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REPORT OF THE WORKING GROUP ON THE BIOLOGY AND ASSESSMENT OF DEEP-SEA FISHERIES RESOURCES (WGDEEP)

8 - 15 MAY 2007

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Contents

1 EXECUTIVE SUMMARY

WGDEEP07 has updated data relevant to deep-sea fisheries, and it has also addressed specific issues related to stock identification (in conjunction with SIMWG), and set of NEAFC requests.

Stock assessments are carried out by WGDEEP on a bi-annual basis, and 2007 was a no-assessment year. The WG reviewed one of the key issue it faces when proceeding with stock assessments: the standardisation of CPUEs. The different approaches carried out by WGDEEP have been reviewed and the WG made some recommendations. The WG was also of the opinion that this issue should be addressed more broadly by a dedicated IES SG, for which it provided some suggested terms of reference.

A three-day WGDEEP/SIMWG stock identification workshop was organised to clarify the structure of a selection of deep-sea species: ling, blue ling, tusk, greater argentine, roundnose grenadier, black scabbardfish, red (black spot) seabream. A general review of methods, which could be used in relation to stock identification, was carried out by the WG. Genetics appeared to be a powerful method in relation to that purpose. Recent genetics data were available for red (black spot) seabream and tusk. As for red seabream, genetics seem to support the current ICES perception, which consist of three stock units: (i) VI, VII, VIII; (ii) IXa and (iii) Xa. As for tusk, changes were suggested in the current ICES perception of stock structure. The WG suggested that new stock structure consists of five units: (i) Va, XIV; (ii) Rockall; (iii) I, II; (iv) Mid-Atlantic Ridge and; (v) combined areas including areas not included in (i-iv). Further sampling is required to clarify whether or not the Faroese waters (Vb) could an independent stock, and also to demonstrate the independence of the Rockall unit from Hatton Bank and Western Scotland (VIa).

One of the NEAFC requests concerned the international coordination of dedicated deep-sea surveys. The scope of these surveys would include the collection of fisheries-independent stock abundance indices but also relevant data on biodiversity, biological parameters, morphometrics, genetics, diet, habitat mapping, basic hydrography, benthos, seamounts and vulnerable habitats, MPAs, cetaceans and seabirds, fish behaviour, contaminants, parasites. The WG identified 3 potential surveys, and also provided terms of references for planning groups, which would be responsible for the coordination of these surveys. The first priority would go for an annual international (UK, Ireland, France, Spain, Portugal) survey covering the European continental slope, from the West of British Isles to Portugal. For the sake of cost-effectiveness, the WG recommended that this survey build on existing surveys prosecuted on the European shelf in the third and fourth quarter. The second priority would be a tri-annual international (EU, Iceland, Norway, Russia) survey on the mid-Atlantic ridge. Finally a combined trawl-acoustic survey was suggested in relation to greater silver smelt, but the feasibility of that survey could not be fully investigated, due to the absence of some assessment experts.

NEAFC also requested ICES to make recommendation on the precision of VMS and catch data required to address some of its requests. With regards VMS data, the WG made recommendations on the need to document the gear type, to refine the recording frequency (inter-pings interval). The WG, whilst commending NEAFC for providing VMS data in the Regulatory Area, emphasised that such data be available for the whole Convention Area, including EC and national waters. The NEAFC also provided ICES with weekly catch data, but these were made available one week before the WG started, so a full investigation of these data could not be carried out. The WG noted however that catch data were not recorded consistently, so linking effort and catches through an automated procedure is not straightforward. In order to make a better use of VMS data, the WG recommended that a dedicated SG be set up by ICES around the development of methods based on VMS data (SGVMS). WGDEEP also suggested terms of reference for that SG.

With regards the other NEAFC requests (identification and mapping of deep-sea fisheries, area closures, blue ling spawning aggregations), the WG either did not have relevant information to substantiate a response, or received these information shortly before the meeting started, so these could not be processed.

2 INTRODUCTION

2.1 Participants

Alexis Bensch	FAO
Tom Blasdale	UK
Guzman Diez	Spain
Leonie Dransfeld	Ireland
Ivone Figueiredo	Portugal
Juan Gil	Spain
Lei Harris	Canada
Kristin Helle	Norway
Emma Jones	UK
Ole Jørgensen	Denmark
Paul Keyzer (part time)	ACME chair
Halvor Knutsen	Norway
Kristjan Kristinsson	Iceland
Phil Large	UK
Pascal Lorance	France
Paul Marchal (WGDEEP chair)	France
Stefano Mariani (SIMWG chair)	Ireland
Lise Helen Ofstad	Faroe Islands
Michael Pennington	Norway
Juan-Pablo Pertierra	EC observer
Mario Pinho	Portugal
Jakup Reinert	Faroe Islands
Mark Tasker (part time)	ACE chair
Vladimir Vinnichenko	Russia

Appendix 1 is a list of the 2007 attendees of WGDEEP and their contact details.

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 summarised the current status of knowledge on 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) seabream (*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 assessemnts 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 data series 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 wo that species-specific sections were provided for those species for which sufficient infromation was available to provide evaluations of stock status was possible, at least in some areas. As in previous years, it was recognised 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 showed 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, fisheries 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 assessement 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 data sets, 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 assessements.

In 2004, WGDEEP updated fisheries descriptions, biological parameters and time series of abundance indices. Assessments were attempted for some stocks and preliminary results were shown (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, due to requests from the NEAFC and the EC, a plenary meeting was organized in the end of the year. No assessment 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 seabream in X), separable VPA (red seabream in IX, roundnose grenadier in Vb, VI & VII), CSA (blue ling in Vb, VI & 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.

2.3 Terms of reference and special requests

The terms of reference of the Working Group adopted at the 2006 Annual Science Conference (94th Statutory Meeting) were as follows (C. Res. 2006/ACFM:2ACFM08):

a) hold a 3-day workshop on stock identity for the deepwater stocks of ling, blue ling and tusk with invited experts from SGSIM to review existing knowledge and submit new information on stock identity for these species;

b) further develop assessments methodologies for ling, blue ling and tusk and assess the state of the stocks;

c) compile on the finest scale possible data on landings, discards and effort of deep-water species, including blue ling, ling, tusk, greater argentine, roundnose grenadier, orange roughy, black scabbardfish, red seabream, greater forkbeard, alfonsino; evaluate the quality of these data

d) evaluate the effects of the closed areas introduced in 2005 in the NEAFC area, with special regard to species diversity, and /or changes in the density of commercial fish species or any other living organisms, which may indicate the quality of the ecosystem;

In addition to these terms of reference, four NEAFC requests were directed to WGDEEP:

1) NEAFC requests ICES 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. If data quality allows such analyses, these should be provided with particular emphasis on activity in the NEAFC Regulatory Area.

2) NEAFC reiterates its request that ICES develop suitable criteria for differentiating fisheries into possible management types (e.g. directed deep-water fisheries, by-catch fisheries etc.) and to apply these criteria to categorise individual fisheries in order to enable NEAFC to develop fishery-based management initiatives. Shortcomings in data quality that impede this exercise should appear in the evaluation under pt 1.

3) ICES is also asked to compile data on documented historical or present spawning/aggregation areas of blue ling in the NEAFC Convention area.

4) NEAFC asks ICES to consider co-ordination of existing deep-sea surveys. The evaluation may also include recommendations for the development of new surveys if it is considered to be appropriate.

The report of the workshop on stock identification (TOR a) is presented in Section 4, data compiled in relation to TOR c are shown in the different stock sections (Sections 5-12), and the WG's response to TOR d is given in Section 13.

The group decided to give a lesser priority to TOR b (stock assessment explorations), for two main reasons. First, because of the extra NEAFC requests which emerged in 2007, less time was available to investigate the TORs agreed in 2006 in the time allocated at that time, so priorities had to be set for the different tasks allocated to the group. Second, an on-going EU project (POORFISH) is currently investigating assessment methods applicable to data-poor situations (EC, 2004). When the project is completed, the assessment methods being developed could be transferred to WGDEEP. However, the outcomes of this project are still preliminary at present, and the group was of the opinion that it would be too premature to make use of them this year. In order to make the best use of the time available in relation to TOR b, the WG decided to concentrate on recommendations pertaining the protocols of standardising the CPUE used as inputs to stock assessments rather than on time-consuming explorations of assessment methods. These recommendations may be found in Section 3.5.

The responses of WGDEEP to the NEAFC requests 1-4 are presented in Sections 14-17.

WGDEEP will report by 18 May 2007 for the attention of ACFM.

3 DATA AVAILABILITY

3.1 Landings

Most landings data for 2006 were provided by working group members because official statistics available to ICES were incomplete. In particular, official landing statistics were unavailable in 2005 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. The reporting for such species depends to a large extent on the efforts of individual members of the group, and changes of membership appears to affect this reporting. This may result in inconsistency, and lack of reporting makes compilation of data very difficult.

3.2 Discards

Several EU countries have initiated observer programs as in accordance with their obligations under EC regulations 2347/2002 (regulating deep water fisheries) and 1639/2000 (minimum and extended sampling programs). These have been provided for the French trawlers over the period 2004-2006.

3.3 Fishing effort

3.3.1 Log-book data

No stock assessments were carried out this year, so the availability of fishing effort data was less critical than in 2006. 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 pair-trawlers 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) seabream and alfonsinos in Division Xa

3.3.2 VMS data

WGDEEP had in the past stressed 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, the NEAFC provided ICES with a full extraction of its VMS database over the period 2001-2005. This comprised the geo-localisation of fishing vessels' positions in the international waters within NEAFC jurisdiction. Despite some limitations in their completeness and format, these data could be used inter-sessionnally to respond to the 2006 NEAFC request concerning the impact of area closures. In 2007, the 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 no sufficient time for the group to make use of them in relation to the 2007 NEAFC requests (see Sections 14-17).

In national waters, access to VMS data continues to be problematic.

3.4 Research surveys

The text below summarises the national surveys, which were made available to WGDEEP07. In response to a NEAFC, the WG also made a proposition for internationally coordinated deep-sea surveys (Section 19).

Faroe Islands

The Faroese groundfish surveys for cod, haddock and saithe have fixed stations distributed within the 500 m contour of the Faroe Plateau. The spring surveys are from 1994 (conducted in February-Mars) cover 100 stations while the summer survey are from 1996 (conducted in August) covers 200 stations. The surveys also yield useful information on many other species. It needs to be kept in mind that the surveys are restricted to depths shallower than 500 m, so it only covers a part of the distribution area of deep-water species.

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 can not 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 taken 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 deepwater 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 deepwater 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 deepwater fishes during the early development of the commercial fishery, and provided samples of deepwater fish for biological analysis. The surveys have also produced catch per unit effort (CPUE) and discarding information.

In 2006 the Marine Institute recommenced its deepwater 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, 500m, 750m, 1000m and 1500 meters. The survey attempted to standardise gear, sampling strategy and protocols with the FRS survey as much as possible. As part of this standardisation 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 deepwater 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 deepwater species in the survey area in the 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 springtime, 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 sea-bottom is very rough, which does not permit use of other gears (e.g. trawl), and also due to a combination of behavioral and physiological factors of the demersal species (e.g. deep-water species are difficult to detect acoustically, particularly those living near the sea bed, and mark recapture studies are ineffective for some of the species because they die when brought to surface).

Spain

In line with the recommendations of the 2005 WGDEC, IEO has planned to develop a multidisciplinary deep-sea survey project (Durán Muñoz *et al.* WD in WGDEEP 2005) in order to know the spatial distribution of vulnerable deep-water habitats in the Hatton bank, in particular cold-water corals. Two surveys have been planned for the period 2005-2006. The first one, *ECOVUL/ARPA 2005/10*, was conducted from 10/03/05 to 10/30/05 with the Multi-propose Research Vessel *B/O VIZCONDE DE EZA* in ICES Divs. VIb1 and XIIb in the main fishing area of the bottom trawlers, that appear to be mainly sedimentary grounds, a plastered contourite-drift system called *"Hatton Drift"*. Were obtained 13693 $Km.^2$ of multibeam (EM-300) bathymetry and 433 Km of high resolution seismic profiles (TOPAS PS 018 parametric echosounder), both on the slope of the bank in a depth range from 520 to 2055m. In addition fishing hauls (30' duration) using LOFOTEN bottom trawl (35 mm mesh size) were conducted in depth range 850m. from 1500m. Length distributions and CPUE for main commercial species were obtained (WD18, WGDEEP 2006). The second survey will be carried out in october 2006, with the aim to complete the multidisciplinary sampling.

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 deepwater 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 deepwater *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 400-1900m. A commercial trawl is used with a 4-5m headline and a 100mm codend with 20mm blinder. The trawl is towed along pre-specified depth contours for a period of 1.5 - 2 hours at a speed of 3 - 3.5 knots. Data collected is in the form of length frequencies for all species, weight of each species, length/weight data and biological sampling as required for current projects.

In 2006, as part of a new SEERAD-funded research project, 5 short exploratory hauls on the eastern edge of the Rockall Plateau and the Anton Dohrn seamount were carried out in order to collect biological information on fish populations. As part of this project analysis of selected deep sea species for halogenated persistent organic polluants such as polybrominated diphenyl ethers (PBDEs), and chlorobiphenyls (CBs) is also planned and samples were collected during the survey. Six of the survey stations formed part of a comparative fishing exercise with The Marine Institute vessel Celtic Explorer which completed a deepwater survey earlier.

3.5 Commercial CPUEs

3.5.1 Introduction

Due to the sparsity of survey data currently available, the WGDEEP has relied heavily on CPUE to reflect changes in stock abundance. Although new deep-sea 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.

In the past years, WG members have adopted different strategies to standardise fishing effort and CPUE. The scope of this section if to summarise the different approaches, which have been carried out to standardise the CPUEs of the different stocks being assessed, and also to provide orientations for future work on catch rates.

As a suggestion, in reviewing these methods, concerns are expressed regarding the reliability of derived abundance indices. However, experience has shown that where strong depletion of stocks has occurred, available CPUE, even for aggregating species, may still be a useful abundance indicator.

3.5.2 Review of WGDEEP procedures to standardise CPUE

We will classify the different approaches pursued by WGDEEP to standardise CPUE, based on when the process of standardisation takes place (before or after data are collected).

3.5.2.1 Standardisation of the process of collecting catch and effort

Before data are collected, it is possible identify a reference fleet of vessels, of similar physical characteristics, covering most of the stocks' distributional range, and following similar fishing strategies from year to year. Catch rates derived from this reference fleet may have broadly similar trends than those that would be derived from a standard research survey.

This procedure was adopted to derive catch rates for a reference Norwegian fleet harvesting blue ling, ling and tusk (Sections 6.2, 6.3, 12.1, 12.3). This reference fleet, which comprises 4 vessels, has been used to provide abundance indices, in the form of catch rates, since 2001. Data from the reference fleet were combined with log-book data for the entire high-seas long-liners fleet, which were available over the period 2000-2006 (see WGDEEP06 WD3 for full details). A similar approach has been undertaken to identify a reference Faroese fleet in relation to the ling and tusk assessments (Sections 6.3 and 7.2) and, in the past, a reference French trawler fleet.

3.5.2.2 Standardisation of available catch and effort data

Catch and effort data extracted from official log-books should be used as abundance indicators only with caution. Such data may only provide adequate indices of population abundance if they are corrected for the effects of fleet dynamics (e.g. shifts in tactics and strategies, technical creep) and for changes in the fleet composition (Walters, 2003).

At present, ICES has not provided specific guidelines or recommendations on approaches to standardise catch rates. So far, the methods applied by the WG were based on current practices in the national laboratories, and these are reviewed below.

Application of a catch proportion threshold for target species

This procedure consists in selecting those fishing trips where a minimum proportion of the targeted species has been caught. This procedure is currently used to calculate abundance indices for the Icelandic trawlers and longliners harvesting blue ling, ling, tusk and greater argentine in Division Va (Sections 5.2-5.5), and also Faroese trawlers harvesting blue ling, black scabbard and roundnose grenadier in Vb (Section 7). It has also been used in the past to derive French CPUE series (see e.g. ICES WGDEEP00, WGDEEP02, WGDEEP04).

The main advantage of this method is its simplicity, and also the fact that it may be applicable when information on fishing gears and spatial distribution of fishing effort is impaired. However, it has a number of limitations. First, by filtering in fishing trips above a certain catch proportion level, one may give an optimistic view of the state of the stocks. In particular, it may wrongly lead to rejecting fishing trips targeting a given species, but which have been unsuccessful in catching it, because that species has been depleted. Second, this procedure is probably inadequate for species subject to heavy and unaccounted discarding (e.g. roundnose grenadier), in which case the catch data reported in official log-books are not adequate to reflect exploitation profiles.

Statistical analyses

GLMs have a long history of application in standardising CPUE in relation to stock assessment (e.g. Robson, 1966; Gavaris, 1980; Kimura, 1981; Large, 1992; Maunder and Punt, 2004).

GLM was used as the standardization method to adjust the CPUE trends of several species from the Azores bottom longline fishery, namely of blackspot seabream, 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 since the coefficients derived from these analyses can be directly used to standardise 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).

Selection of reference fishing grounds

Fishing vessels are continuously adapting their strategies to prevailing conditions. This may result in differences from year to year in the fishing grounds being visited. In the case of deep-sea fisheries, it is believed that previously unfished grounds have recently been explored in relation to e.g. roundnose grenadier fishing. Calculating CPUE over the whole range of fishing grounds visited in a year may therefore lead to an inadequate representation of stock abundance.

An approach has been pursued for the French trawlers harvesting blue ling, roundnose grenadier and black scabbardfish (see WD11 in ICES WGDEEP06 report). Reference zones, including both traditionally exploited and new fishing grounds have been identified, and CPUE indices calculated in each of them. The fishing activities in the 'New grounds', which largely contribute to the deep species landings in recent years, are clearly separated.

The main benefit of this approach is that it improves the consistency of the CPUE series, within each reference grounds selected. There are two difficulties though. First, if there are strong inconsistencies in CPUE across major fishing grounds, it may be impractical to derive a coherent abundance index covering the whole stock area. Second, the reference fishing grounds consisted of a set of ICES rectangles. However, some ICES rectangles comprise a wide depth range may be visited by vessels targeting deep-sea species but also shallower-water species (e.g. monkfish or hake).

Analysing haul-by-haul catch and effort data

CPUE from the French observer program were available. As the program started in recent years, they do not yet provide sufficient time series. However, they provide CPUE at individual hauls scales which brings new information to the working group. In the French observation program, the data includes the target species of each tow, this information is provided to observers by the skipper during the trawl tow.

CPUEs of roundnose grenadier (Figure 3.5.1) and blackscabbard fish (Figure 3.5.2) per depth and per target species were computed. This new data indicate that, catches of roundnose grenadier are quite similar when skippers targets are roundnose grenadier and miscellaneous deepwater species and much smaller when targeting blackscabbard fish. The highest catch rates of roundnose grenadier are obtained when targeting this species in deep waters. Similarly, for CPUEs of blackscabbard fish, tows targeting this particular species provide higher CPUE.

This highlights the ability of the fishery to target individual species which does not appear in catch and effort statistics aggregated by statistical rectangles.

The WG viewed these results at a late stage in the meeting, and did not have time to investigate them thoroughly. Therefore, these results should be treated only with great caution until further examination.

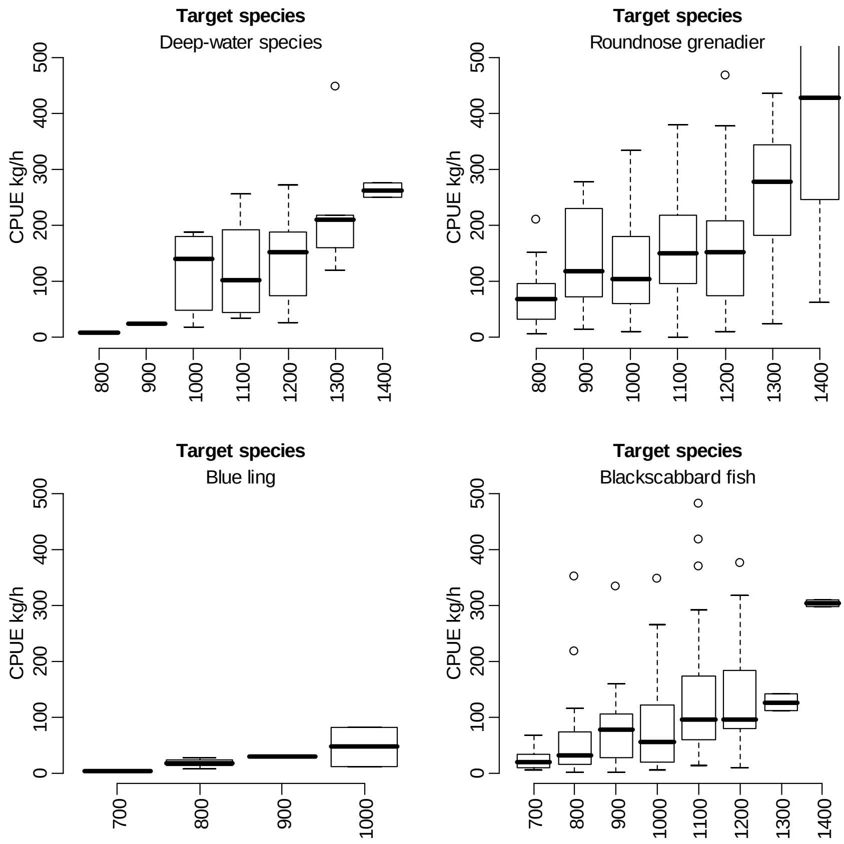


Figure 3.5.1. CPUEs from the French observer program. CPUE of roundnose grenadier per hour hauling and per depth when targeting deepwater species (upper left), roundnose grenadier (upper right), blue ling(lower left) and blacksccardfish (lower right).

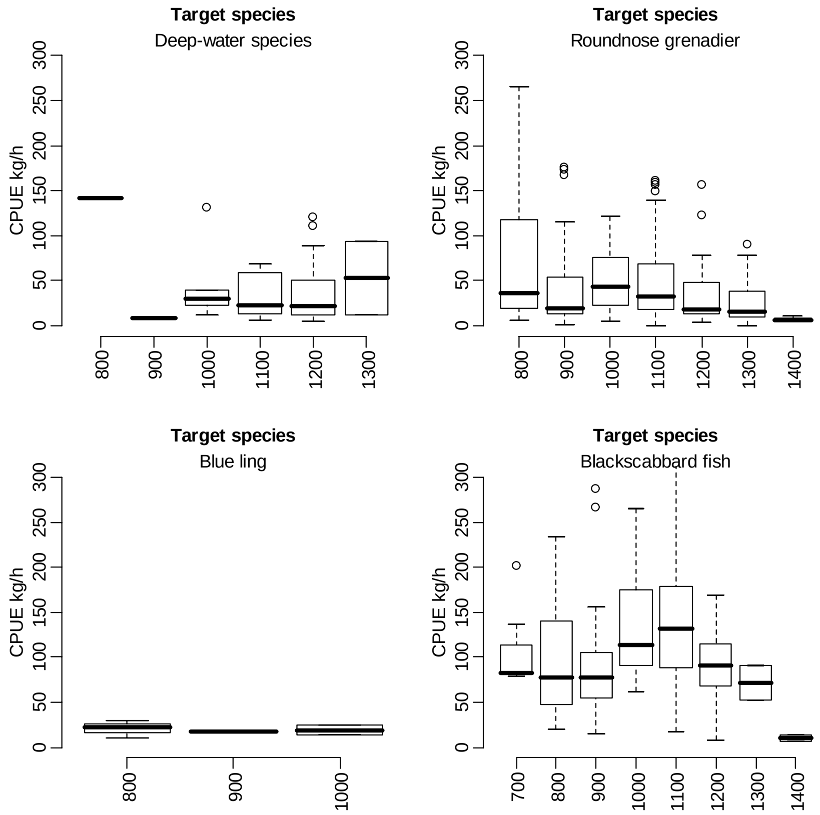


Figure 3.5.2. CPUEs from the French observer program. CPUE of Blackscabbard fish per hour hauling and per depth when targeting deepwater species (upper left), roundnose grenadier (upper right), blue ling(lower left) and blacksccardfish (lower right).

