocks, for example black scabbard fish, alfonsinos and deep-water sharks in the ICES area straddle into the CECAF area. For these stocks the assessment areas adopted for reporting catches to ICES may be inappropriate. European fleets operating in this areas report the information to the CECAF. The statistical and biological information collected in those areas should be made available to ICES.

Reports of the data collected by observer under the EU deep-water licensing regulations should be made available to WGDEEP and WGDEC on a regular basis. These data, from 2009 onwards, should include information on the maturity composition of blue ling catches. (See response to EU request).

National sampling plans submitted to the EU under the deep-water licensing regulations should be submitted to ICES for scientific evaluation.

Stakeholder information

The NWWRAC, SWWRAC and the French fishing industry have requested guidance on future work on haul by hauls cpue data collected under the cooperation between IFREMER and the French fishing industry. WGDEEP recommends that collection of these data should be continued. Collection of new data should have higher priority than extending the dataseries further back in time because both the fishing strategy and the composition of the fleet have changed over time.

Work undertaken by the Portuguese industry in collaboration with IPIMAR should be continued. (Joint data collection between the fishing sector and the scientific community in western waters FISH/2007/03 Lot 1).

INTERCATCH issues

Because some of the fleets with fisheries capturing deep-water species also catches other species which are analysed in other ICES WG groups, WGDEEP recommends that an initial effort be made to guarantee that the connections between fleets treated in different WG groups are *a priori* established and a standardized fleet set. It is also WGDEEP opinion that this upper level work must be defined by the DataBase designers together with stock coordinators. This is a fundamental step, just prior to the data uploading process, to avoid loss of information as a consequence of different data aggregation. The WG also recommends the agreement of the stocks coordinators at national level and between different WGs to set and define the fleets involved in each stock in order to avoid the creation of different names for same fleets (i.e. otter trawlers and longliners fishing demersal and deep-water species).

WGDEEP recommends that algorithms to convert length landing distribution into age distribution be incorporated to INTERCATCH so that data input be a faster process, with lower probability of error introduction.

Deep-water surveys

In order to produce appropriate abundance indicators, a survey needs to cover the whole of the distribution area of the stock(s) in question. Therefore the Working Group recommends that the spatial distribution of the main stocks for which the surveys coordinated under PGNEACS aim to provide abundance indicators is reviewed. Based on this review the design of the survey should be adjusted to ensure adequate stock coverage. Considering the stock assessment units in Vb, VI, VII and XIIb, (which include roundnose grenadier, blue ling and black scabbard fish), a geographical wider survey maybe appropriate as the abundance indices generated would cover their full spatial distribution.

The inclusion of the Nordic Surveys into PGNEACS would be beneficial, as a joint approach would provide survey coverage of widely dispersed stocks such as ling and greater silver smelt. Additionally, an international coordination of the existing Nordic surveys (from Norway, Faroe Islands, Iceland and Greenland) would be highly beneficial for assessment in the Nordic areas. It would ease joint research on important commercial deep-water species that are common for the Nordic areas as e.g. Greenland halibut, the redfish species and greater silver smelt, and commercially less important species as elasmobranchs. Consistency between countries in data sampling would be ensured and new research with a broader ecosystem perspective would be encouraged.

WGDEEP has recommended biological data to be collected by surveys coordinated under PGNEACS. These are detailed under ToR h in this report. (See Section 18).

21.4 Further issues

The Working Group recommends that stock identity issues should not be considered in the benchmark meeting as the expertise required is highly specialised and the importance of this subject warrants detailed investigation. At the WGDEEP stock identity workshop in 2007, ongoing genetic studies of stock identity were described. ICES should review whether another stock ID workshop is needed to review outcomes.

Based on the recommendations of WGDEEP in previous years, ICES reviewed the definition ICES divisions in several subareas and introduced new division definitions. The background to this was to separate catches for international waters from EEZs and to facilitate the division of catches reported in Subarea XII between the Mid-Atlantic Ridge and the Hatton Bank. It is considered that fisheries on the eastern and western parts of Hatton Bank prosecute the same stocks that exist in Vb VI and VII, and by including XIIb (western Hatton bank) this will provide improved assessment unit definition. WGDEEP recommends that ICES review stock definitions to include XIIB for blue ling, black scabbard fish (XIIb has already been included for roundnose grenadier).

WGDEEP recommends that Countries should provide catch data disaggregated by the new ICES divisions and data should be up-loaded to INTERCATCH in this form.

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22.2 Working documents

For summaries of working documents supplied to WGDEEP see section 3.5.

WD1. Pawlowski, L., Lorance, P., Evrat, F., Le Garrec., A. and Lamonthe, J. 2009. Collection process and validation of haul by haul data: a partnership between science and Industry

WD2. Helle, K., Bergstad, O. A., Pennington, M. 2009. Estimates of effort, CPUE, and mean length for the Norwegian commercial catch of ling, blue ling and tusk

WD3. Bergstad, O. A., Øverbø Hansen, H. and Jørgensen, T. 2009. Fisheries-independent information on temporal variation in abundance, size structure, recruitment and distribution of the roundnose grenadier Coryphaenoides rupestris, 1984-2009

WD4. Figueiredo, I. and Farias, I. 2009. Fishing effort standardization of black scabbardfish commercial data from ICES division IXa – period 1995-2008

WD5. Figueiredo, I. 2009. APHACARBO project

WD6. Fernandes, A.C., Silva., D, Henriques, E. and Pestana G 2009. Discards on Portuguese set longlines fishery targeting black scabbardfish

WD7. Velasco, F., Blanco, M., Baldo, F. and Gil J. 2009. Results on argentine (Argentina spp.), bluemouth (Helicolenus dactylopterus), greater forkbeard (Phycis blennoides) and spanish ling (Molva macrophthalma) from 2008 Porcupine bank (NE Atlantic) survey

WD8. Gil, J., Canoura, J., Burgos, C., and Farias, C. 2009. The red seabream (Pagellus bogaraveo) fishery in the Strait of Gibraltar: Data updated for assessment of the ICES Sub area IX

WD9. Vinnichenko, V.I. and Mitina, A.S. 2009.Russian deep-sea fisheries in the North-East Atlantic in 2008

WD10. Figueiredo, I. and Farias, I. 2009. Information on deep-water species from mainland Portugal

WD11. Hallfredsson, E. H. and Svellingen, I. 2009. Greater argentine research in Norway 2008

WD12. Ofstad, L. H. 2009. Data on Faroese deep sea fisheries

WD13. Pinho, M. R. 2009. Information of deep water species from the Azores (Xa2)

WD14. Ofstad, L. H. and Homrum, E. 2009. Greater silver smelt (Argentina silus) in Faroese waters (Division Vb)

WD15. Pawlowski, L. and Lorance, P. 2009. Effect of discards on roundnose grenadier stock assessment in the Northeast Atlantic

WD16. Thordarson. G. 2009. Exploratory stock assessment on tusk in Va using GADGET

WD17. Vinnichenko, V.I., Fomin, K.Yu., Safronov, A.M., Zhivov, B.D. and Mashkov, V.N. 2009 Russian investigations of deepwater fish in the Northeast Atlantic in 2008

WD18. Lorance, P., Pawlowski, L. and Trenkel V. M. 2009. Analysis of haul by haul data for blue ling.

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