3.5.3 Recommendations of WGDEEP as to CPUE standardisation

The WG made some recommendations for internationally coordinated deep-water surveys (Section 18). If these take place, the first useable survey indices would not be available before 2015. In the meanwhile, the WG will still have to rely heavily on CPUE as abundance indicators. Although using CPUE is a concern to WGDEEP, it probably also applies to other assessment WGs. Within its own remit, the WG made the following recommendations.

- To choose a reference fleet is believed to be an appropriate preliminary filter. This however does not prevent from applying any of the standardisation methods mentioned above (statistical analyses, selection of reference fishing grounds).
- To systematically standardise the CPUE used in stock assessments. In doing so, a limited number of protocols should be followed, and these should be formatted as much as possible, to facilitate traceability and quality control. In doing so, it is suggested that a suite of common codes (written in e.g. FLR or SAS) be developed and delivered to stock coordinators.
- To convene an ICES SG, involving stock coordinators from WGDEEP, but also from other assessment WGs. The remit of this SG would be to identify protocols and develop the common methodological approach for CPUE standardisation.

4 Stock Identity (report of the SIMWG workshop)

4.1 Introduction

Stock assessments rely heavily on the capacity to identify stock units. For many species, and not specifically deep-sea species, the scientific basis underlying stock definitions has been rather loose. In the case of deep-sea species, the criteria used to identify stocks built on either limited bio-geographical information (e.g. direction of currents, natural barriers, fish ecology), or practical considerations (e.g. stocks caught in the same mixed fishery were assumed to have a similar geographic distribution).

Since these stock units have been suggested, WGDEEP has repeatedly stressed the need for enhancing the scientific basis underpinning these definitions. In its 2006 resolutions, ICES recommended that a 3-day workshop on stock identity should be held in 2007, under the auspices of WGDEEP, for the deepwater stocks of ling, blue ling and tusk, with invited experts from SGSIM, to review existing knowledge and submit new information on stock identity for these species.

The group followed two routes of investigation. A first sub-group carried out a general literature review of the different methods and indices used to differentiate between fish stocks. The report of the first sub-group is provided in Section 4.2. A second sub-group reviewed published and unpublished information available on specific deep-sea species. The species considered included those initially targeted in TOR a (blue ling, ling and tusk), but also a selection of species chosen on the basis of expertise available in the workshop (greater argentine, roundnose grenadier, black scabbardfish, red seabream). The report of the second sub-group is provided in Section 4.3. General conclusions as well as recommendations of the future of this workshop are given in Section 4.4.

4.2 Methods for the identification of deep-sea fish stocks

4.2.1 Objectives

The present section is aimed at *a)* **reviewing** the current methods employed in describing the stock structure of deep-sea fisheries resources, and *b)* **critically evaluating** their usefulness and their likely future role in influencing management strategies.

The vast majority of such methods have long been tested and optimised in the context of more "traditional" coastal and shelf stocks (Cadrin et al., 2005), and are now being applied to deep-sea resources as the exploitation rates of the latter steadily increase. In general, the advantages and caveats of each method are well known, however, due to the less accessible nature of deep-sea species, a number of limitations apply, requiring a specific reappraisal and some recommendations for the near future.

4.2.2 State-of-the-art

4.2.2.1 Fisheries data

Commercial fisheries are an important source of information for studies of stock structure. They provide opportunity for inexpensive collection of biological samples in seasons and areas not covered by surveys, and fishing records can also be used as indications of stock structure.

Data which describe the distribution and abundance of fish, at various stages in their life history, are collected routinely to assess the status of fisheries. Geographic differences in age-or size-composition of catches by a given gear type could suggest independence of recruitment or other biological or fishery factors as a basis for assuming stock discreteness (Begg and Waldman 1999). Landings data or standardised CPUE from the commercial fishery provide a valuable indication of general population distribution and movements. Time to recovery for collapsed fisheries may also indicate stock independence.

New data from fisheries have become available in recent years or could be available in the near future.

Furthermore, an EU-implemented regulation for increased **On-board observations** (EU Council reg. 2347/2002 of 16/12/2002) now provides catch and effort data at the scale of individual hauls. Compared to fishery statistics, on-board observations provide additional data on discards (therefore distribution and abundance of juveniles and non commercial species), fishing depth, haul by haul catch composition (therefore species associations). The distribution of juveniles is a lesser known component of deepwater population.

The **Vessel Monitoring System** (VMS) informs on the distribution of fishing vessels and a filtering method can allow for the separation of steaming time and fishing time. At least in some sectors, such data can inform as to whether the fishing effort is scattered or concentrated on a few locations. For aggregating species, such as blue ling (*Molva dypterygia*) at spawning time, this may be of help to assess if the fish distribution is rather continuous or scattered and even allow for an estimate of the distance between aggregations.

4.2.2.2 Distribution and life-history

The collection and the examination of catch data from research surveys and commercial landings may also be used to attain an idea of the distribution of the various life stages of target species (Pawson & Ellis, 2002).

Life-history parameters, such as growth rate, maturity, fecundity, age structure, sex-ratio, etc. can also be examined across putative stocks, in order to identify management units. As suggested by Begg (2005), life history parameters should be the first data examined in any stock identification study and the information derived from these parameters could be used to describe stock boundaries at a range of spatial scales that may assist in directing future studies to refine stock descriptions using more sophisticated techniques.

Undoubtedly, given the poor knowledge of deep water species, the collection of basic life-history and ecological data is an essential pre-requisite for the succesful identification of stocks.

4.2.2.3 Meristics and morphometrics

Morphological variation has been used to classify putative stocks of orange roughy (*Hoplostethus atlanticus*) in both Australian and New Zealand fisheries (Elliott et al, 1995; Haddon & Willis, 1995), but seldom the patterns identified have been found to be consistent with the stock structure inferred by genetic techniques (Elliott et al, 1994; Kojima et al, 2001; Ward & Elliott, 1993). Morphometrics and meristic counts have occasionally proven to be informative in some other cases, such as the blue hake *Antimora rostrata* (Kulka et al, 2001), the ophidiid *Neobythites stefanovi* (Uiblein, 1995), and the deep-sea osmerid *Glossonodon semifasciatus* (Jayasinghe & Kawakami, 1974), but the application of such methods in stock identification is likely to be practically useful only when in conjunction with genetic information, as shown also in low-mobility gastropods (Iguchi et al, 2004; Iguchi et al, 2005). Meristic characters are generally set early in ontogeny and remain stable throughout life; thus reflecting environmental effects over a relatively brief time of larval development (Begg & Waldman 1999). Because of this, significant statistical differences can occur within a stock among year classes or geographic subgroups subjected to varying environmental conditions.

Most morphology-based techniques can have high statistical power, but morphological variation is strongly affected by environmental variation during the ontogeny, and its heritability is hard to estimate as deep sea fish cannot be reared in controlled conditions. Moreover, the most sophisticated analytical techniques are very time-consuming, and these seem to represent great limitations for the future development of morphometrics as "stand-alone" methods.

4.2.2.4 Genetics

Several molecular genetic markers have been employed over the last two decades in order to assess the patterns of spatial structure and the degree of connectivity of exploited stocks. Initially, the technique readily available was the analysis of **allozyme** polymorphisms, which allowed for the identification of stock structure in orange roughy (Elliott et al, 1994; Smith et al, 1997), unveiled some diversity trends in macrourid species (Oyarzun et al, 1993), but proved inconclusive in the redfish *Sebastes mentella* (Johansen et al, 2000). In general, the levels of genetic allozymic polymorphism in deep-sea fish are remarkably lower than in other species (Siebenaller, 1978), and this seems to be the case also in deep-sea invertebrates (Drengstig et al, 2000). While it is unclear as to whether such low degree of genetic variability may be due to balancing selection (Karl & Avise, 1992), it is evident that this – alongside the requirement of fresh/frozen material for analyses – strongly limits the informative power and the efficiency of allozymes in stock identification.

As soon as PCR technology became available, new DNA-based markers were employed, with **mitochondrial DNA** (mtDNA) being to date the class of marker most successful at providing scientists with new insights into the genetic structure of deep-sea fish. The evolutionary history of black scabbardfish (*Aphanopus carbo*), alfonsino (*Beryx splendens*), the bluemouth (*Helicolenus dactylopterus)*, the patagonian toothfish (*Dissostichus eleginoides*), the orange roughy, the deep-sea eelpout (*Bothrocara hollandi*) and others, has been illuminated by mtDNA studies (Stefanni & Knutsen, 2007; Rogers et al, 2006; Aboim et al, 2005; Kojima et al, 2001; Hoarau & Borsa, 2000). More recently, the development of species-specific **microsatellite** markers have allowed to complement the haploid, maternally-inherited mtDNA information, with co-dominant, highly sensitive nuclear information. A number of studies using both mtDNA and microsatellites were able to characterise exhaustively the patterns of present-day population connectivity among stocks, and their most likely recent evolutionary history. Consequently, the stock structure of patagonian toothfish (Rogers et al, 2006), red black-spot seabream (*Pagellus bogaraveo*) (Stockley et al, 2005), orange roughy (Smith et al, 1997) have been greatly illuminated by the application of genetic methods, and revealed various spatial patterns that should be taken into account in management decisions. The hydrographic features of ocean basins, the topographic and geomorphological characteristics of the sea bottom, and possible effects of human exploitation and disturbance are believed to be the major forces in shaping the structure of deep-sea stocks (Rogers et al, 2006; Aboim et al, 2005; Stockley et al, 2005; Roques et al, 2002; Kojima et al, 2001).

Considering the difficulty of conducting experimental/observational/behavioural studies on deep water fish, genetic inference is likely to become an essential tool for the understanding of the stock structure of these species.

4.2.2.5 Otolith analyses

Otolith techniques employed in stock identification fall into two main categories: **chemical** (trace element composition) and **morphometric** (elliptic fourier analysis). In terms of chemical composition, the main constraints seem to be the relatively little variation in water chemistry across large portions of the deep-sea environment, which made the application of this method inconclusive in *Sebastes mentella* (Stransky et al, 2005), but rather more promising in *Aphanopus carbo* (Swan et al, 2001). The intraspecific levels of otolith shape variation proved sufficient to discriminate between orange roughy stocks (Gauldie & Jones, 2000), whereas the lack of spatial otolith shape variation in *Sebastes mentella* was interpreted as a likely absence of stock differentiation (Stransky, 2005).

4.2.2.6 Tagging

Tagging fish is one of the earliest approaches to the study of stock structure. Moreover, tagging studies may also provide data for age validation and growth determination, which are themselves an important component of stock identification studies (Pawson & Ellis, 2002).

Many factors are known to affect the probability of tagging fish being recaptured, such as: the choice of tag, the fishing gear, the handling of fish (Pawson et al., 1987) as well as the condition of the fish after tagging and the possible shedding of the tag (Beverton and Bedford, 1963). The most obvious difficulty in tagging deep water species is the health conditions of fish, after the dramatic pressure stress during the ascent. This is strongly affected by the fishing procedures selected and of course by the physiological resistance of each species.

Thus, in spite of the numerous tagging experiences carried out in pelagic (tunas, billfishes, sharks..) and demersal species (hake, sharks and skates), only a minority of deep water species could be used in tagging studies. To the best of our knowledge, only seven species have so far been studied using tagging methods: *Pagellus bogaraveo* (Gil et al., 2001; Sobrino & Gil, 2001), *Hoplostethus atlanticus* (Latrouite et al, 1999) and more recently *Sebastes mentella* (Sigurdsson & Thorsteinsson, 2004, Sigurdsson et al 2006).

4.2.2.7 Parasites

The identification of parasites and the quantification of parasitological parameters such as abundance and prevalence can be used in stock identification of deep water species. Moreover, “parasite tags” have certain advantages over other stock identification methods in deepwater fishes, for which for example artificial tags can either be used with difficulty or not at all. The application of parasites as biological markers of stocks has been used for many years in many teleost species to interpret the migration routes, the feeding and spawning areas, and other population aspects, but only in very few cases to date has this approach been applied to deep sea fish: Greenland halibut (*Reinhardtius hippoglossoides*) (Arthur & Albert, 1994), orange roughy (Gauldie & Jones, 2000) and deep-sea redfish (*Sebastes mentella*) (Saborido-Rey et al, 2004).

General results and conclusions on the usefulness of parasites as biological tags for stock discrimination of marine fish have been published recently as a guide showing the best procedures to apply this methodology (MacKenzie & Abaunza, 1998, 2005), and a book on the taxonomy of deep sea metazoan parasites is also available as an important benchmark for future studies (Klimpel et al, 2001).

4.2.2.8 Other methods

Concentrations of **contaminants** vary with levels in the environment. Separate stocks of a species may also have differences in their levels of contamination as a result. Organochlorine contaminants have been used to determine stock affiliation of marine mammals (Aguilar 1987; Aguilar et al 1993; De March & Stern 2003; De March et al 2004; Innes et al 2002), whereas little information is available on the application of this methodology to fish. There has been some study of contaminant levels in deep-sea fishes including PCBs (Bergstad and Hareide 1996) and heavy metals (Mormede and Davies 2001, Cronin et al 1998, Vas et al. 1993, Windom 1987). However, these studies did not make any attempt to apply their findings to the definition of stock structure.

Intraspecific variation in **fish feeding habits** is known to occur amongst different areas. For example, the diet of adult cod on the Grand Banks is dominated by capelin, the eastern Scotian Shelf cod diet is comprised mostly of sandlance whereas cod on the western Scotian Shelf feed predominantly on herring. These differences in diet could be used as an additional line of evidence when using other, more reliable methods to identify stock structure. Care must be taken when interpreting these data as many factors can influence diet, such as season, prey abundance, ontogeny, etc.. Some methods for studying fish diet include gut content analysis and stable isotope analysis. Gut content analysis only provides information on most recent prey, and very large sample sizes would be required for generalists. Stable isotope analysis of predator tissues provides only trophic level information on diet, but it can also be used to detect differences in diet. Not a lot of research has been conducted on the use of diet to provide evidence of stock structure.

Fish species have unique **fatty acid signatures** (Ackman 1980), and differences in these profiles can potentially be used to infer aspects of population structure, as shown by Jensen & Grahl-Nielsen (2004), who suggested the existence of some degree of substructure in redfish (*Sebastes mentella*).

4.2.3 Candidate novel approaches

4.2.3.1 Ocean circulation models

Hydrological features have been suggested as factors for deepwater fish distribution. In relation to their morphology, diet, behaviour, etc, species are dispersed or aggregated on some bathymetric and/or hydrological features. In particular, orange roughy is presumed to be associated to fronts, areas of increased current/turbulence (Clark, 1995, Koslow, 1997, Lorance et al. 2002).

For shelf species, circulation carries particles and passive organisms such as planktonic stages and therefore has major effects in structuring populations (Edwards et al., 2006). Hydrological features are major factors structuring marine populations. For example upwelling zones (Ayers and Waters, 2005) have been suggested to act as barriers to larval dispersal of shelf organisms. Physical circulation models and genetic measures of larval transport can be coupled to assess the geographic scale of larval dispersal in marine environments (Gilg and Hilbish, 2003). In the deepwater, hydrographic factors might also be important and the current ICES view of stock structure of deepwater species relies partly upon large scale water masses distribution, even though the actual knowledge is very sparse.

According to differences in the early life history of deepwater species, larval dispersal might vary. The distribution of these early stages in the water column is still poorly known but there are striking difference between species. For example, the orange roughy eggs have a positive buoyancy, after being spawned at depth, they rise to the upper mixed layer in about 50 hours and stay there for about 150 hours before sinking again, they are believed to hatch on the bottom (Bulman and Koslow, 1995; Zeldis et al., 1995, 1998). This species, also spawns on discrete locations, and it seems to have a complex stock structure (Dunn, 2006). The roundnose grenadier has a different early life history with a pelagic stage (including egg and larval stages) estimated to last for about one year (Bergstad and Gordon, 1994).

The circulation of the northeastern Atlantic Ocean at intermediate depths is characterized by water mass transformation processes that involve Iceland–Scotland Overflow Water (ISOW) from the northeast, Labrador Sea Water (LSW) from the west, and Mediterranean Water from the south (Lankhorst and Zenk, 2006). Progress is being made on the understanding of smaller scale circulation features (e.g. Getzlaff et al;, 2006). However, much less data than in shallower waters are available, which make circulation models less accurate. Some process may not yet be properly represented and uncertainty is likely to remain high for several years.

These problems may be even more important along the slope were complex circulation/bathymetry interactions occur.

4.2.3.2 Acoustics

Historically the use of acoustic methods in fisheries and marine research has been focused in the study of behaviour of species and in biomass estimations of stocks of pelagic demersal fish and zooplankton.

Acoustic surveys combined with trawling for the identification of the acoustic registrations provide data on distribution, abundance and species composition of small pelagic resources. For biomass estimation, previous knowledge of Target Strength (TS) of target species is necessary (which depends on its behavioural, anatomical, physiological features), and the record of echograms in the surveys must be combined with simultaneous hauls of the school in order to identify the species detected by the sounds and the size range of individuals. More refined behavioural studies by means of acoustics (e.g. tunas and sharks) require the use of individuals tagged with electronic tags and tracking systems able to record information about vertical and horizontal movements and even physiological information on the fish (temperature, stomach pH).

The stock identification of deep water species presents the same problems described for pelagic ones, but the larger distance travelled by the beams and the sloping deep-water bottom make the detection of the species living in the deep more difficult than that of species living higher in the water column. However there are recent examples of acoustic surveys focused to the estimation of aggregated biomass and temporal and spatial dynamics of aggregated schools of deep water species (orange roughy; Hampton & Soule 2003).

As described above, the use of acoustic methodologies is useful in studies of biomass estimation and for the description of the behaviour and geographical distribution of fish populations (Melvin et al. 2001, Gauthier & Rose 2002, Boyra & Uriarte 2006).

4.2.3.3 Direct observation

In deepwater, direct visual observations have been used to estimate the density of some species and to study behaviour, small scale habitat preference, catchability (e.g. Bailey & Priede, 2002; Koslow, 1995; Lorance & Trenkel, 2006; Trenkel et al., 2004; Zaferman, 1991). Its application in stock structure investigations is likely to be ineffective.

4.2.3.4 Underwater tagging

Underwater tagging (in situ tagging) is a relatively new method developed in Iceland (Sigurdsson and Thorsteinsson, 2004, Sigurdsson et al. 2006b). Traditional tagging methods of fish typically involve catching specimens at depth with various types of fishing gear, bringing them to the surface, and on deck, where the fish are transferred to containers with seawater and the survivors tagged and released (Thorsteinsson 2002). However, a rapid trip to the surface remains a major hazard for the survival of fish in a tagging experiments (Jakobsson 1970, Jones 1979, Bone et al. 1996) and often results in death. In this respect, various redfish species have been considered impossible to tag by these conventional methods as they are especially vulnerable to pressure change, and suffer total mortality when hauled to the surface by conventional fishing gear. The advantage of underwater tagging for marine fish (in situ) are:

- The Underwater Tagging Equipment (UTE) is specially designed for tagging deepwater fish that cannot survive changes in pressure and surface temperatures.
- It prevents the need for hauling the fish to the surface for tagging and release.

- Less time is spent in handling the fish, which leads to increased tagging efficiency.
- Fish is tagged in its natural environment, avoiding stress factors as pressure and temperature changes and therefore decreases tagging mortality.

Deep-sea redfish have been successfully tagged on traditional fishing grounds (Sigurdsson & Thorsteinsson 2004, Sigurdsson et al. 2006b) using this novel system.

In total, 2,441 deep-sea redfish have been tagged, with 41 fish being recaptured. Results show that most of the fish were recaptured in the vicinity of the area where they had been tagged and released, although the longest dispersal distance was 320 miles. The time between release and recapture ranged from one day to more than 49 months. The fish recaptured after 49 months was caught 22 miles away from its tagging site

4.2.4 Methodological recommendations for the future

On the basis of what examined in the working group, a number of important points are raised, hoping they will serve as complementary guidelines to drive future directions of research, monitoring and management.

1) Given the increasing fishing pressure on deep-sea resources, it is paramount to put effort into well-coordinated research and monitoring activities. A greater level of communication among institutions and countries is needed, and organisations such as ICES can play a pivotal role in promoting and maintaining healthy transnational networks of investigators.

2) A higher deegre of communication will allow for a more efficient use of time and energies aboard scientific cruises and surveys, ensuring the collection of as many data as practically possible. For instance, it is strongly advised that tissue samples for DNA analysis be taken and stored for each specimens that is handled/examined for other analyses. This should be done even if no on-going genetic studies are being carried out on a certain species, as such material might prove invaluable in future years. It is worth mentioning that up to 15,000 tubes with ethanol-preserved finclip or muscle samples can be contained in as little as 1 m^3. Fish scales are also a good source of DNA and do not require ethanol for preservation.

3) Genetic methods will become more and more useful and cost-effective. Both mtDNA and microsatellites (or other available nuclear markers) should be employed, as the two classes of markers can complement each other, by providing a clearer picture of the evolutionary history of the studied stocks (mtDNA is more informative on the historical events, post-glacial expansions, colonisation routes after sea-level changes, etc., whereas microsatellites are more effective in detecting fine scale structure and present-day patterns of gene-flow).

4) Morphology-based methods are unlikely to represent a pivotal tool, unless they are coupled with genetic information. The reasons for this stem from the time-consuming nature of the most sophisticated morphometric techniques, to the impossibility to set-up common garden experiments to disentangle the effects of genetic adaptation from environmentally-induced phenotypic plasticity.

5) Ocean circulation modelling and methods borrowed from landscape ecology (GIS, remote sensing) are likely to increasingly provide help in stock identification, as hydrographic dynamics and topographical features are among the main factors in determining patterns of deep-sea fish stock structure. For instance, 3D GIS analysis could be used in conjunction with genetic identification to create "stock maps" and predict patterns of stock units and their physical boundaries.

6) Advances in otolith microchemistry should be explored further in order to effectively test its efficiency in detecting migration routes also in the less chemically variable deep waters.

7) Less invasive underwater tagging methods could be employed more extensively, provided that better coordinated large scale efforts are made, and that the experiments are advertised adequately, in order to maximise recapture rate and areas covered.

8) In June 2007 a new integrated project funded by the European Science Foundation within the Eurocore/EuroDEEP framework will start on the population structure of deep-sea fish between the Mid-Atlantic Ridge and the Norwegian trench. The project, entitled “DEECON”, will employ mtDNA, microsatellites, otolith microchemistry and oceanographic circulation modelling to study patterns of stock structure in *Aphanopus carbo, Molva molva, Coryphaenoides rupestris, Macrourus berglax, Centrophorus squamosus*. The project will involve scientists from IMR, Bergen and Oslo University, Norway, DOP, Portugal, UCD, Ireland, and FRS MarLab Aberdeen, UK. Results will begin to be available in 2009.

4.3 Indicators of stock identity available to WGDEEP

4.3.1 Objectives

The group focused on seven species (blue ling, ling, tusk, greater argentine, roundnose grenadier, black scabbardfish, red seabream). For each of these species, a literature review was carried out to collate the results of past investigations aiming at identifying stock structure. A compilation was then made of all unpublished data provided by WGDEEP members, which could be used to reflect stock structure. The appropriate information provided by WGDEEP members is summarised in Table 4.3.1.

Based on both sources of information (published and unpublished data), the WG made recommendations on future work orientations to improve the scientific basis for stock identity and, whenever possible, the stock structure to be used in future assessments.

Table 4.3.1. Information on stock identity available brought to WGDEEP07 by WG members.

Species	Area	Genetics	Length distribution	Growth	Maturity	Abundance indices
Blue ling	Va		X	X	X	X
	Vb		X	X	X	X
	VIa		X	X	X	X
Ling	II		X			X
	Va		X			X
	Vb		X	X		X
	IV,VI		X			X
Tusk	I,II	X	X			X
	Va	X	X			X
	Vb	X	X			X
	IV,VIa		X			X
	VIb	X				X
	MAR	X				
	Canada	X			X	X
Greater argentine	IIIa					X
	Va		X			
	Vb		X	X	X	X
	VII		X			X
Roundnose grenadier	MAR		X		X	X
	VIb2,XIIb		X		X	
Black scabbardfish	VIa		X			
	IX		X			X
Red seabream	IX		X	X	X	X
	X		X	X	X	X

4.3.2 Tusk (Brosme brosme)

4.3.2.1 Current stock structure

In the 1998 report it was noted that ripening adult tusk and tusk eggs were found in all parts of the distribution area, but the banks to the west and north of Scotland, around the Faroes and off Iceland, as well as the shelf edge along mid and north Norway seem to be the most important spawning areas (Magnússon *et al.* 1997). Nothing is known about migrations within the area of distribution. Studies of enzyme and haemoglobin frequencies showed no geographical structure, hence it was concluded that tusk in all ICES areas, at least in the North-east Atlantic, belong to the same gene pool (Johansen & Nævdal, 1995; Bergstad and Hareide, 1996).

In 2004 the Group concluded that widely separated fishing grounds may support separate management units, i.e., stocks. It was suggested that Iceland (Va) and the Norwegian coast (I and II) have self-contained units, while there are possibly several stocks to the north and west of the British Isles.

Tusk is one of the species included in a Norwegian population structure study using molecular genetics (microsatellite DNA) that was finalized in 2007 (cf. genetic section below). New data from this project reveal a population structure in the North Atlantic, which may require a revision of the current perception of population structure.

4.3.2.2 Literature review

Dispersal biology may provide information about stock structure. However, contrasting results exist regarding the mobility of tusk. Cosewic (2003 and references therein) ascribe a sedentary behaviour to this species while Lumankov et al. (1985) suggest a migrating behaviour between feeding and spawning grounds.

Until recently, only one genetic study (Johansen & Nævdal 1995) on tusk existed. Their main conclusion was a genetic difference across the North Atlantic. However, they note another minor but interesting result from this work, was the finding of a unique allele from Rockall, although there was no identified population structure in the east Atlantic.

Levels of contaminants may indirectly provide information about stock structure, however very few articles are available. Further, it is presently uncertain whether these articles can be used to infer any new insight into potential stock structure for this species, as there are a number of limitations for interpreting the results as evidence for structure (below). Nevertheless, Berg et al. (1997, 2000) demonstrate an elevated level of organochlorine contamination in the Davies Strait, and also they find differences in metal concentration between tuskin a Norwegian fjord than tusk further off the coast. Bergstad & Hareide (1996), found a slightly elevated PCB level in fish from Skagerrak, compared with those in oceanic waters.

Relevant information on:

a) Growth

UK (North Sea)

L inf 89.0 cm; k =0.08 years -1

Faroe Isl

males, Linf 77.6, k=0.16, M=0.22

females, Linf 84.3, k=0.14, M=0.22

b) Maturity

Maturity at age (UK North SEa): 8 - 10 years

Iceland: L50= 57.7 cm

Canada: L50= 43 cm.

TUSK – European stocks (**BROSME BROSME*****)***

Variable	**Value**	**Source/comment**
Longevity (years)	Approx. 20	Bergstad and Hareide 1996, Magnusson *et al.* 1997
Growth rate, K	No data	Growth curves available in Bergstad and Hareide1996
Natural mortality, M	0.1-0.2	Based on review by SGDEEP 2000
Fecundity (absolute)	millions	No exact data available
Length at first maturity	40-45 cm	Magnusson *et al.* 1997
Age at first maturity	8-10 years	Magnusson *et al.* 1997

TUSK - Canadian stock (BROSME BROSME)

Variable	**Value**	**Source/comment**
Longevity (years)	No data	
Growth rate, K	No data	
Natural mortality, M	No data	
Fecundity (absolute)	700 000-2 600 000	At 81 cm (Oldham 1966)
Length at first maturity	♀ 51 cm ♂ 44 cm	Oldham 1966
Age at first maturity	No data	

4.3.2.3 Information available on candidate stock structure indicators

CPUE

CPUE data for tusk are provided by Iceland, Faroese, Norway and Canada. The CPUE series from the Icelandic fishery is calculated using long-line and trawl data.

The Faroese CPUE series for tusk from the long liners are based on catches of ling and tusk that together are more than 60 % of the total catch and the depth >150 m.

The Norwegian data (2000-2006) are based on logbooks from long liners larger than 21 m. 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.

Historical CPUE data are also available for the years 1972-1994 (Bergstad and Hareide, 1996; Magnusson *et al*., 1997).The results from these studies were presented at earlier WGDEEP meetings, and the Group used analyses of time-series for the Norwegian long liners back to 1972 on effort and CPUE as a basis for assessing stock trends.

The Canadian data are the CPUE from the fixed station proportion of the halibut industry survey (average kg/1000 hooks). And CPUE from the NAFO areas 4X and 5Z by long liners, tonnage classes 2 and 3 (tonnes/trip).

The main fishing areas are well covered. Since different gears and methods have been used, comparing the data has to be done cautiously. At present only the Norwegian data are consistent enough to be used to compare areas.

Apart from a substantial increase in CPUE IVa and Vb in 2006, the trends are similar across regions. However, the data cover only seven years (2000-2006) and should not be over-interpreted. Areas IIa and IVa have apparently a lower CPUE than the other areas (cf. Figure 4.3.5), but this is probably because tusk in these two areas are mainly taken as by-catch.

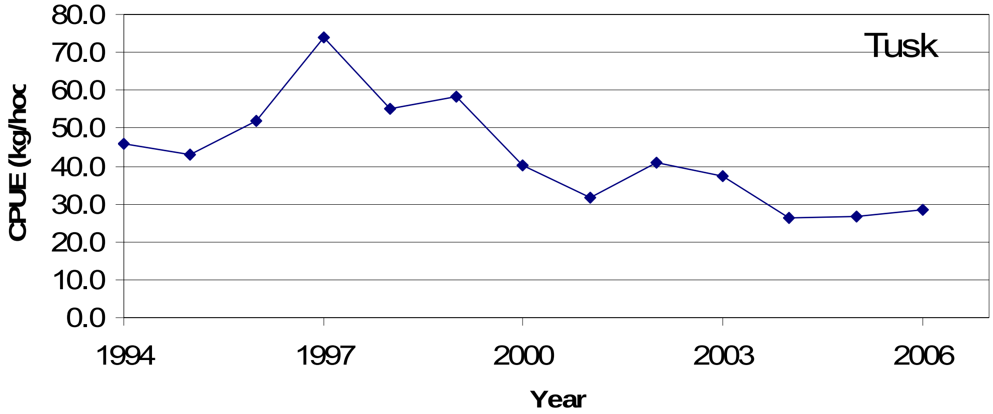


Figure 4.3.1. Tusk catch per unit of effort calculated from the Icelandic long-line fishery.

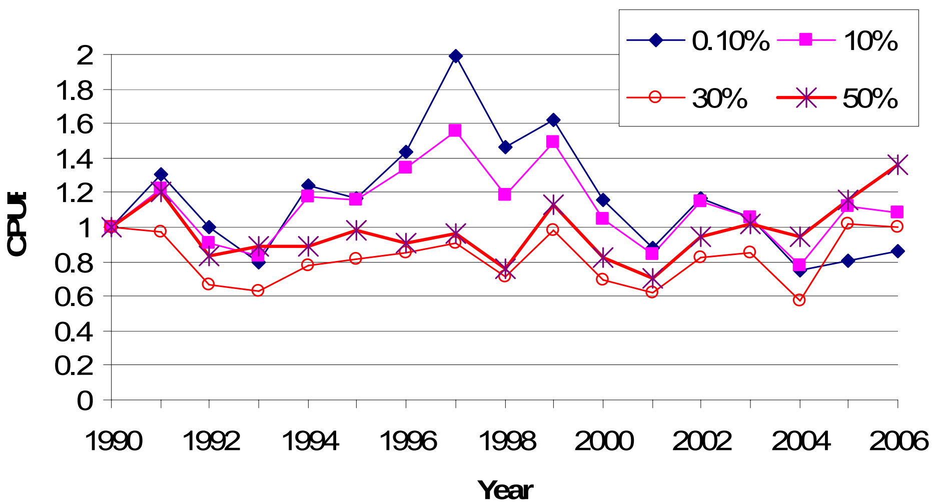


Figure 4.3.2. Tusk catch per unit of effort calculated from the Icelandic long-line fishery, where tusk is more than 0.1, 10, 30 or 50 % of total catch in individual sets.

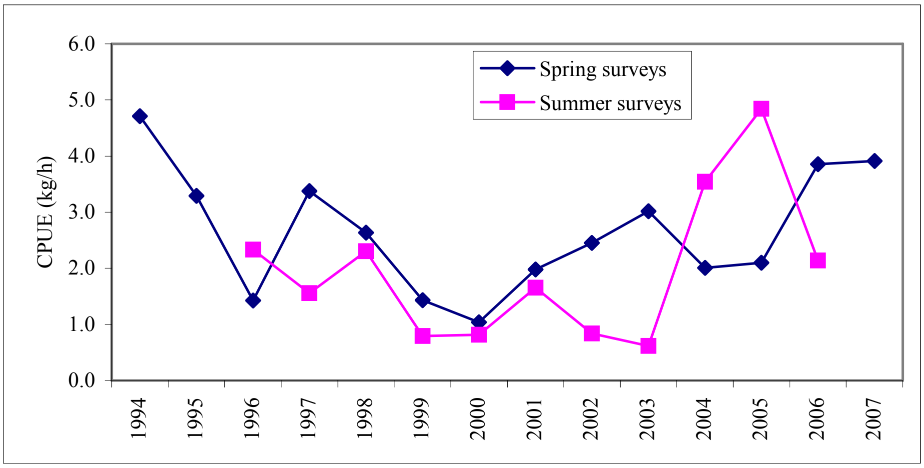


Figure 4.3.3. Tusk in Vb (Faroes).

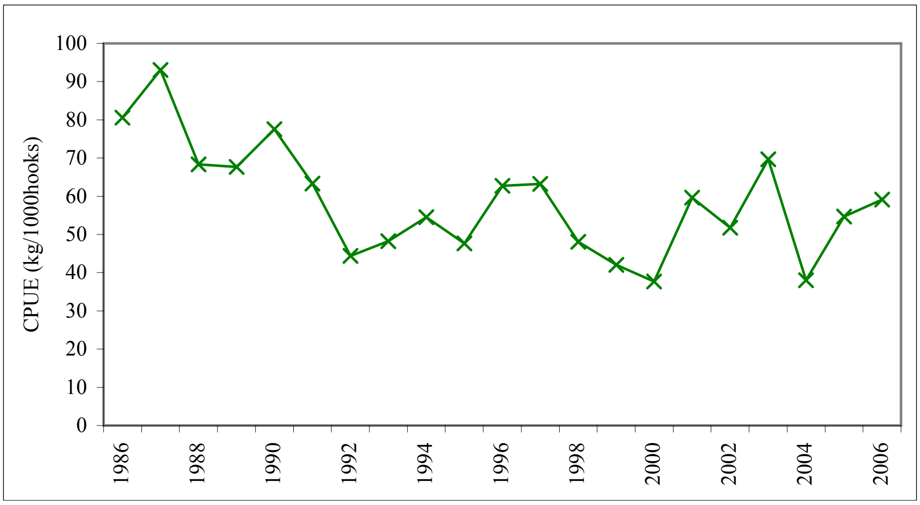


Figure 4.3.4. Tusk in Vb (Faroes). CPUE (kg/1000hooks) from long liners > 100 GRT.

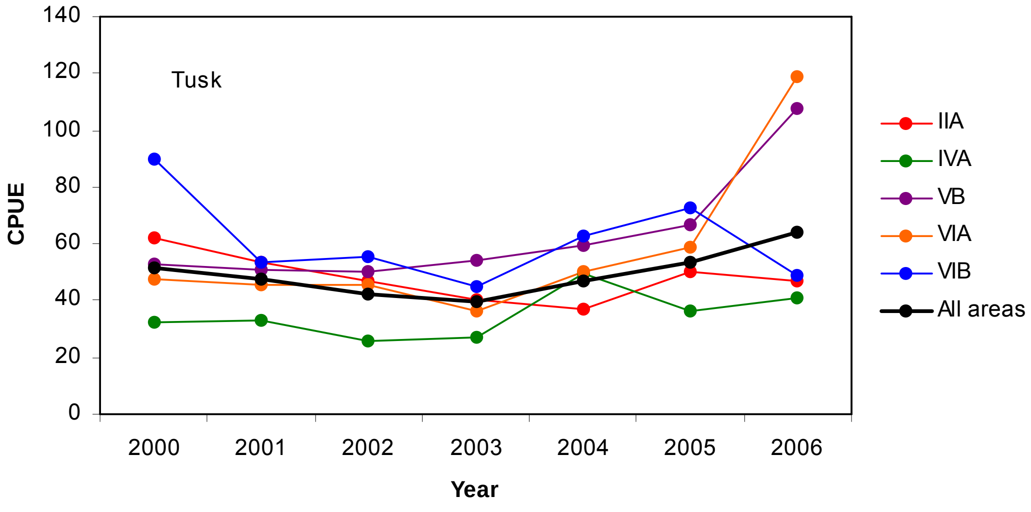


Figure 4.3.5. Estimated mean CPUE ([kg/hook]x1000) based on data from the Norwegian log books for tusk in each ICES subarea and all areas combined for the years 2000- 2006.

Table 4.3.2. Estimated mean CPUE ([kg/hook]x1000) based on log book data along with its standard error (*se*) and number of catches sampled for tusk.

Tusk

	2000			2001			2002			2003			2004			2005			2006		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
I	8,7	101	3,2	22,6	43	4,5	4,2	116	1,9	11,9	141	1,6	3,8	120	3,4	3,5	73	5,1	8,55	15	15,8
IIA	62	1172	0,9	53,2	1903	0,6	47,14	1806	0,5	40,3	1453	0,5	36,7	1065	1,1	50	1046	1,4	46,6	528	2,66
IIB	48,7	17	8	2,5	1	29,4				5,3	5	8,6	2,2	20	8,4	2,7	12	12,7	22,29	4	30,5
IVA	32,6	596	1,4	33,2	686	1,1	25,6	615	0,8	27,1	450	0,9	49,3	437	1,8	36,4	329	2,4	40,63	348	3,27
IVB	18,1	17	8	16,5	2	20,8				45,3	59	2,5									
VA				1,3	1	29,4				105,3	38	3,1	165,2	54	5,1	184	30	6,8	268,81	23	12,72
VB	53,1	375	1,7	50,6	539	1,3	50,1	473	0,9	54,0	478	0,9	59,3	693	1,4	66,6	374	2,3	107,36	128	5,39
VIA	47,6	420	1,6	45,6	398	0,8	45,5	185	1,5	36,4	288	1,1	50,26	307	2,1	59,1	368	2,3	118,7	168	4,71
VIB	89,9	137	2,8	53,5	116	2,7	55,6	149	1,6	44,8	94	2	62,7	111	3,6	72,5	136	3,8	48,63	51	8,54
VIIC	62,7	60	4,3	5	24	6							7,04	23	7,8	15,9	7	14,1			
X				49,2	5	13,1															
XII	51,8	18	7,7	25,9	64	3,7				17,5	9	6,4									
XIVA	63,5	5	14,7																		
XIVB	40,9	84	3,6	48,5	48	4,3	8,8	8	7,1	29,6	33	3,4	17,9	60	4,8						

Length

Length distributions are routinely provided for Iceland (area Va), the Faeroes (area Vb) and for the Norwegian reference fleet (areas I, IIa,IVa, Va, Vb, VIa and VIb). The Icelandic data are from catches (1996-2006) and from the Icelandic bottom trawl surveys that takes place in March (1985-2007).

From the Faroes the length distributions are from the landings from long liners>100 GRT (1996-2006)

To obtain more detailed and targeted information for tusk and ling, the Institute of Marine Research, Bergen, Norway, initiated in 2000 a program to collect data and biological samples directly from selected commercial long-liners, the so-called **"**reference fleet**.**" The fishers measure a subsample of fish at selected locations. Presently four long-liners are members of the reference fleet.

Historical data

Estimating the average lengths was part of the Nordic and a Norwegian project in the Northeast Atlantic (Bergstad and Hareide, 1996; Magnusson *et al*., 1997) and data from this project are available for the years 1976 and 1988-1995.

The length data from the Norwegian long liners show that tusk in areas I and VIb are greater in length than in the other areas (IIa, IVa and Vb) in recent years. The clear difference of area VIb may correspond with the results from a recent genetic study (Knutsen et al. manuscript), finding genetic differences between a sample from Rockall and other sites in the NE Atlantic, however any comparisons should treated with caution because they may reflect changes in fishing regimes. No genetic samples correspond to ICES area I, and the link between the differences in length and genetic population structure, cannot be made.

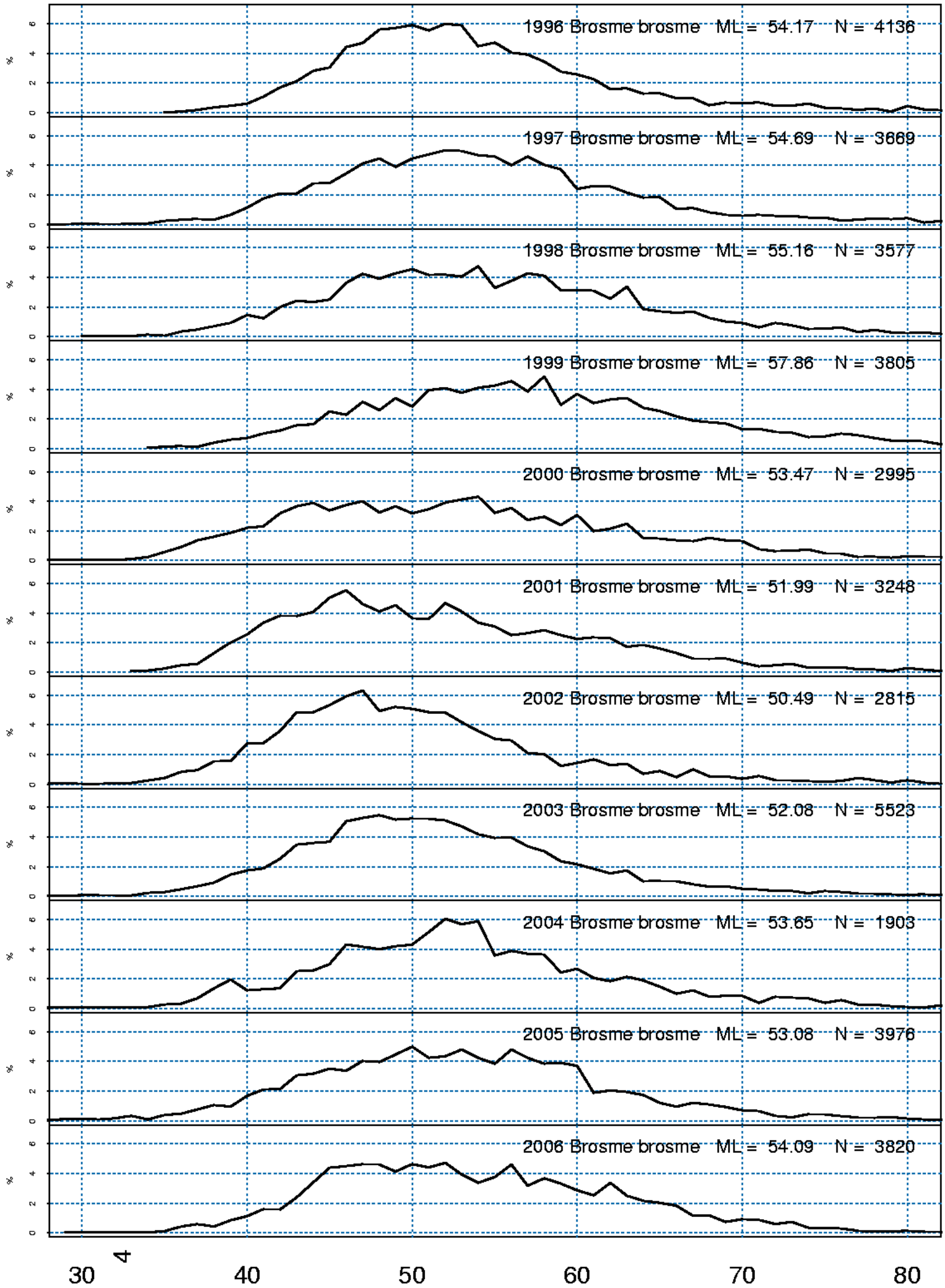


Figure 4.3.6. Length distribution of tusk in the Icelandic catches since 1996. The number of measured fishes and mean length is also given.

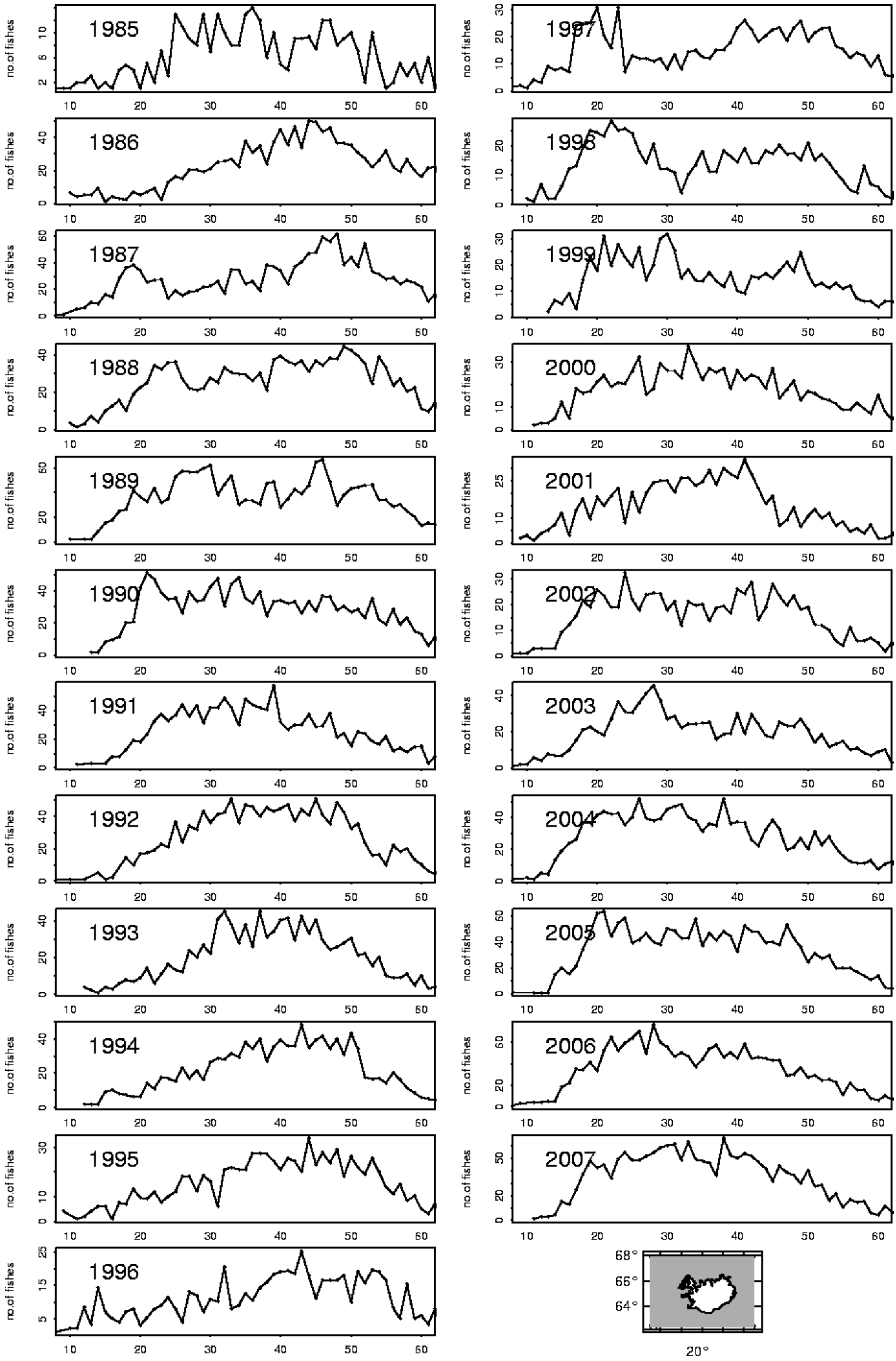


Figure 4.3.7. Tusk length distributions in the Icelandic groundfish survey in March 1985-2007.

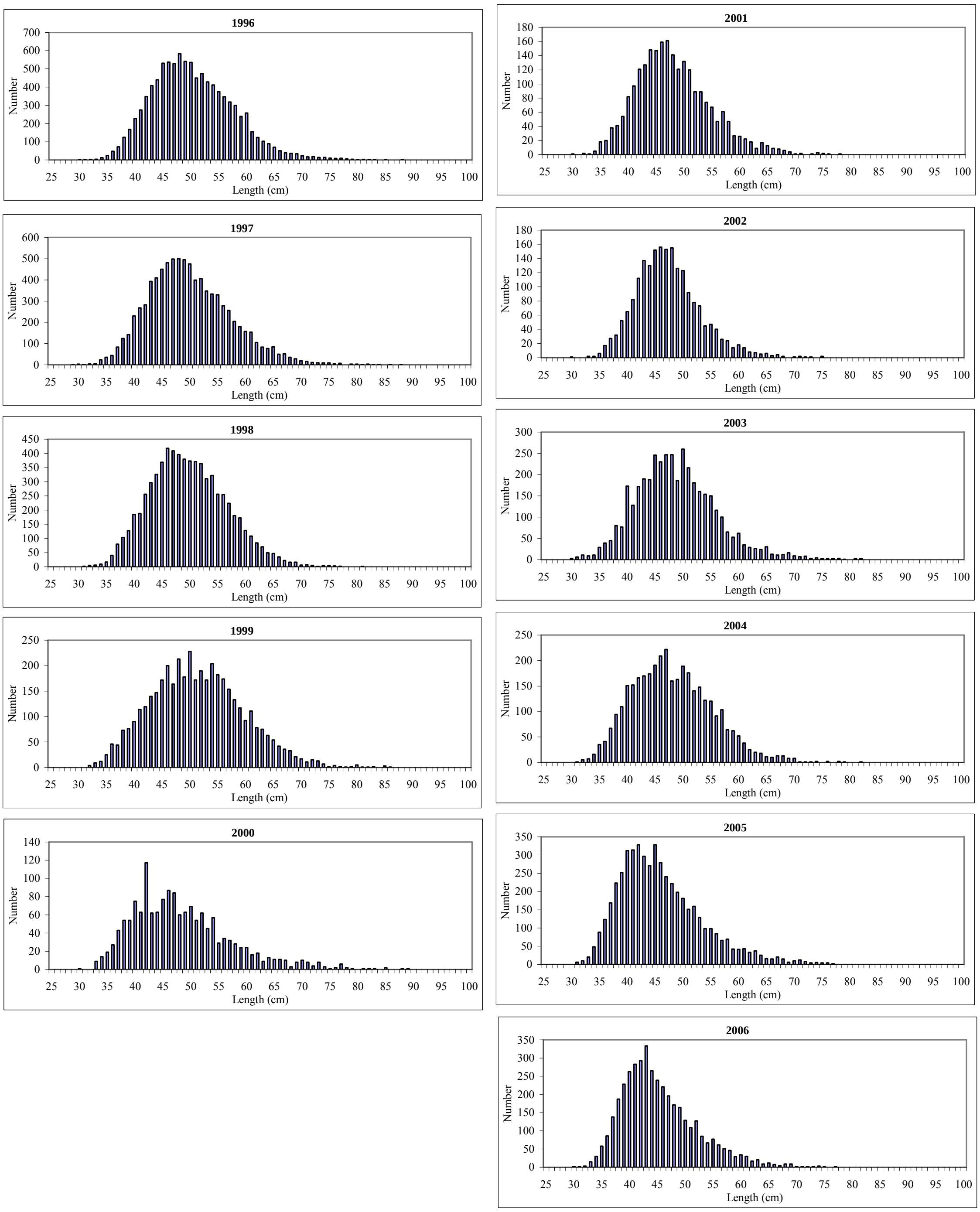


Figure 4.3.8. Tusk in Vb (Faroes). Length distribution in the landings from long liners >100 GRT.

Figure 4.3.9. Estimated mean length of tusk in the period 1996-1995 (Bergstad and Hareide ,1996) and for the period 2001-2006.

Table 4.3.3. Estimated mean length of tusk in the period 1996-1995 are from Bergstad and Hareide (1996). The 2001-2005 estimates along with their standard errors (se) based on the reference fleet data, N denotes the number of fish measured and in parenthesis is the number of stations sampled. The unweighted mean was calculated for 2001, 2002 and areas V and VIb in 2003 and the weighted mean for the other years and areas.

Tusk																
ICES-area	**,**	**1976**	**1988**	**1989**	**1990**	**1991**	**1993**	**1994**	**1995**		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
I	**Mean**									**Mean**		**50,89**	**57,45**	**59,89**	**57,54**	**57,36**
										se		0,61	1,23	0,86	1,1	0,28
	N									N		193 (2)	365 (25)	592 (33)	495(28)	870
IIa	Mean		63,14	50,8	55,39	54,81	50,72	49,78	49,51	Mean	52,68	53,08	49,76	52,56	51,02	51,47
										se	3,9	0,4	0,39	0,29	0,24	0,05
	N		14	1231	1273	865	1374	1837	377	N	4145 (30)	13183(5)	13321 (174)	11986 (278)	15759(268)	25344
IIb										Mean						56,46
										se						0,23
										N						1217
IVa	Mean	60,53	49,89	52,69	53,45		46,8	49,87	54,62	Mean			49,45	50,14	51,79	52,43
										se			0,7	0,67	0,84	0,13
	N	377	976	1329	636		336	1379	1209	N			2465 (22)	3394(80)	3233 (63)	3834
Va	Mean									Mean				57,68		
										se				0,57		
	N									N				1832 (30)		
Vb1	Mean	65,44		57,55		54,23	48,24	52,07		Mean		65,41	54,25	51	49,42	49,58
										se		0,42	1,96	1	0,31	0,15
	N	289		107		139	466	201		N		392 (5)	559(10)	1064 (18)	4916 (82)	3068
Vb2	Mean	63,76		55,78	56,64					Mean						
										se						
	N	142		470	852					N						
VIa	Mean	65,08		57	60,34		54,18	53,67	54,39	Mean			51,74			
										se			0,78			
	N	150		385	973		190	206	72	N			938(39)			
VIb	Mean	67,28		53,33			49,02	54,96		Mean		61,42	64,27		56,93	59,84
										se		0,17	0,87		2,42	0,21
	N	853		945			341	916		N		2365 (11)	2484(49)		180 (3)	3068
All areas	Mean	65,62	50,08	53,12	56,64	54,73	49,84	51,13	53,45		52,68	54,58	51,84	53,33	51,38	52,07
	N	2148	990	4476	3734	1004	2707	4539	1658		4145	16134	20196	18929	24601	35874

Age

Very limited age data are available for tusk and presently no country routinely collect otoliths for age readings for this species. From area Va there are data for the years 1983-1984, 1989-1991 and for 1994-1998. Age reading was part of the Nordic and a Norwegian project in the Northeast Atlantic (Bergstad and Hareide, 1996; Magnusson *et al*., 1997) and data from this project are available for the years 1976 and 1988-1995.

Table 4.3.4. Age readings of deep-sea species since 1981

ar	ling	b.ling	tusk	Gr. silver	Total
1981		199			199
1982		1908			1908
1983		1255	508		1763
1984		435	393	82	910
1986		99		993	1092
1987		164		2204	2368
1988		253		2626	2879
1989	2		4	420	426
1990	131		392	223	746
1991	138		133	114	385
1992	123			117	240
1993	98			113	211
1994	299		194	148	641
1995	808		338	99	1245
1996	934		358	134	1426
1997	957		93	985	2035
1998	1032		259	1075	2366
1999				82	82
2000					0
2001					17
2002					127
2003					0
2004					206
2005					807
2006					1210

Maturity

Maturity data is available from Iceland (area Va) where length at 50 % maturity is 57.7 cm and from Canada.where L50= 43cm.

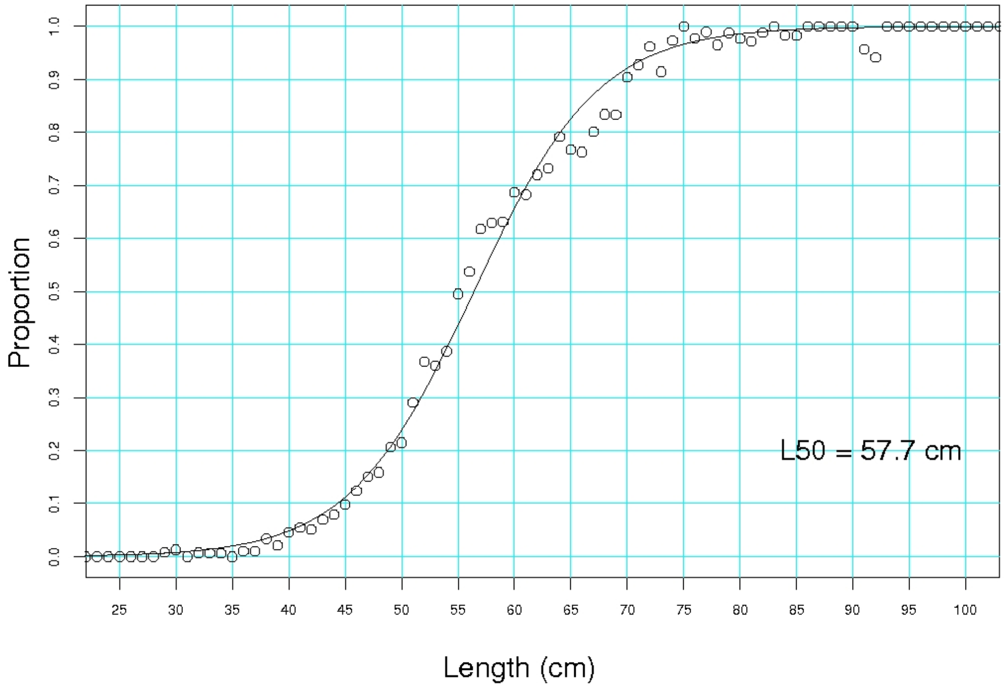


Figure 4.3.10. Tusk maturity. The figure shows average maturity at given length in the Icelandic catches.

Genetic analysis

Earlier studies of the population structure of tusk were hampered by a paucity of suitable polymorphic genetic markers (see Bergstad and Hareide, 1996). In a study of protein-coding loci in the tusk by Johansen & Nævdal (1995), only haemoglobin was found to exhibit any notable variability, whereas the isozyme-coding loci were dominated by a single, common allele at each locus. Significant differences in haemoglobin allele frequencies indicated genetic differentiation across the Atlantic Ocean.

A recent study (Knutsen et al. manuscript) detected statistically highly significant genetic differentiation in tusk (*Brosme brosme*) within its North Atlantic range (cf. Fig 4.3.11 for samples used in this study). Using recently developed microsatellite primers (Knutsen et al. 2007) they found a level of differentiation consistent with a level of migration too low to assume that overexploited populations can be replenished by neighboring ones: a finding that is in accordance with the low mobility ascribed to this species (Cosewic 2003 and references therein). Hence, the results suggest that tusk are probably made up of several population units. The observed level of genetic structure in tusk is comparable to that observed among Atlantic cod populations off Canada (e.g. Ruzzante *et al.* 2001), and is nearly two times higher than what is found in cod between the Skagerrak coast and the North Sea (cf. Knutsen et al. 2003).

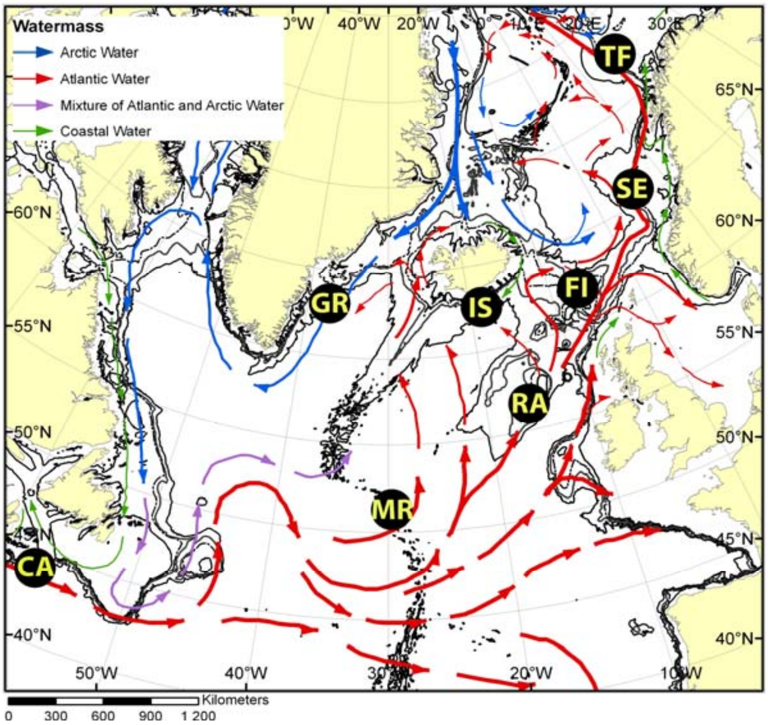


Figure 4.3.11. Map showing sample locations of adult tusk in the study of Knutsen et al. (manuscript). Ocean topography and main currents is also given in the map.

Very little additional information, besides genetics, bearing on the issue of population structure in tusk exists and there are no tagging studies or otolith trace element studies published. Hence, there is limited information to compare and evaluate the genetic patterns against. It has been known since Schmidt (1909) and Ehrenbaum (1909) described occurrence of tusk eggs in European waters, including the Faroe Islands and Iceland, that pelagic eggs and larvae are widespread in fjords and shelf waters (see also Bjørke 1981 and references therein). The potential for intermixing of populations would seem to exist unless circulatory retention processes limit free dispersal. No studies of early life stages of tusk have been sufficiently comprehensive to study such phenomena. Judged by the spatial genetic pattern that we observe, dispersal must be limited at all life stages. If ocean circulation caused gene flow, one would expect samples lying downstream of each other along the prevailing residual current path to be more similar genetically. We find less evidence for this and stronger evidence for structure among samples located in areas separated by great depth. The genetically most divergent samples (from Rockall, the Mid-Atlantic Ridge, and off Canada) all represent either banks surrounded by great depths (Rockall) or areas that are separated by deep ocean basins beyond the normal maximum depth distribution of tusk.

After an early pelagic embryonic and larval stage, adult tusk remains benthic and does not appear to move longer distances (Svetovidov 1986). Migration of tusk along the seabed and across major basins and troughs deeper than 1000m therefore seems unlikely. This is consistent with our findings of limited gene flow over such deep trenches, suggesting that deep water acts to restrict dispersal and promote population structuring in this species. A similar observation has recently been conducted for blue whiting from Rockall, which also is considerable (by a factor of 8-10 times) more genetically differentiated than other sample localities around UK and Ireland (Anna Was, unpublished results, GMIT Ireland). Thus, Rockall appears to harbor distinct populations of several fish species. This is supported by a study on deep sea fish-species on Rockall, finding substantially higher levels of heavy metal concentration than found in surrounding areas (Mormede and Davies, 2001)

The finding of significant genetic structuring in North Atlantic tusk implies that the species within this region does not constitute one single biological population. Instead, we can identify several genetically distinct groups or populations of tusk in the North Atlantic. In particular, tusk around Rockall, the Mid Atlantic Ridge, and off Canada, most likely represent different biological populations that are at least partially demographically autonomous as judged by the low inferred dispersal rates (above). These populations clearly warrant separate management considerations. For the remainder of the North Atlantic this study has uncovered limited genetic differentiation, and no firm conclusion can be reached at present regarding the number of populations and assessment units. First, there is no definitive lower limit to genetic differentiation below which one can safely judge that samples represent a single biological population (e.g., Waples and Gagiotti, 2006). Second, the geographical coverage of the present study is insufficient to exclude the possibility of additional, so far undetected, genetically differentiated populations of tusk. The genetically distinct Rockall sample serves as a reminder that populations can be geographically very limited in extent, and that future studies should aim for more exhaustive geographic sample coverage. With these caveats, we note that the samples from Storegga and Tromsøflaket are similar and may represent a single population in this area, and likewise for Greenland and Iceland. Tusk from around Faroe Islands differ significantly both from those from Iceland and Tromsøflaket, but the differences are small and it is at present unclear how these differences should be interpreted in terms of management implications.

4.3.2.4 Recommendations

- Based on the genetic investigation, the group suggests the following stock units:
    - tusk in Va and XIV
    - tusk on the MAR
    - tusk on Rockall
    - 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.
- Get more samples around Iceland, Faroe Island, Hatton Bank and Western Scotland to disentangle potential structure within and among these areas
- Get more samples from other parts of tusks distribution range (Barents Sea, North Sea, West Greenland also) to get a more complete picture of the species population structure.

4.3.3 Ling (Molva molva)

4.3.3.1 Current stock structure

No new information on stock separation was available. Relevant data were presented and discussed in reports of previous Norwegian and Nordic projects and summarised in the 1998 report of the study group (ICES C.M. 1998/ACFM:12). 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'.

4.3.3.2 Literature review

Only one article dealing with genetic analysis was found (Møller og Nævdal 1967). They concluded on the basis of haemoglobin frequencies that there was segregation in the population structure.

Bergstad & Hareide (1996) identified clear differences in CPUE among areas (Faroes, Hebrides, Norw. Tr., Rockall, Shetland, Storegga) with no vessel effect (no statistical differences among vessels. These differences indicate that the different areas may not intermix. Upcoming genetic analysis will confirm if this has a genetic basis.

Presently, very few articles dealing with either toxins/contaminants or parasite prevalence are available. Further, it is uncertain whether these articles can be used to infer any new insight into potential stock structure for this species as there are a number of limitations for interpreting the results as evidence for structure (below). However, Mormede & Davies (2001) found that arsenic was higher in the deep-sea individuals from Rockall than in fish from surrounding areas.

LING (MOLVA MOLVA)

Variable	Value	Source/comment
Longevity (years)	Approx. 20	Bergstad and Hareide 1996, Magnusson *et al.* 1997
Growth rate, K	No data	Growth curves available in Bergstad and Hareide 1996
Natural mortality, M	0.2-0.3	Based on review by SGDEEP 2000
Fecundity (absolute)	Millions	No exact data available
Length at first maturity	60-75cm	Magnusson *et al.* 1997
Age at first maturity	5-7 years	Magnusson *et al.* 1997

4.3.3.3 Information available on candidate stock structure indicators

Length distribution

Length distributions are routinely provided by Iceland (Va), the Faeroes (Vb) and from the Norwegian reference fleet (IIa,IVa, Va, Vb, VIa and VIb). The Icelandic data are from commercial catches (1996-2006) and from the Icelandic bottom trawl surveys, which that takes place in March (1985-2007). From the Faroes the length distribution are from the landings from pair trawlers >700 HK (1996-2006) and from long liners >100GRT.

To obtain more detailed and targeted information for tusk and ling, the Institute of Marine Research, Bergen, Norway, initiated in 2000 a program to collect data and biological samples directly from selected commercial long-liners, the so-called **"**reference fleet**.**" The fishers measure a subsample of fish at selected locations. Presently four long-liners are members of the reference fleet.

Estimated mean length was part of the Nordic and a Norwegian project in the Northeast Atlantic (Bergstad and Hareide, 1996; Magnusson *et al*., 1997) and data from this project are available for the years 1976 and 1988-1995.

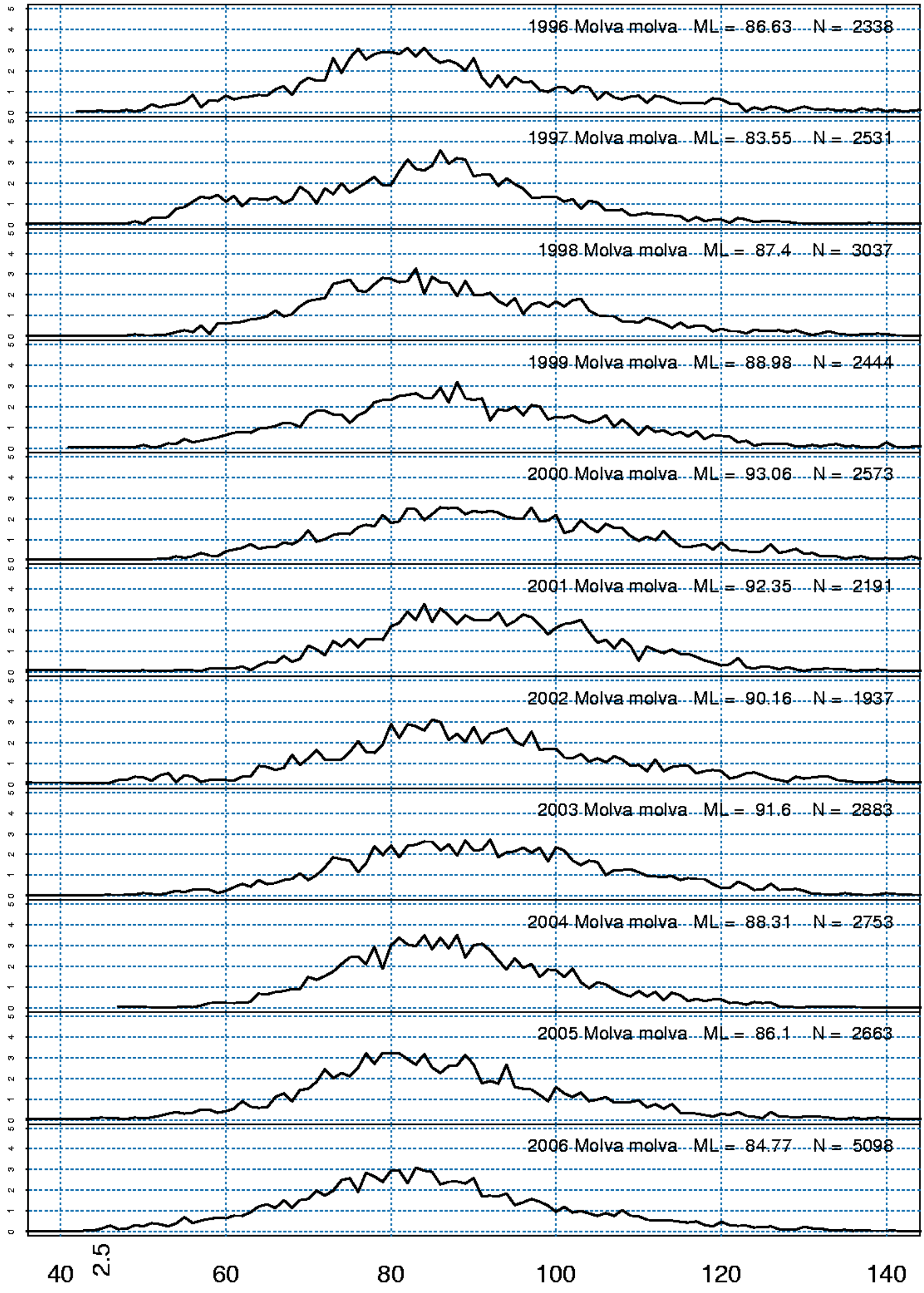


Figure 4.3.12. Length distribution of ling in the Icelandic catches. The number of measured fishes and mean length is also given.

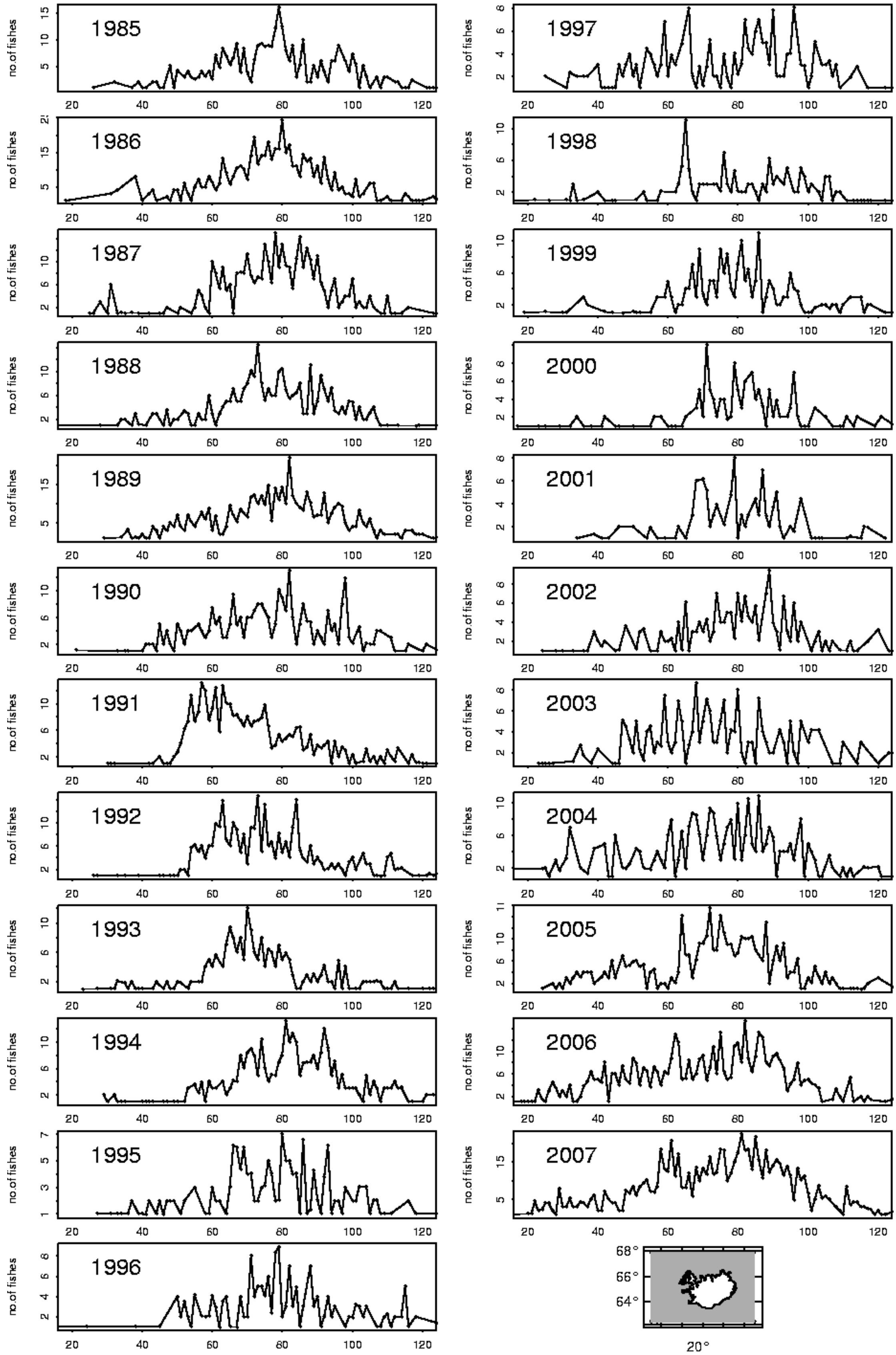


Figure 4.3.13. Ling length distributions in the Icelandic groundfish survey in March 1985-2006.

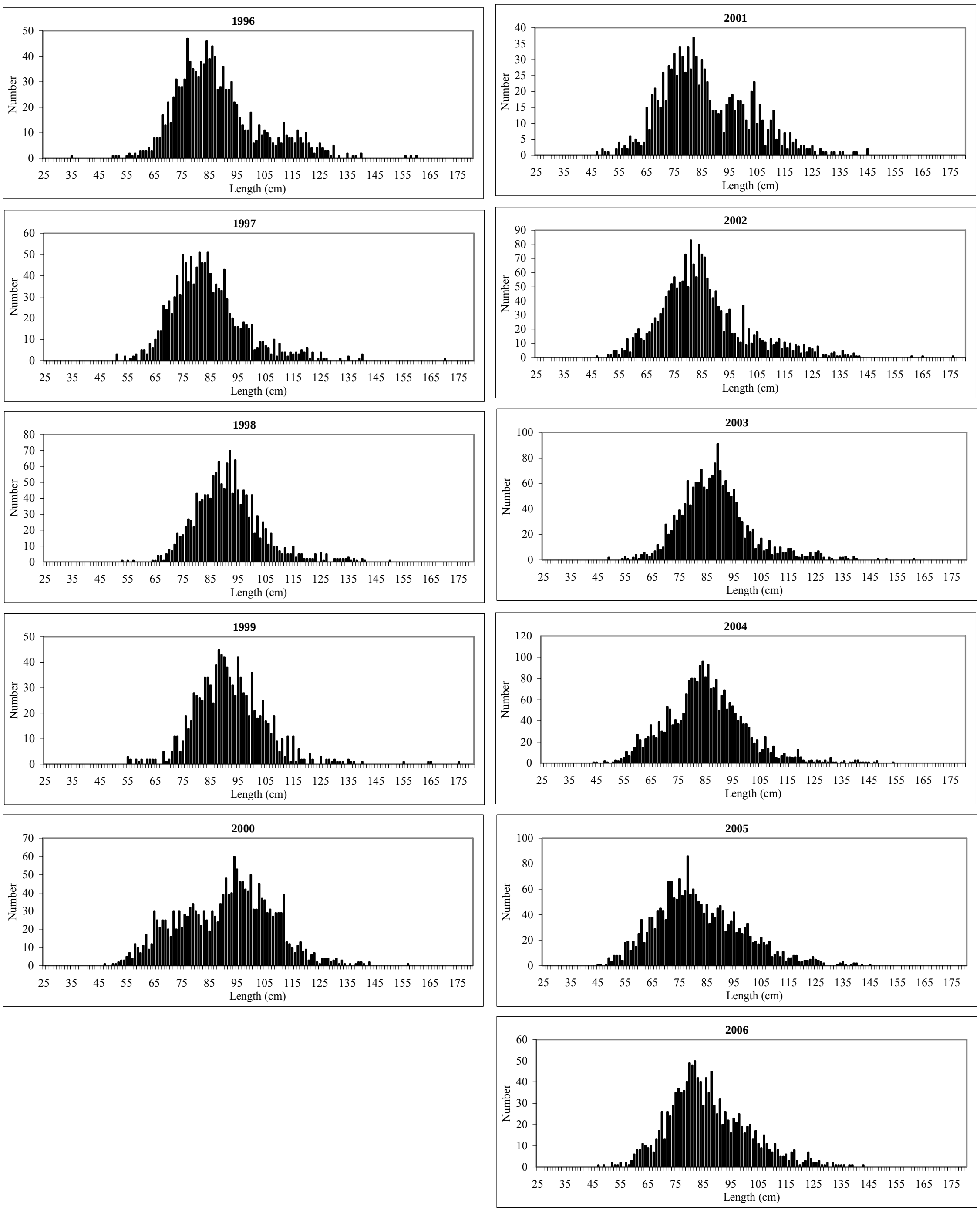


Figure 4.3.14. Ling in Vb (Faroes). Length distribution in the landings from pair trawlers > 700 HK.

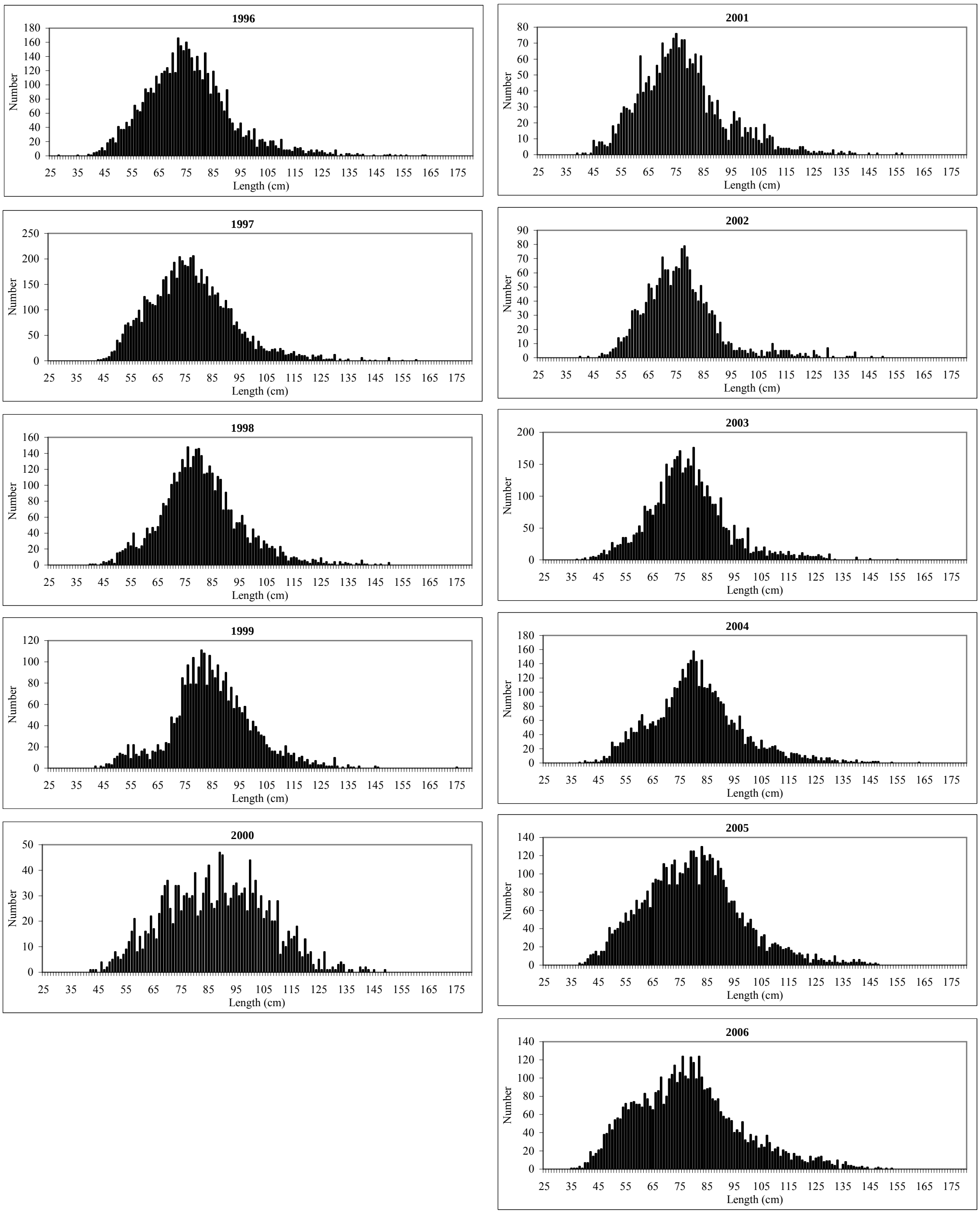


Figure 4.3.15. Ling in Vb (Faores). Length distribution in the landings from longliners >100GRT.

Table 4.3.5. Estimated mean length of ling in the period 1996-1995 are from Bergstad and Hareide (1996). The 2001-2005 estimates along with their standard errors (se) based on the reference fleet data, N denotes the number of fish measured and in parenthesis is the number of stations sampled. The unweighted mean was calculated for 2001, 2002 and areas V and VIb in 2003 and the weighted mean for the other years and areas.

Ling **ICES-area**		**1976**	**1988**	**1989**	**1990**	**1991**	**1993**	**1994**	**1995**		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
IIa	Mean			81,7	89,4	91,1	79,5	77,1		Mean	90,78	88,81	80,42	86,19	86,73	87,34
	Std,dev			15,2	13,5	13,5	13,7	12,3	8,3	se		1,6	0,55	1,05	0,42	0,11
	N			61	384	63	122	304	382	N	485 (13)	4793 (72)	4620 (102)	4139 (102)	11693 (216)	17764
IVa	Mean	87	81,1	76,8	81,1		74,6	77	81,1	Mean			79,14	88,9	88,88	90,38
	Std,dev	13,8	14,4	12,5	12,3		14,5	10,8	13	se			0,9	0,65	0,68	0,021
	N	1133	989	487	698		589	830	2203	N			1702 (38)	4654 (80)	5109 (55)	5124
Va	Mean									Mean				83,47		
	Std,dev									se				0,81		
	N									N				1502(29)		
Vb1	Mean			80			76,7			Mean			78,49	81,36	85,28	84,67
	Std,dev			13,7			12,1			se			1,84	2,66	0,5	0,028
	N			45			107			N			446 (9)	290 (12)	4130 (80)	2734
Vb2	Mean	90,3		82,7	85					Mean						
	Std,dev	13,8		12	13,7					se						
	N	253		614	318					N						
VIa	Mean	80		79,1			71,9	72	73,7	Mean		79,3	79,17			
	Std,dev	11,5		13,5			10,6	10,5	10	se			0,86			
	N	492		969			472	616	583	N		160 (2)	2590 (41)			
VIb	Mean	89,7		72,5	77,7		79,8	92	88,3	Mean		102,3	89,54			92,59
	Std,dev	9,8		16,7	13,6		12,4	16,2	12,2	se			1,1			0,28
	N	507		518	261		47	401	48	N		367 (5)	1393 (25)			2734
All areas	Mean	86,5	81,1	78,4	83,3	91,2	74,5	78,4	81,1		91,49	89,48	81,71	87,49	87,76	88,15
	Std,dev	13	14,4	14,2	13,7	13,6	13,1	13,9	13							
	N	2385	989	2694	1661	63	1337	2152	3220		570	5325	10912 (215)	10585	20934	28572

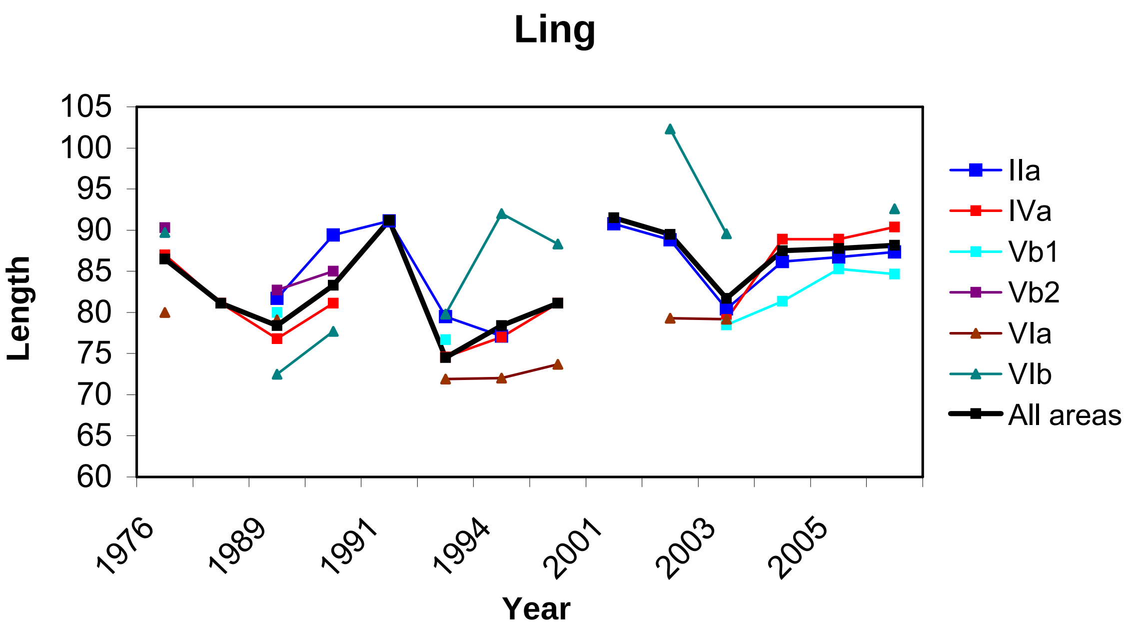


Figure 4.3.15. Estimated mean length of ling in the period 1996-1995 (Bergstad and Hareide ,1996) and the period 2001-2006

The data above, with emphasis on the Norwegian data (as only these data compare different ICES areas), reveal no clear differences among areas. There is however limitations in the data, as catch effort are unevenly distributed among areas, making a comparison difficult.

CPUE

CPUE data for ling is provided by Iceland, Faroese and Norway. The CPUE from the Icelandic fishery is calculated using long-line and trawl data.

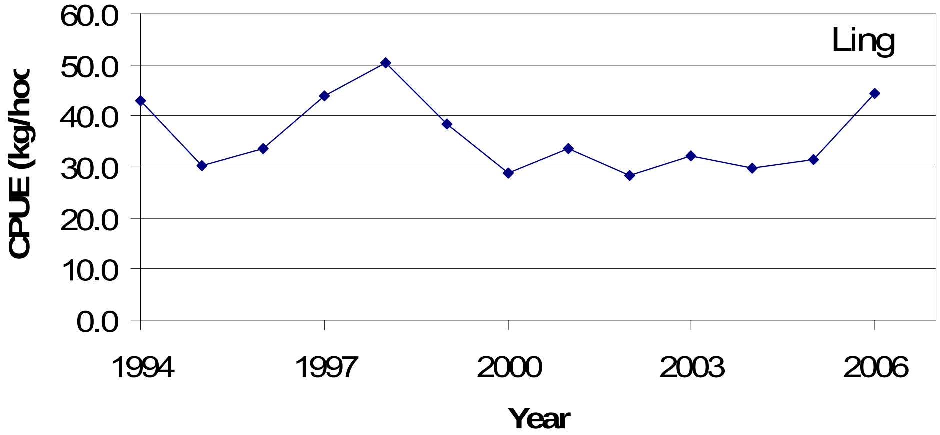


Figure 4.3.16. Ling catch per unit of effort calculated from the Icelandic long-line fishery.

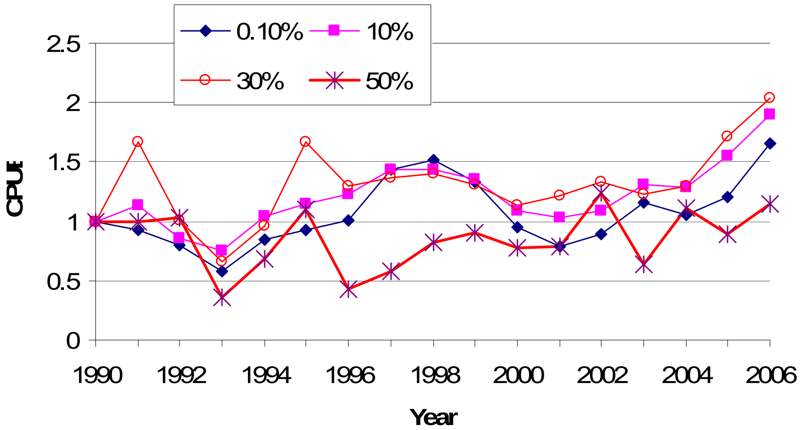


Figure 4.3.17. Ling catch per unit of effort calculated from the Icelandic longline fleet.

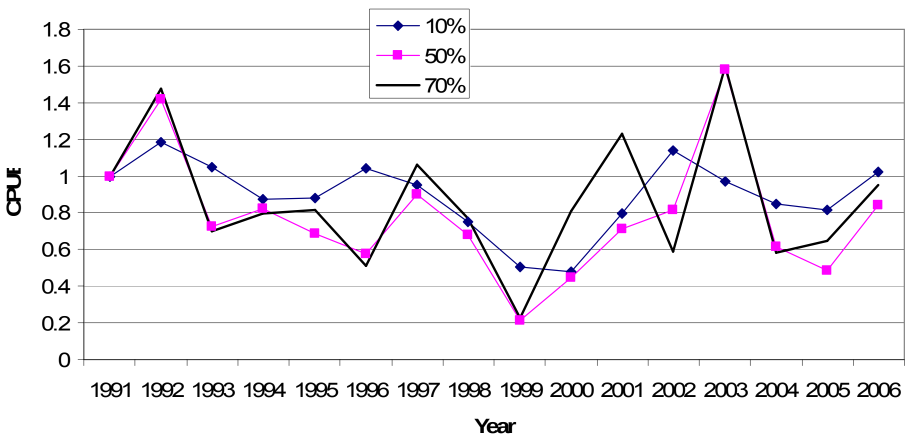


Figure 4.3.18. Ling catch per unit of effort calculated from the Icelandic trawler fleet. Less than 20% of the total

The Faroese CPUE bycatch series for ling is from the pair trawlers > 1000 HP selected where the catch of saithe is more than 60 % of the total catch in the haul.

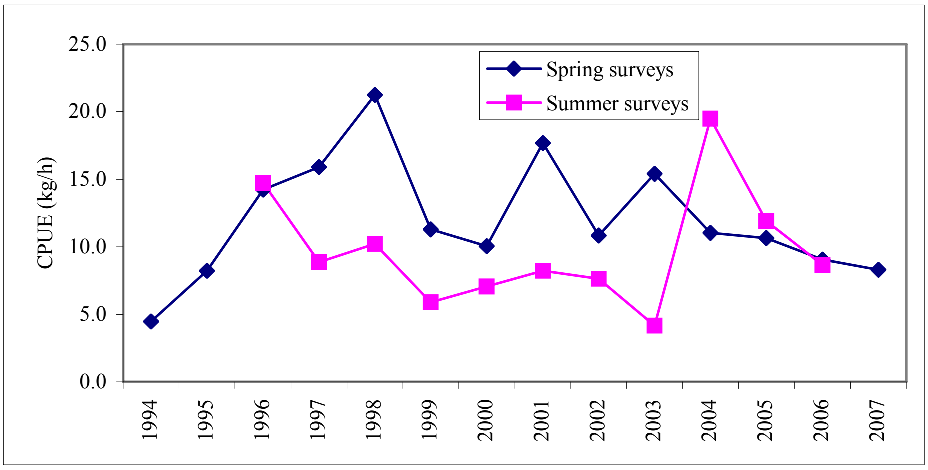


Figure 4.3.19. Ling in Vb (Faroes).

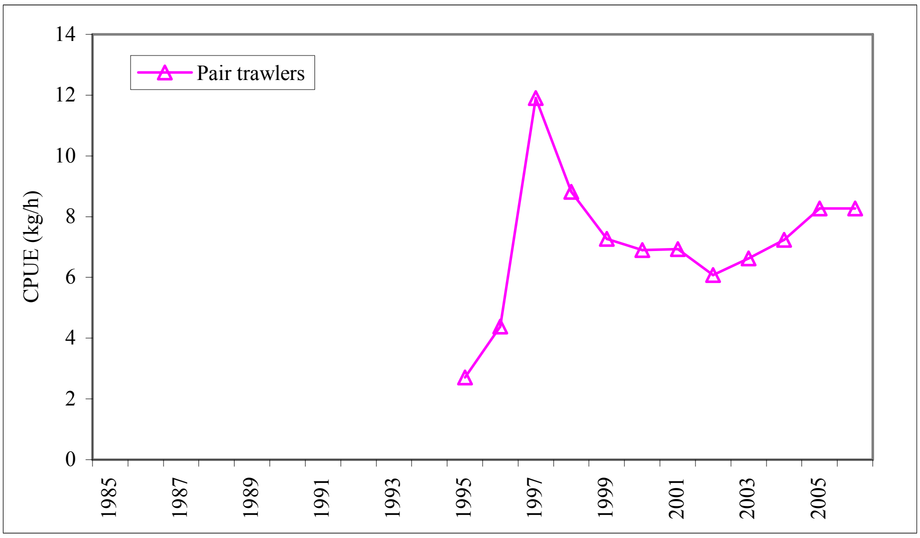


Figure 4.3.20. Ling in Vb (Faroes). CPUE from long liners.

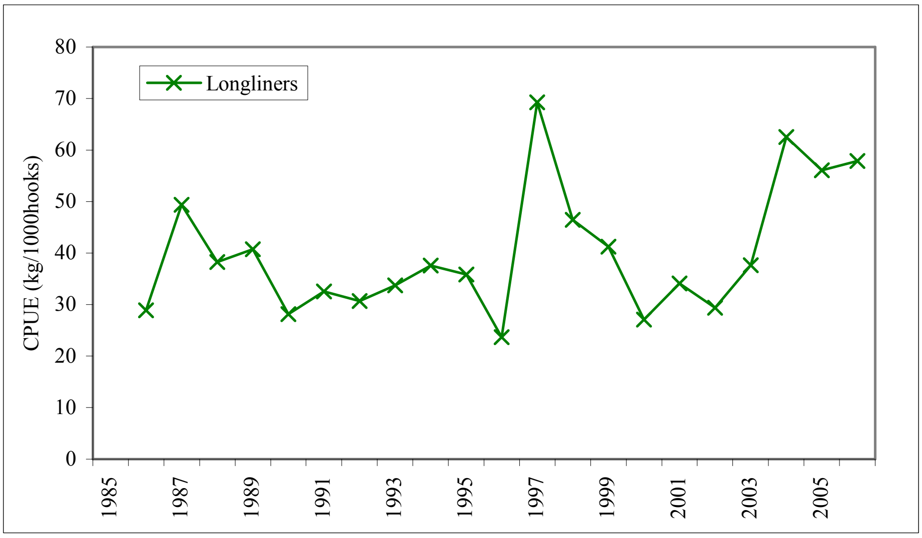


Figure 4.3.21. Ling in Vb (Faroes). CPUE from pair trawlers.

The Norwegian series (2000-2006) is based on logbooks from long liners larger than 21 m. 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.

Table 4.3.6. Estimated mean CPUE ([kg/hook]x1000) based on log book data along with its standard error (*se*) and number of catches sampled for ling .

	2000			2001			2002			2003			2004			2005			2006		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
I										1,7	3	12,0									
IIA	26,2	727	1	22	1308	0,6	24,2	1346	0,5	29,0	924	0,7	37,3	630	1,4	50,1	770	1,5	35,73	406	1,94
IIIA	5,6	4	13,5							2,4	25	4,1									
IVA	58,7	597	1,1	48,3	694	0,8	55,5	618	0,8	57,2	505	0,9	78,5	439	1,7	85,12	328	2,3	89,08	348	2,1
IVB	8,3	25	5,4	2,4	12	6,6	1,4	3	10,8	2,9	29	3,8									
VA										68,2	37	3,4	46,6	54	4,8	38,8	29	7,1	38,6	22	8,36
VB	75,2	369	1,4	62,8	526	1	65,6	466	0,9	71,0	467	1,0	71,7	693	1,4	82	373	2,2	88,05	126	3,49
VIA	102,2	411	1,4	87,9	378	1,2	76,9	176	1,4	74,2	284	1,2	101,7	308	2,0	116,8	369	2,2	88,09	169	3,01
VIB	45,9	127	2,4	35,8	114	2,1	37,6	149	1,5	67,9	85	2,2	71,9	110	3,4	68,8	137	3,6	119,02	51	5,49
VIIC	82,9	78	3	78,4	37	3,7							122	28	6,7	66,4	7	14,4			
XIVA	3,75	6	11,1																		

Historical CPUE data are also available for the years 1972-1994 (Bergstad and Hareide, 1996; Magnusson *et al.*, 1997).The results from these studies were presented at earlier WGDEEP meetings, and the Group used analyses of time-series for the Norwegian long liners back to 1972 for effort and CPUE as a basis for assessing stock trends.

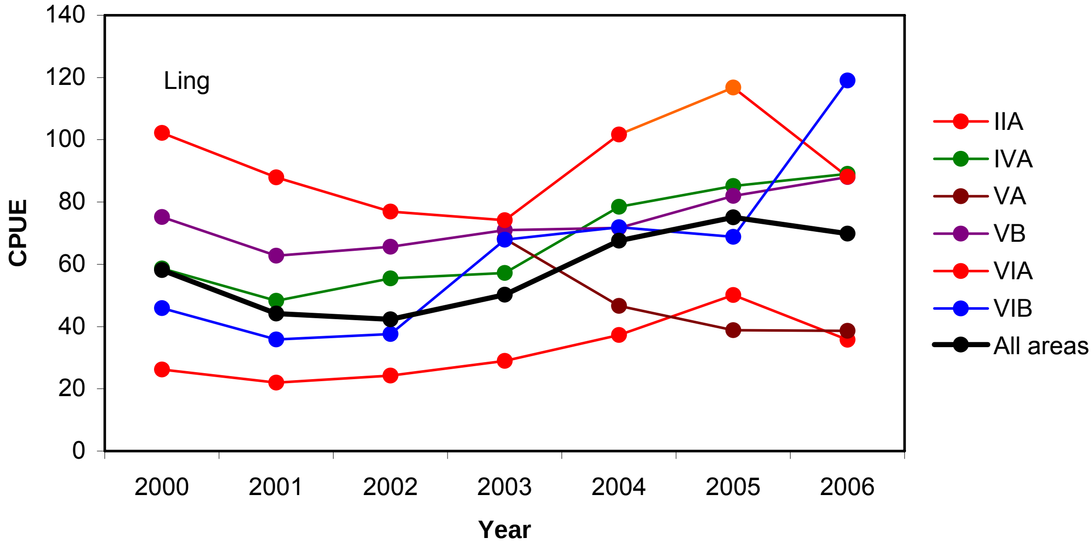


Figure 4.3.22. Estimated mean CPUE ([kg/hook]x1000) based on data from the Norwegian log books for tusk and ling in each ICES subarea and all areas combined for the years 2000- 2006.

As for tusk, there are some minor differences in CPUE trends among areas (Figure 4.2.22). However there are difficulties in making direct comparisons, as time series are very short, the effort in the different areas varies substantially and there are also a mixture of by-catch data and targeted catch data from different areas. Differences in CPUE among areas with direct catch data should be tested statistically to check for other possible patterns in the data (correcting for effort).

Age

Presently only the Faroes routinely age read ling. Data from 1996-2006 are available. The Iceland age data are for 1989-1998.Age reading was part of the Nordic and a Norwegian project in the Northeast Atlantic (Bergstad and Hareide, 1996; Magnusson *et al.*, 1997) and data from this project are available for the years 1976 and 1988-1995.

Maturity

Maturity data is available from Iceland (area Va) where length at 50 % maturity is 75.5 cm.

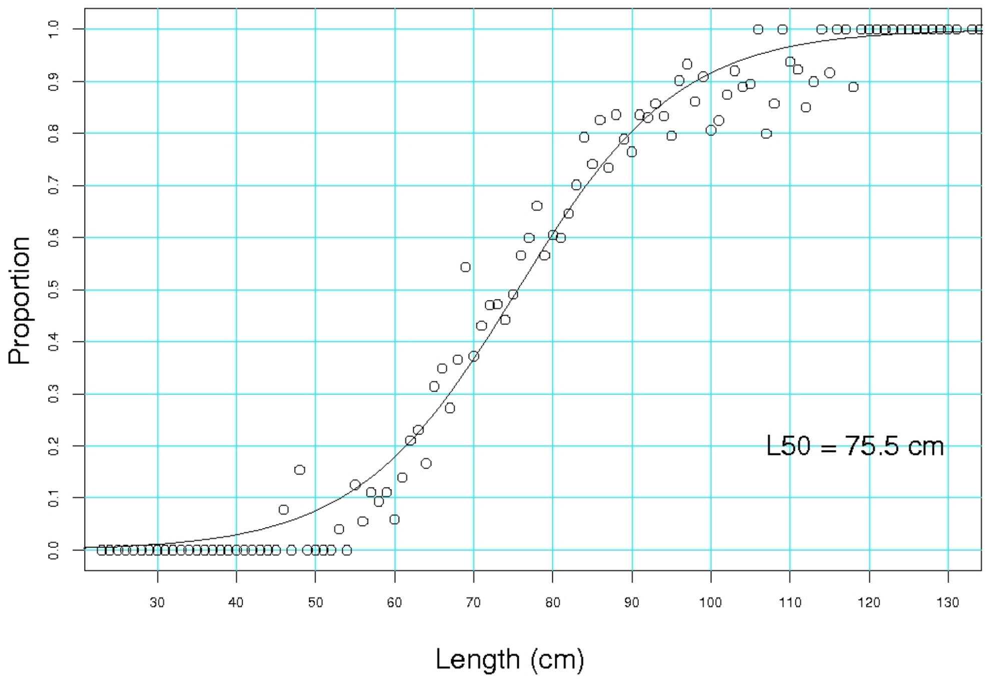


Figure 4.3.23. Ling maturity. The figure shows average maturity at given length in the Icelandic catches. The fitted curve is also shown and the constants in the equation.

Genetic analysis

Presently, no genetic studies focusing on the population structure of ling is published

4.3.3.4 Recommendations

Available information is not sufficient to suggest changes to current ICES interpretation of stock structure. However, an ongoing project microsatellite DNA primer development is soon to be completed, funded by the Norwegian Ministry of Fishery and Coastal Affairs and by Grant MAR-ECO (www.mar-eco.no), a field project under the Census of Marine Life programme. Further, samples from several areas within ling's distributional range will be obtained. DNA analysis will be initiated autumn 2007 funded by Norwegian Ministry of Fishery and Coastal Affairs and ESF (www.esf.org; contact person: dr. Halvor Knutsen, IMR: halvor.knutsen@imr.no).

4.3.4 Blue ling (Molva dypterygia)

4.3.4.1 Current ICES stock structure

The current ICES WGDEEP interpretation of the stock structure of blue ling was developed at the SGDEEP meetings in 1996 and 1998. At that time, the Group was requested to commence exploratory assessments by ICES ACFM. To make progress with assessments, SGDEEP had, therefore, to make an informed judgement of stock structure (not just for blue ling but for all other stocks) based on the sparse information in the literature and on ad hoc views provided by fishery biologists attending the Group. The latter were not referenced and even information in the literature frequently lacked references. The interpretation of stock structure for blue ling (and other species) has been rolled forward without any re-evaluation until this Working Group. This interpretation is described below (WGDEEP, 2006):

"Biological investigations in the early 1980s suggested that at least two adult stock components were found within the area, a northern stock in Sub-area XIV and Division Va with a small component in Vb, and a southern stock in Sub-area 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 Sub-areas 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."

4.3.4.2 Literature review

Only a comparatively small proportion of identified relevant papers were available to the Working Group through ICES, so this summary is not comprehensive.

1. Biological Investigations on the blue ling, *Molva dypterygia dypterygia* in the areas of the Faroe Islands and west of the Shetland Islands. By Rainer, T., 1987. Arch.FischWiss 38 (1/2) 9-34.

Relevant information on:

a) Growth;

From Faroe Isl.

Females: Linf 116.25; k= 0.17

Males: Linf 104.2; k=0.197

From Shetland Isl.

Females: Linf 137.37; k= 0.13

Males: Linf 108.31; k= 0.185

b) Maturity;

L 50 (females) 8.1 years

L 50 (males) 6.4 years

Note: no significant differences in maturity ogive between both areas.

c) Diet

From a sample of 30 individuals collected from February to March, 1979.

Otholiths from Gadiculus argenterus thori and Micromesistius poutassou were found in stomachs.

d) Parasites

Nematods: Anisakis spp. Porrocaecum decipeus

Crustaceans: Sarcotaces articus

2. Heavy metal concentrations in commercial deep-sea species from the Rockall Trough (2001), Continental Shelf Research 21, 899-916. by Mormede and Davies.

Relevant information: Results from the analysis of various deep-sea species tissues, including muscle, liver, gills and gonads, for arsenic, cadmium, copper, lead, mercury and Zn concentrations. These show highest levels of arsenic concentration in muscle tissue for monkfish and blue ling. Medium cadmium concentration in muscle also appears significant and are above the EU dietary standards recommended level (2 mg/kg wet weight). All metals concentrations appear to be highly positively correlated to length and weight in all analysed cases.

3. Results of a deep-water experimental fishing in the north Atlantic: an example of cooperative research with the fishing industry (2001) by Durán Muñoz, P, E. Román. and F. González., ICES CM 2000/W:03

Relevant information: Length – Weight relationship

Sex	Individ.	a	b	R2	Length range (cm)	Weight range (gr)
Males:	994	0.0013	3.2234	0.9252	63 – 115	890 – 6170
Females:	481	0.0017	3.1793	0.9216	62 – 149	810 – 10000
Combined:	1475	0.0012	3.2454	0.9532	62 – 149	810 –10000

4. Project Report on Ling, Blue ling and Tusk of the NE Atlantic (1996) by Bergstad, O.A. and N.R. Hareide.

Information on the fishery, landing statistics, biology, ageing, size and age distribution, some genetics analysis. No relevant information for stock discrimination.

5. Project Report on Ling, Blue Ling and Tusk of the NE Atlantic by Magnusson et al. (1997). TemaNord 1997:535.

Relevant information: plots main distribution of blue ling in NW Atlantic with two sub-species; M. dypterygia dypterygia and M. dypterygia macrophtalma. The former has a more eastern distribution and the latter covers the area W of the British Isles and further south to Marroco and into the M;editerranean. Both sub species mix in the area W and S of the British Islands. Weak basis for these results as population genetics had low priority in the project and was also the most difficult to sample.

There is a paragraph included *'Observations of spawning aggregations in several places in the NE Atlantic suggest that blue ling in the area is divided into several stock units. This is further confirmed by the distribution of eggs and larvae as well as on differences in growth between areas. However, it is not possible at this stage to define the different stock units'.* However, references are not given.

4.3.4.3 Information available on candidate stock structure indicators

Length distributions

These data include both length frequencies and mean length data by ICES area.

Time-series length frequency data from commercial landings are available for VIa (French trawlers, 1988 to 2006) , Vb (Faroese trawlers, 1994 to 2006) and Va (Icelandic trawlers – 1996 to 2006) (Figures 4.3.24-4.3.26, 4.3.28). Time-series annual mean length data are available from the same sources for VIa and Va (Figure 4.3.27).

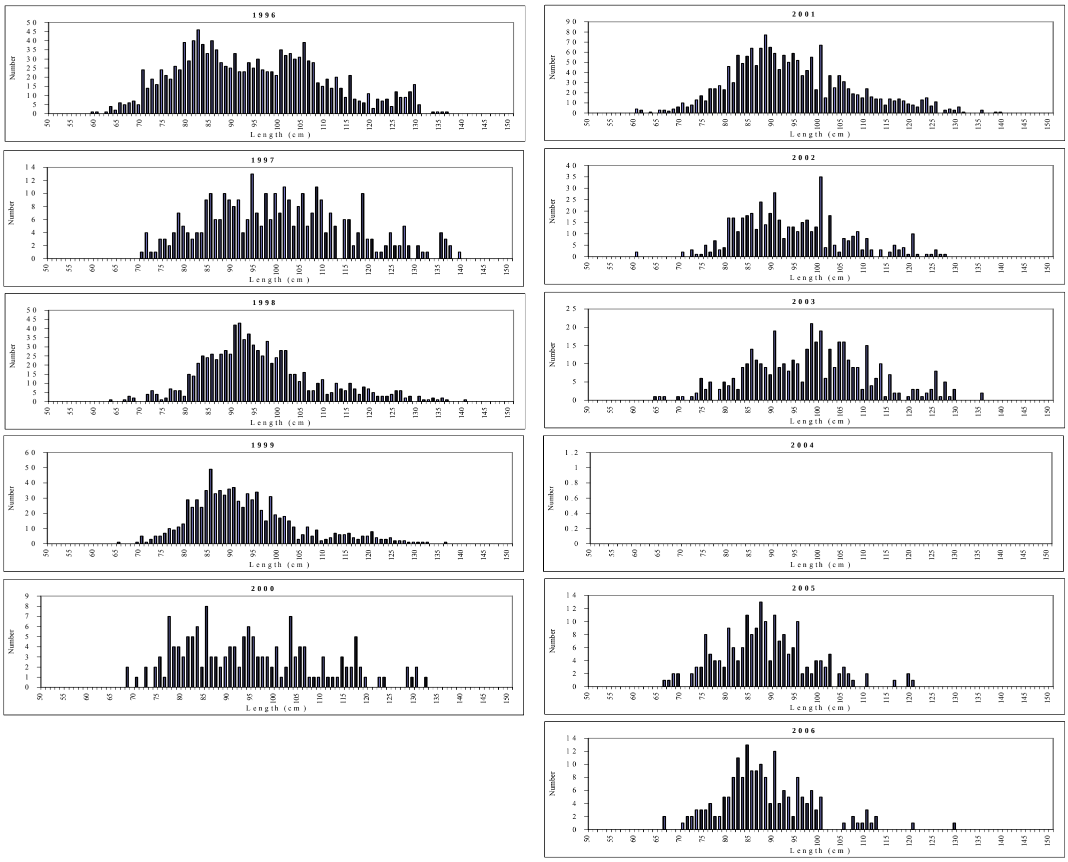


Figure 4.3.24. Blue ling in Vb (Faroes). Length distribution in the landings from otterboard trawlers >1000 HP (note data for 1994 and 1995 are not presented)

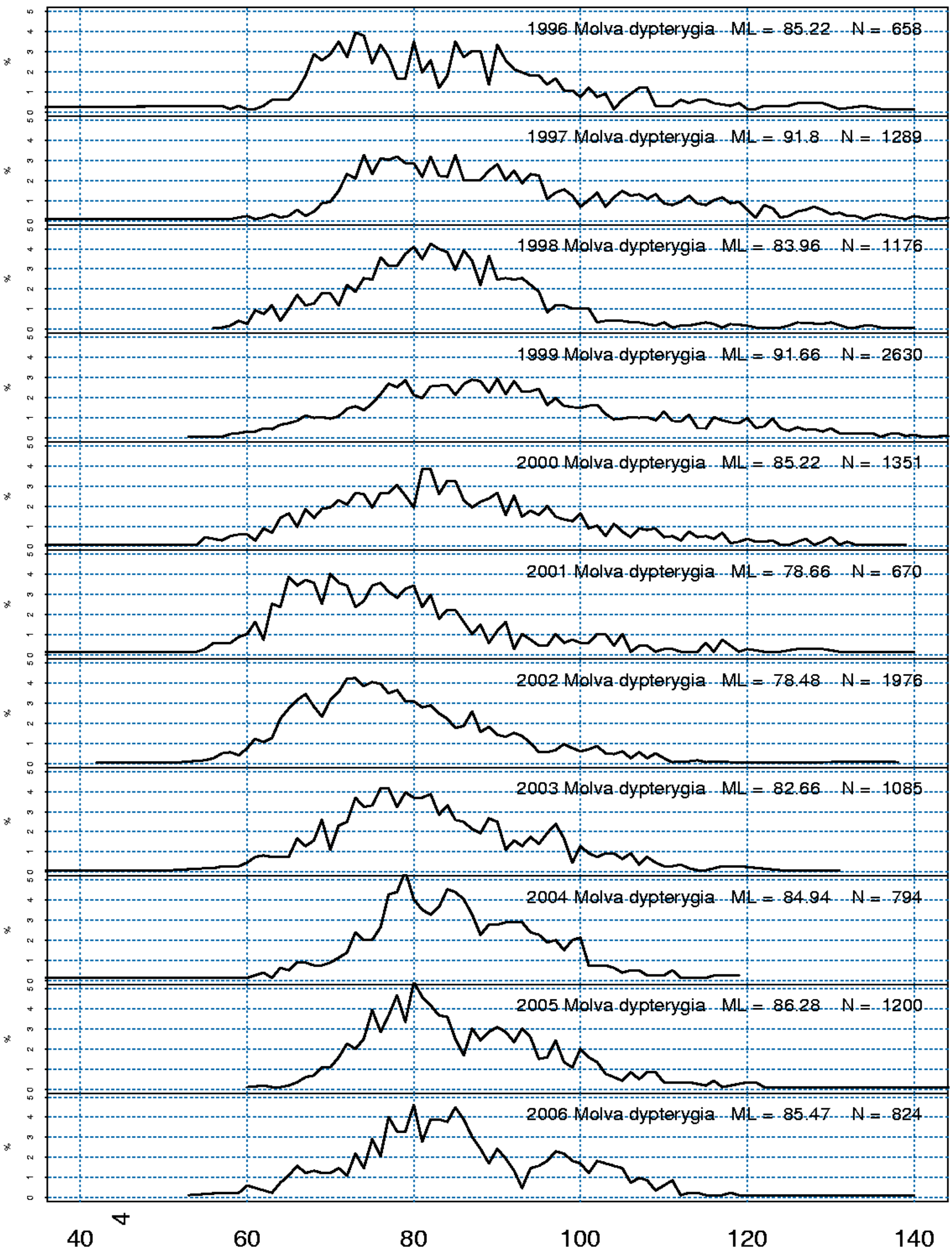


Figure 4.3.25. Length distribution of blue ling in the Icelandic catches from Va. The number of measured fish and mean length is also given.

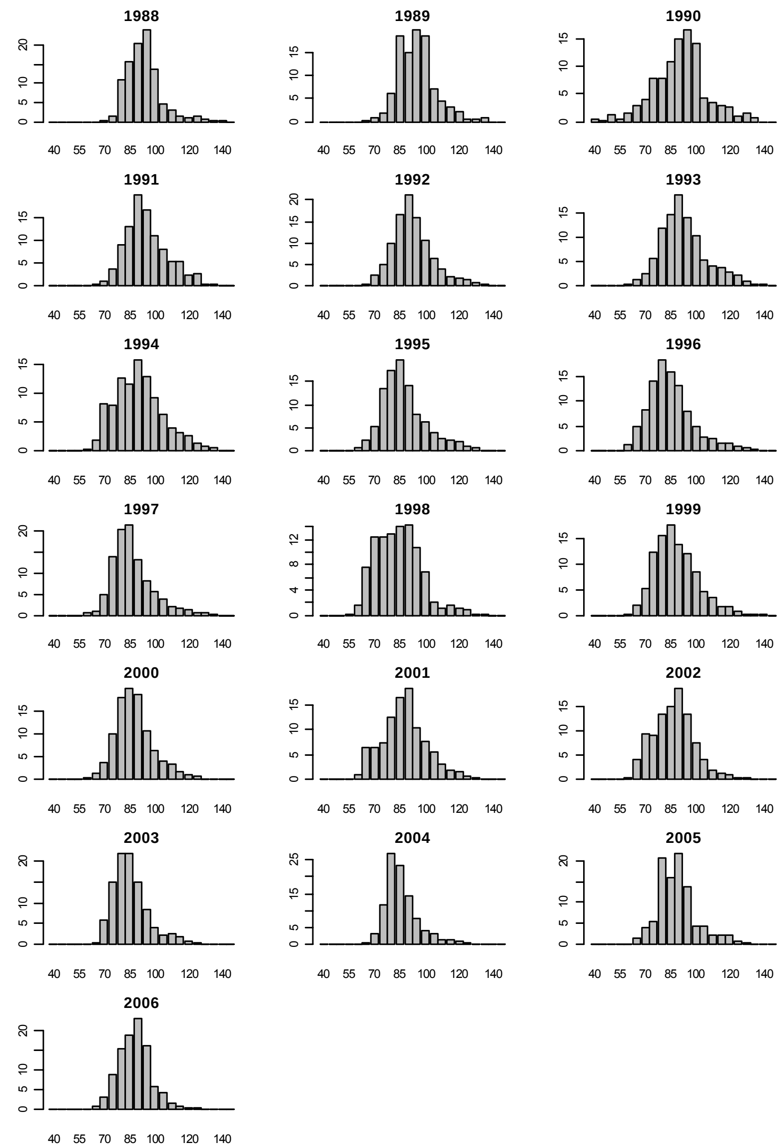


Figure 4.3.26. Length distribution in the landings of blue ling from French otter trawlers fishing in VIa.

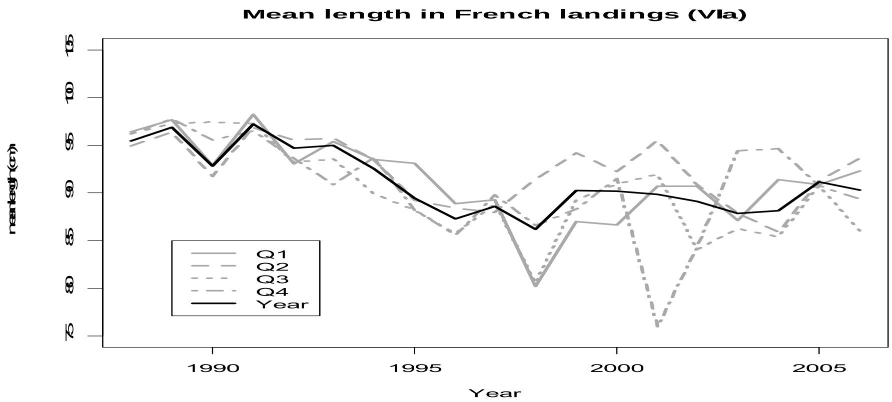


Figure 4.3.27. Time series of quarterly and annual data of mean length in French trawler landings from VIa.

It is not obvious how these length data from commercial catches can be used for stock identity purposes. Any area differences probably reflect differences in selection between fleets/areas and other factors. It should be noted that in all areas there has been gradual shift away from directed fisheries on spawning aggregations towards by-catch fisheries. This shift has been driven by depletion of spawning aggregations and by recent EU legislation banning directed fisheries for blue ling. The trend with time in mean length observed at VIa, for example, may reflect this change in exploitation pattern and also overall depletion of blue ling in this area.

Time-series length frequency data from fisheries-independent surveys are available for Va (Icelandic groundfish survey, 1985 to 2006), however these data also contribute little to deliberations on stock structure.

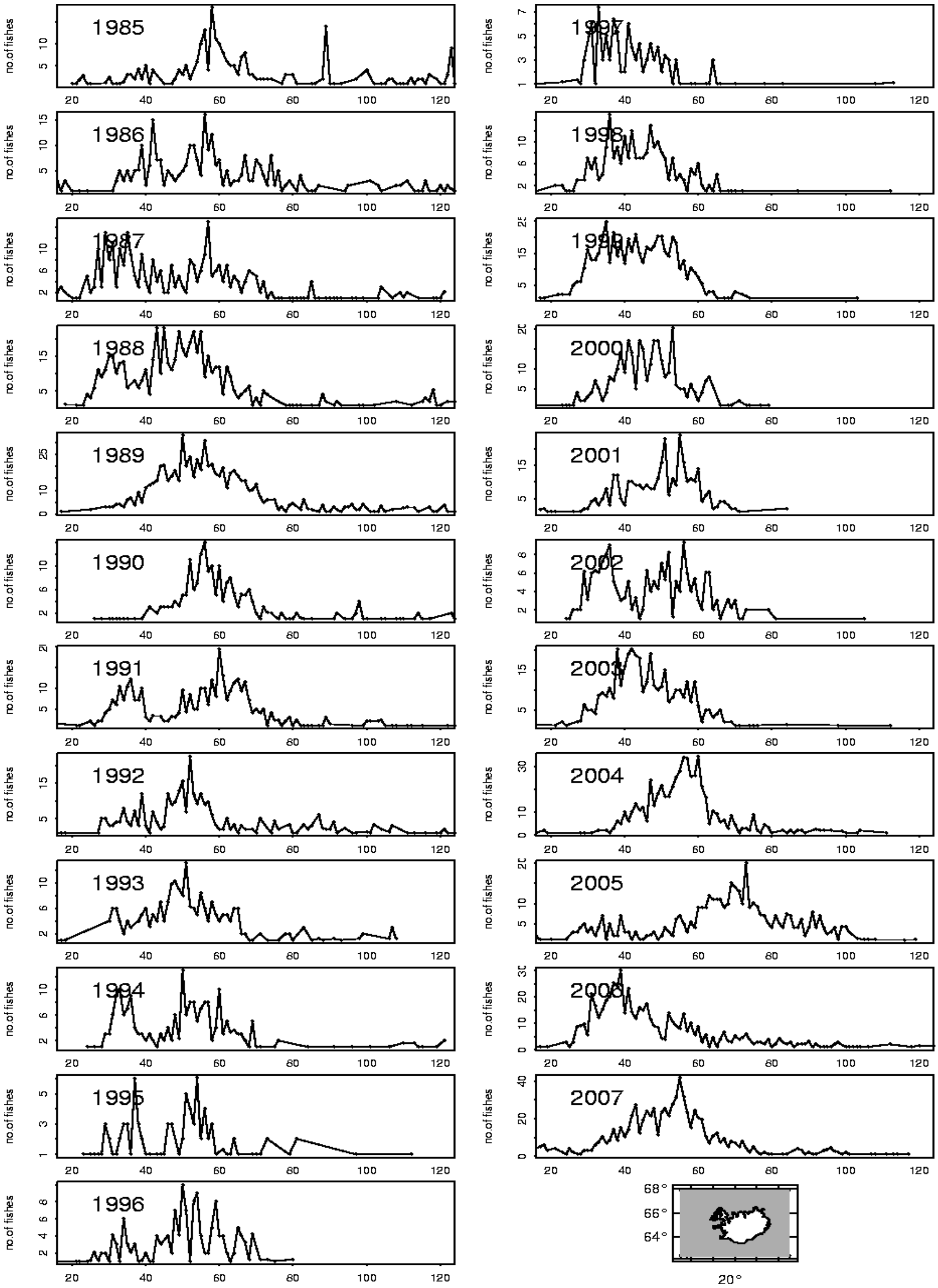


Figure 4.3.28. Blue ling length distributions in the Icelandic groundfish survey in March 1985-2006

CPUE/abundance data

CPUE data are available from the Icelandic and Faroese trawl fleets for Va and Vb and also French trawlers in VIa (Figures 4.3.29-4.3.33).

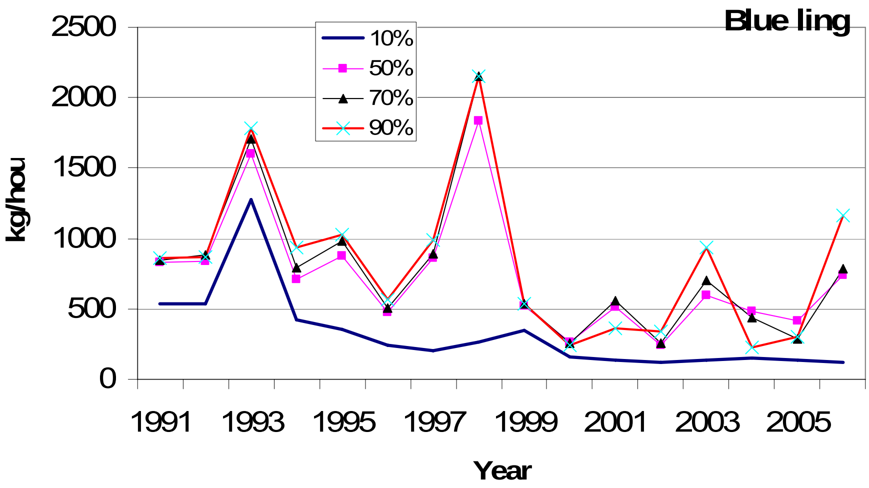


Figure 4.3.29. Blue ling catch per unit effort calculated from the Icelandic trawl fishery where blue ling is more than 10, 50, 70 and 90% of total catch in individual tows.

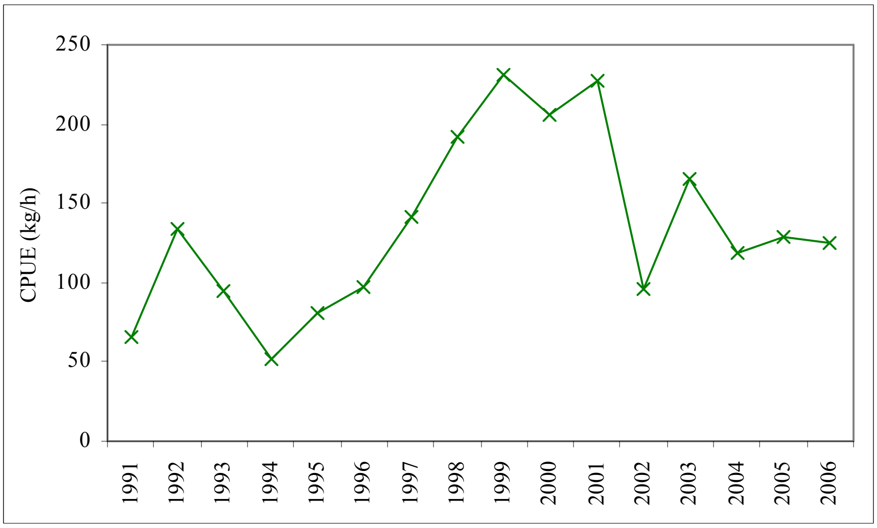


Figure 4.3.30. CPUE of blue ling in Vb (Faroes) - otterboard trawlers >1000 HP

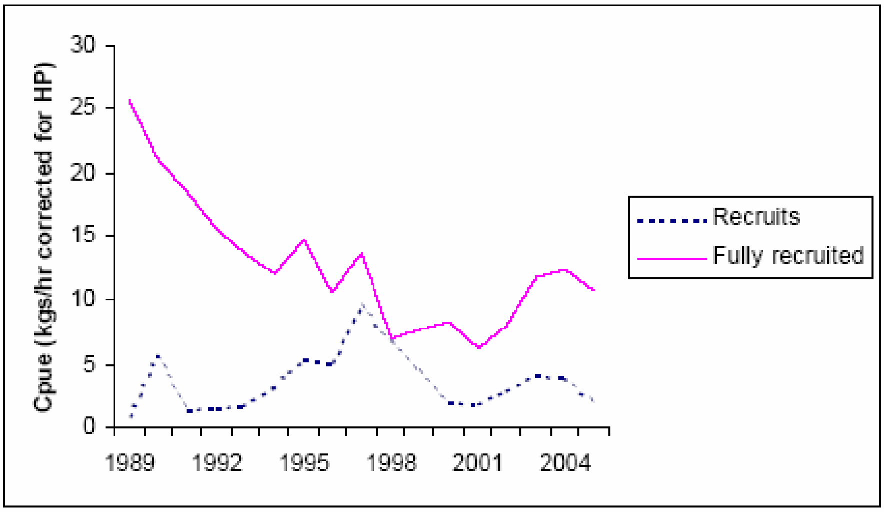


Figure 4.3.31. French trawl CPUE in reference rectangles in VIa

These data in Va and VIa indicate a strong decline in exploitable biomass with perturbations at a low level in recent years. The CPUE data from Faroese trawlers in Vb should be interpreted with caution because there has been shifts in species-directivity during the time period. For example, there was a shift away from saithe and redfish towards deep-water species between 1995 and 1999 and this is reflected by a large increase in CPUE for blue ling across these years.

Time-series abundance data are also available from Icelandic and Faroese fisheries-independent surveys at Va (in spring and autumn) and Vb, respectively. The indices from the Icelandic spring and autumn surveys are compared in Figure 4.3.32.

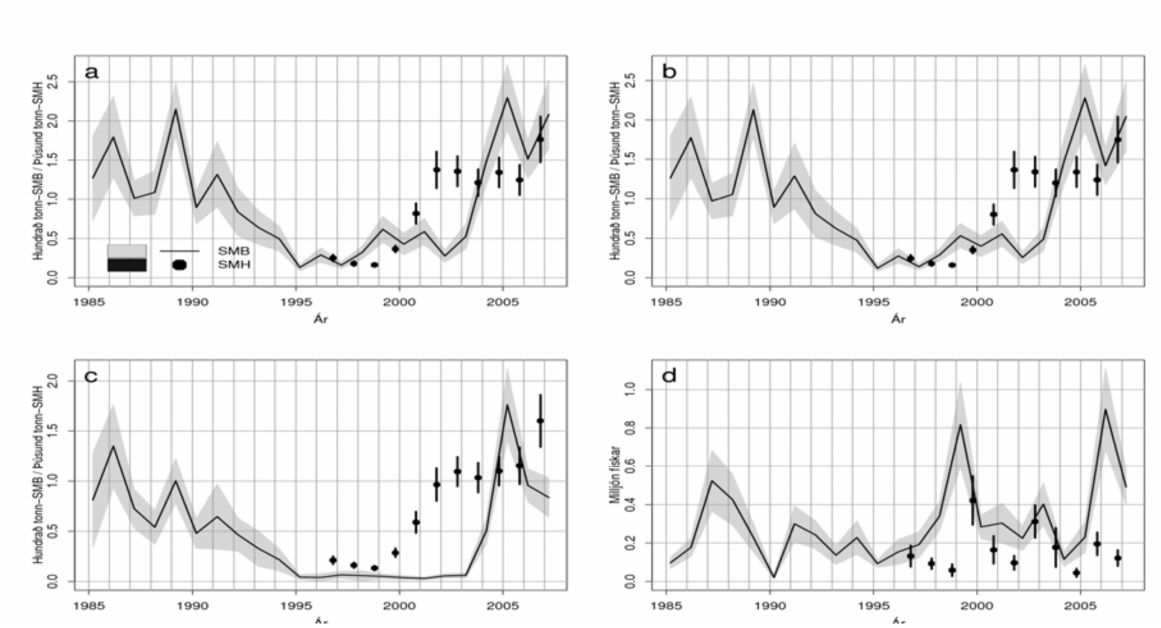


Figure 4.3.32. Blue ling. Indices form the Icelandic groundfish survey in Autumn (SMH) a) Total biomass index, b) Biomass of 50 cm and larger, c) Biomass 90 cm and larger, d) Abundance of < 40 cm. Corresponding indices from the spring survey are also shown (solid line).

The spring index indicates a decrease in the fishable biomass of blue ling since the survey started in 1985 until 2001, but since then the index has increased significantly. The index of fishable stock of blue ling is now similar as it was in 1985 after a steep increase in recent surveys. However, the survey area does not cover the most important distribution area of blue ling as their distribution area goes to greater depths, so these trends should be interpreted with caution. The Icelandic autumn survey has been conducted annually since 1996. However, the survey was extended in 2001 and therefore the indices obtained from the survey are not comparable prior and after 2001.

CPUE data from Faroese trawl surveys are shown in Figure 4.3.33. There appears to have been an increase in CPUE of blue ling in the summer survey in 2004 and 2005. However, the CPUE trend from both surveys should be treated with caution because blue ling is usually taken in low numbers because both surveys are targeted at cod, haddock and saithe.

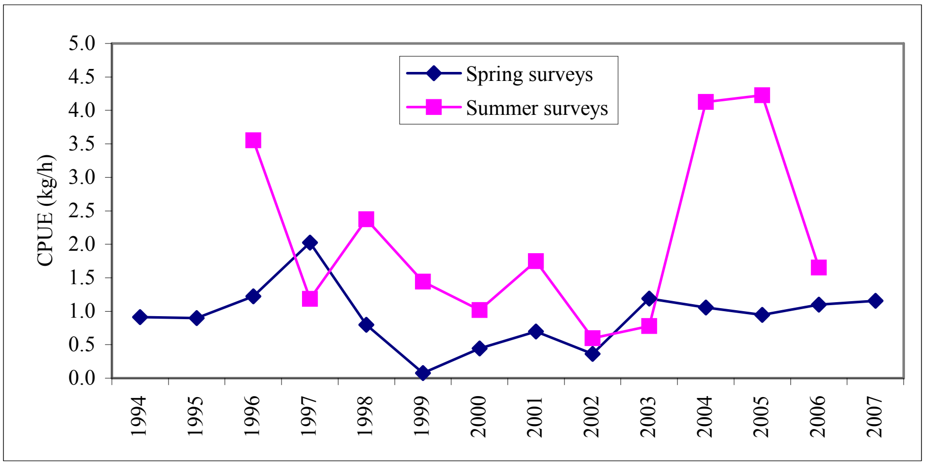


Figure 4.3.33. Blue ling. CPUE series from the Faroese spring and summer surveys in Vb.

The CPUE data presented here from commercial fleets and from fisheries-independent surveys appear to be of little use in stock discrimination. Excluding Vb, where there are no reliable data available, all indices show a strong decline in CPUE until around 2001/2002. In VIa CPUE has remained at this low level but there has been a substantial increase in survey CPUE in recent years at Iceland, however this should be treated with caution because this survey only covers part of depth distribution of blue ling at Iceland.

Age data

Experimental data are available for many ICES areas but these are not presented due to difficulties in the ageing of this species.

Life history characteristics

Available data of life history characteristics for blue ling compared by ICES area (Table 4.3.7) are broadly similar.

Table 4.3.7. Life history charcteristics for blue ling by ICES area

Variable	VIa	Vb	Va
Longevity	Approx 30yrs[1]	Approx 30yrs[1]	Approx 30yrs[1]
L inf	110-113 male[2] 145-166 female[2]	104 cm male[6] 116 cm female[6]	
K	0.16-0.20 male 0.08-0.12 female[2]	0.20 male[6] 0.17 –female[6]	
Length at maturity	75 cm male 80 cm –female[3]		80 cm male[4] 85 cm female[4]
Age at maturity	7 yrs male[3] 8 yrs female[3]	6 yrs male[6] 8 yrs female[6]	
M	0.15-0.17[5]		

1 Bergstad and Hareide (1996) ; Magnusson *et al.* (1999)

2 Ehrich and Reinsch (1985); Moguedet (1988)

3 Moguedet (1998)

4 Magnusson *et al*. (1997)

5 WGDEEP

6 Rainer, (1987)

Genetics data

No information is available on the genetic structure of blue ling. Protein electrophoresis is not informative given the very low levels of genetic variation in enzymes, and presently no microsatellite DNA primers are developed.

Spawning aggregations

Spawning blue ling have been observed at several locations over a wide spread area (Magnusson et al, 1997), including Lousy Bank and Bill Bailey Bank to the north-west of Scotland, Faroe Bank, Reykjanes Ridge, the Westman Islands, East Greenland (Dohrnbank) (Reische, 1988) and off the Norwegian Coast at Storegga. Spawning aggregations are known be quite localised and disparate and this may be consistent with multiple blue ling stocks in the ICES area. However, other hypotheses e.g. serial spawning may underly this observation.

4.3.4.4 Recommendations

Available information is inadequate to evaluate the stock structure of blue ling in the NE Atlantic. It is suggested that the current practise of separating blue ling into a northern stock (Va and XIV) and a southern stock (Vb,VI,VII) is continued until information from microsatellite studies is available. The stock structure should then be reviewed. Future research should aim at developing msat DNA primers, as genetic analysis has proven very informative in detecting potential population structure in other marine fish species such as e.g. the Atlantic cod and Greenland Halibut.

4.3.5 Greater argentine (*Argentina silus*)

4.3.5.1 Current ICES structure

The current ICES structure for greater argentine is that ICES Sub-areas 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.

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 Sub-area 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 Sub-area VI and the south of Sub-area 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 the winter but in the summer the species is widely distributed (Bergstad, 1993)*". No new information was presented to the Working Group.

The distribution of greater argentine in the eastern Atlantic is from Svalbard to the west coast of Scotland and Irelands, deeper parts of North Sea and across the Wyville Thomson ridge to Denmark Strait (FishBase). In western Atlantic greater argentine is distributed from Davis Stait to Georges Bank in Canada.

Greater argentine is a benthopelagic deep-water species and lives probably in schools close to the bottom.

4.3.5.2 Literature review

Icelandic

*** J.V. Magnússon. 1996. Greater silver smelt, *Argentina silus* in Icelandic waters. Journal of Fish Biology 49 (sa), 259-275.**

The paper describes differences in the size composition in relation to area and depth.

Ageing show a relatively fast growth up to the age of 8-9 years.

Females grow faster than males.

L50 for males are 36-37 cm and age at that length are approximately 8 years

L50 for females are 37-38 cm and age approximately 9 years.

Norwegian

*** A. Johannesen and T. Monstad. 2003. Distribution, Growth and Exploitation of Greater Silver Smelt (*Argentina silus* (Ascanius, 1775) in Norwegian Waters 1980-1983. J.Northw.Atl.Fish.Sci., Vol.31: 319-332.**

Females mature earlier than males. A50 is at about 6 years for females and 7 years for males. Considering the slower growth rate of males vs females, both sexes seemed to mature at similar length.

Specimens in the size range 12-48 cm were caught, and age and length compositions were skewed towards higher values with increasing depth. Preference for increasing depth with increasing age and size.

The estimated growth coefficient of males and females were not different, but highly variable.

Several biological features (growth rate, age distribution, sex composition) of greater silver smelt in the Vestfjord area differed form most other locations, but variations due to sampling and size segregation with depth give no reason to exclude it as a different stock component.

*** O.A.Bergstad. 1993. Distribution, population structure, growth, and reproduction of the greater silver smelt, *Argentina silus* (Pisces, Argentinidae), of the Skagerrak and the north-eastern North Sea. ICES J.mar.Sci., 50: 129-143.**

Females grow larger than males, asymptotic lengths being 42.6 and 40.3 cm, respectively. Growth rate for females was 0.19 and for males 0.21. Age at first spawning, as determined from otoliths, is 4-9 years, usually 6 years. Segregation by depth of smaller and larger fish in winter.

Difference in age composition between the Skagerrak and the northern area suggests that the Skagerrak concentration may be somewhat isolated from those to the north.

Canadian

*** T.D. Beacham. 1982. Variability in size and age at sexual maturity of argentine, Argentina silus, on the Scotian Shelf in the Northwest Atlantic Ocean.**

Data from 1965-1969 showed that males and females matured at similar lengths, but males tended to mature at older ages.

Median length at maturity for males range from 35.5 cm in NAFO Subdiv. 4Vs to 26.4 cm in NAFO Subdiv. 4W. For females ranged from 28.0 cm in Subdiv. 4Vs to 24.9 in Subdiv. 5Ze.

Median age at maturity was about 5.3 years for males and 4.6 years for females.

4.3.5.3 Information available on candidate stock structure indicators

Length distribution

The length measure on greater argentine is total length in the Icelandic area and fork length in the Faroese area.

Both the length distribution from the landings on greater silver smelt in Divisions Va (Iceland) and Vb (Faroes) show a decreasing trend in mean length (Figure 4.3.34 and 4.3.36). The mean length decreases from 45 cm in 1997 to 38/39 cm in the latest years in the Icelandic catches. In the Faroe area the mean length decrease from 43 cm in 1994 to 36 cm in 2006. This could be due to a natural reaction for a virgin stock to an introduced fishery, strong year classes or high fishing mortality on older fish.

The length distributions from the Icelandic survey do not show any particular trend (Figure 4.3.35) and the same were for the two Faroese bottom trawl surveys. The mean length in the Spanish survey on Porcupine bank west of Ireland (area VII) was about 26 cm in all years (Figure 4.3.37).

The length distribution of greater argentine in the Faroese bottom trawl survey, divided into 100 m depth strata, in Division Vb show a clear increasing length with depth (Table 4.3.8).

Overall, there are conflicting signals in the trends in average length across the time series available and no firm conclusion can be inferred as to the stock structure.

CPUE

CPUE is unlikely to reflect the level of abundance of this bentho-pelagic, aggregating species, therefore is it difficult to evaluate the stock identity with this available information (Figures 4.3.38 – 4.3.40).

Genetic Studies

No information is currently available.

4.3.5.4 Recommendations

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.

Table 4.3.8. Mean length data by depth interval for greater silver smelt in the Faroese spring- and summer surveys (1994 to 2006 combined).

Depth (m)	<100	100-199	200-299	300-399	400-499	>500
Average length (cm)	20	25	30	30	38	40
Number	11	3330	4564	3087	2029	621

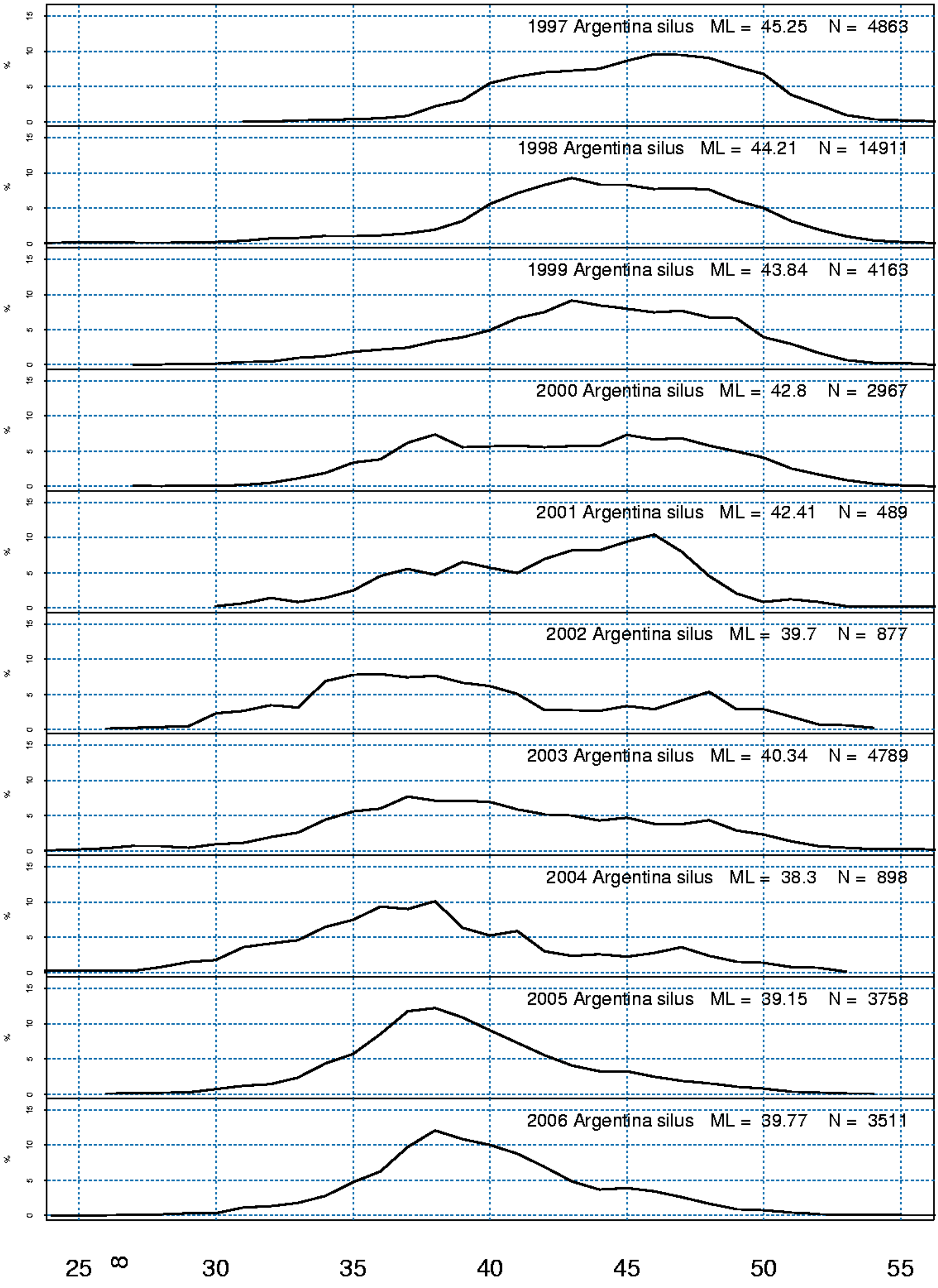


Figure 4.3.34. Length distribution of greater silver smelt in the Icelandic catches since 1997. The number of measured fishes and mean length is also given.

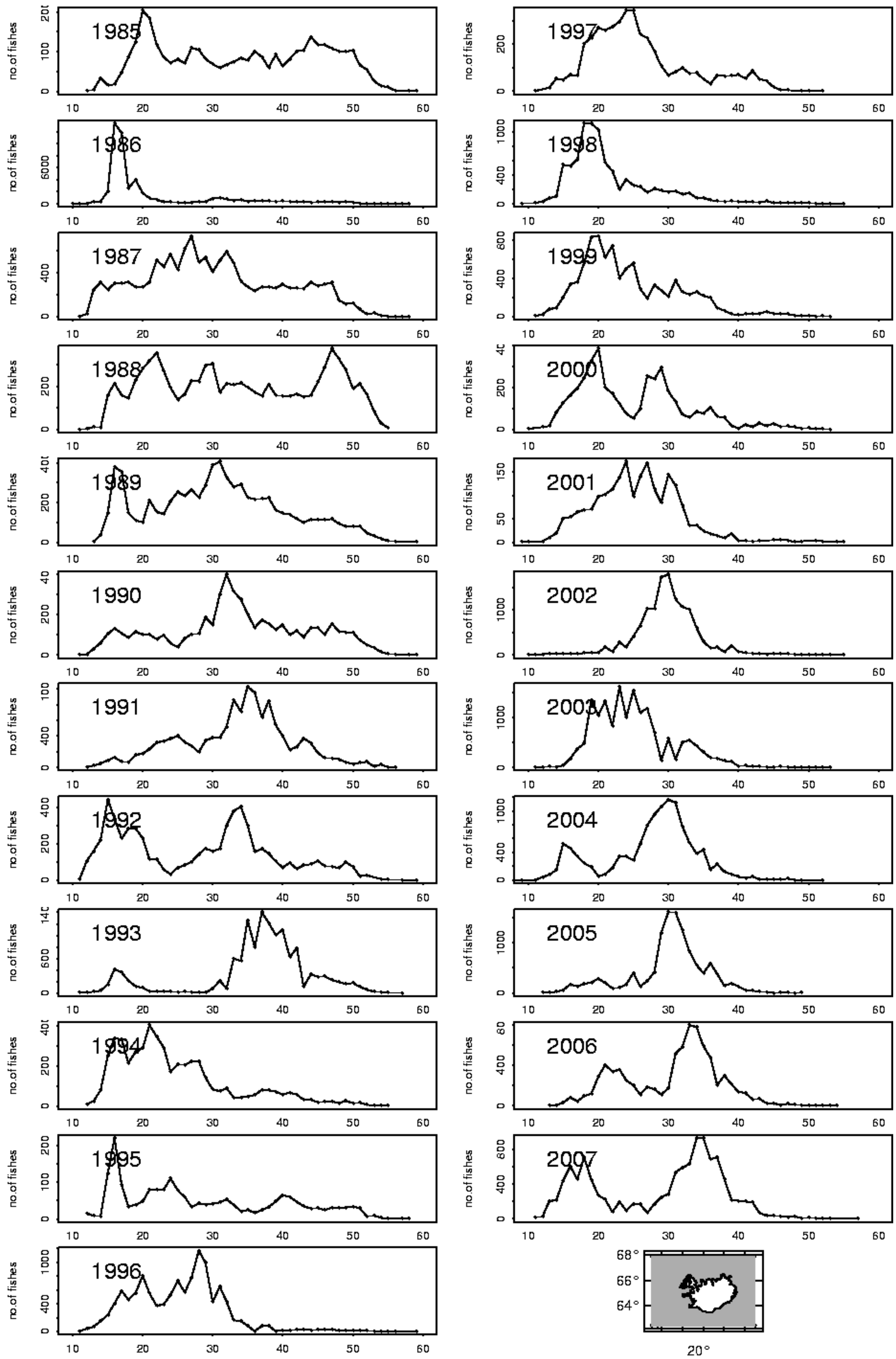


Figure 4.3.35. Greater silver smelt length distributions in the Icelandic groundfish survey in March 1985-2007

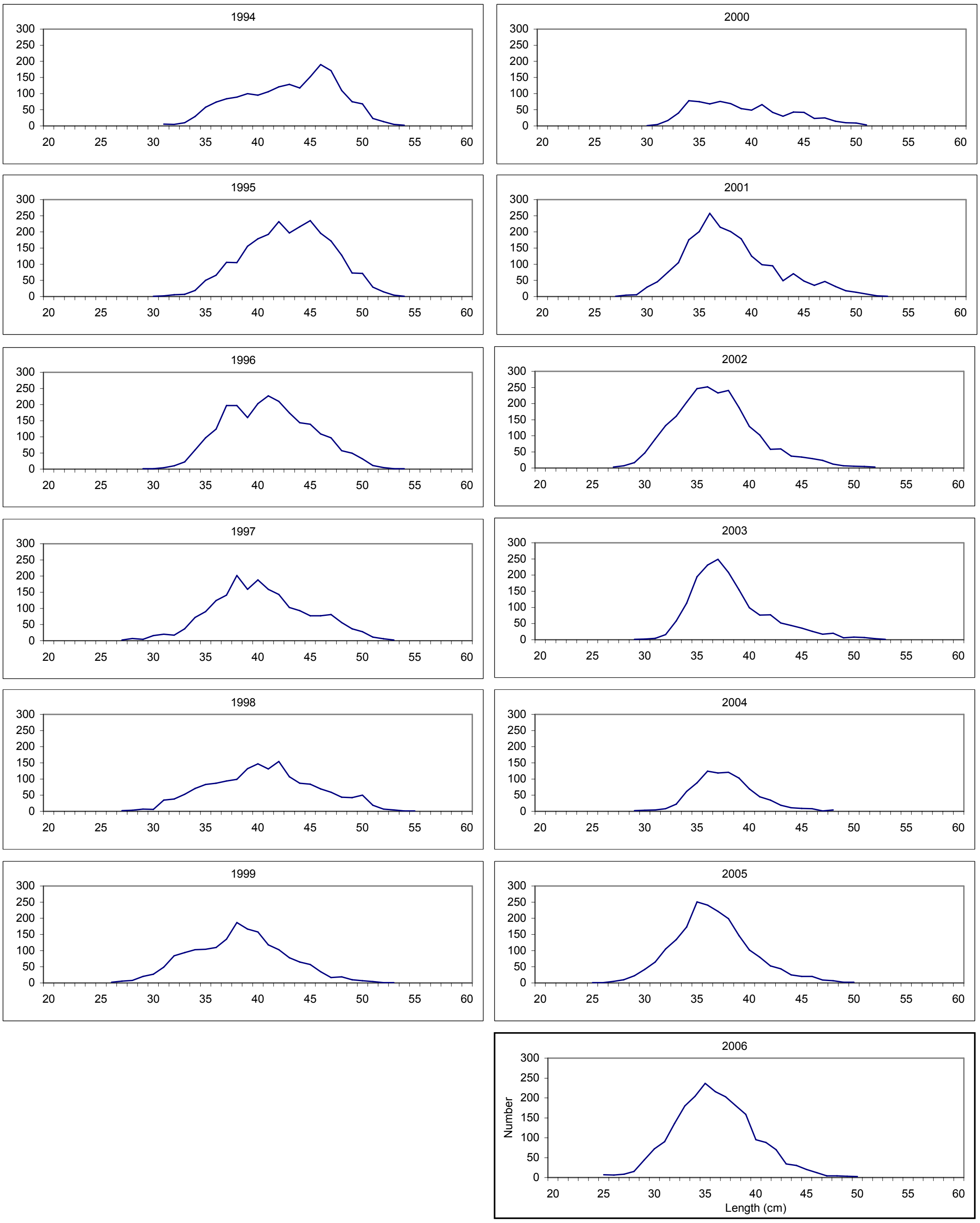


Figure 4.3.36. Length distribution from the Faroese Spring survey.

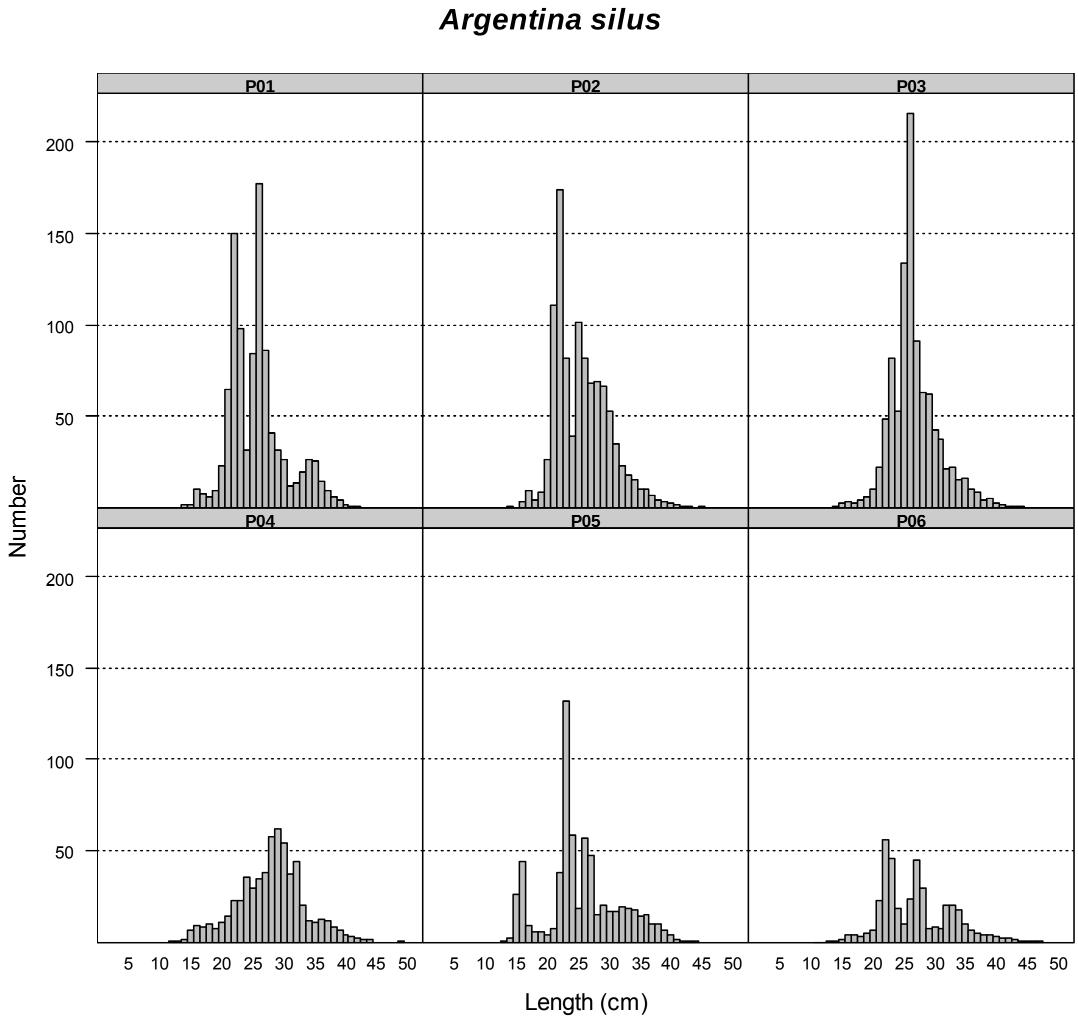


Figure 4.3.37. Mean stratified length distributions of *Argentina* spp. in Porcupine surveys (2001-2006) (F. Velasco, *pers. com.*)

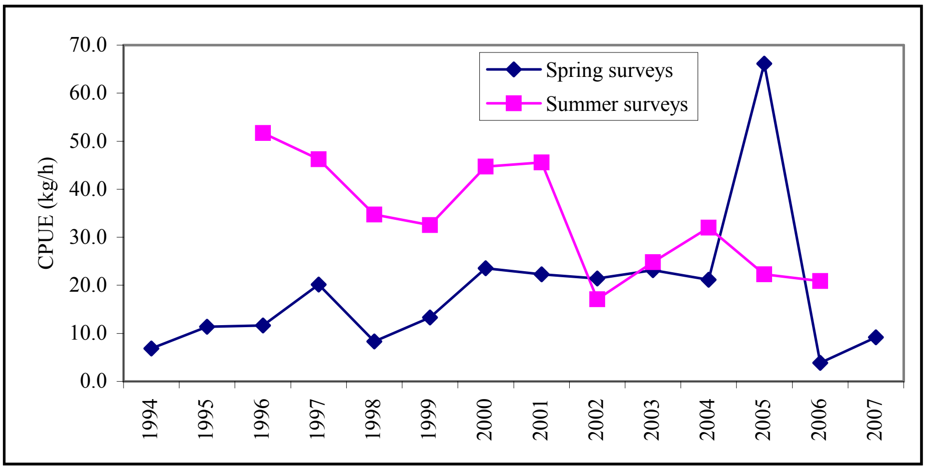


Figure 4.4.38. CPUE in area Vb from Faroese annual spring- and summer survey.

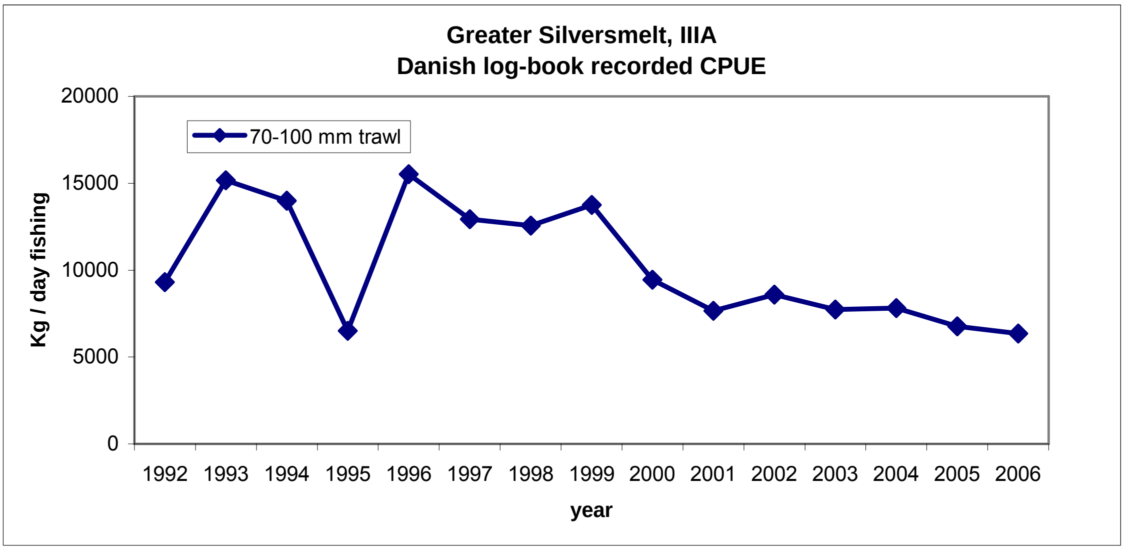


Figure 4.3.39. CPUE in ICES area IIIA from Danish logbooks.

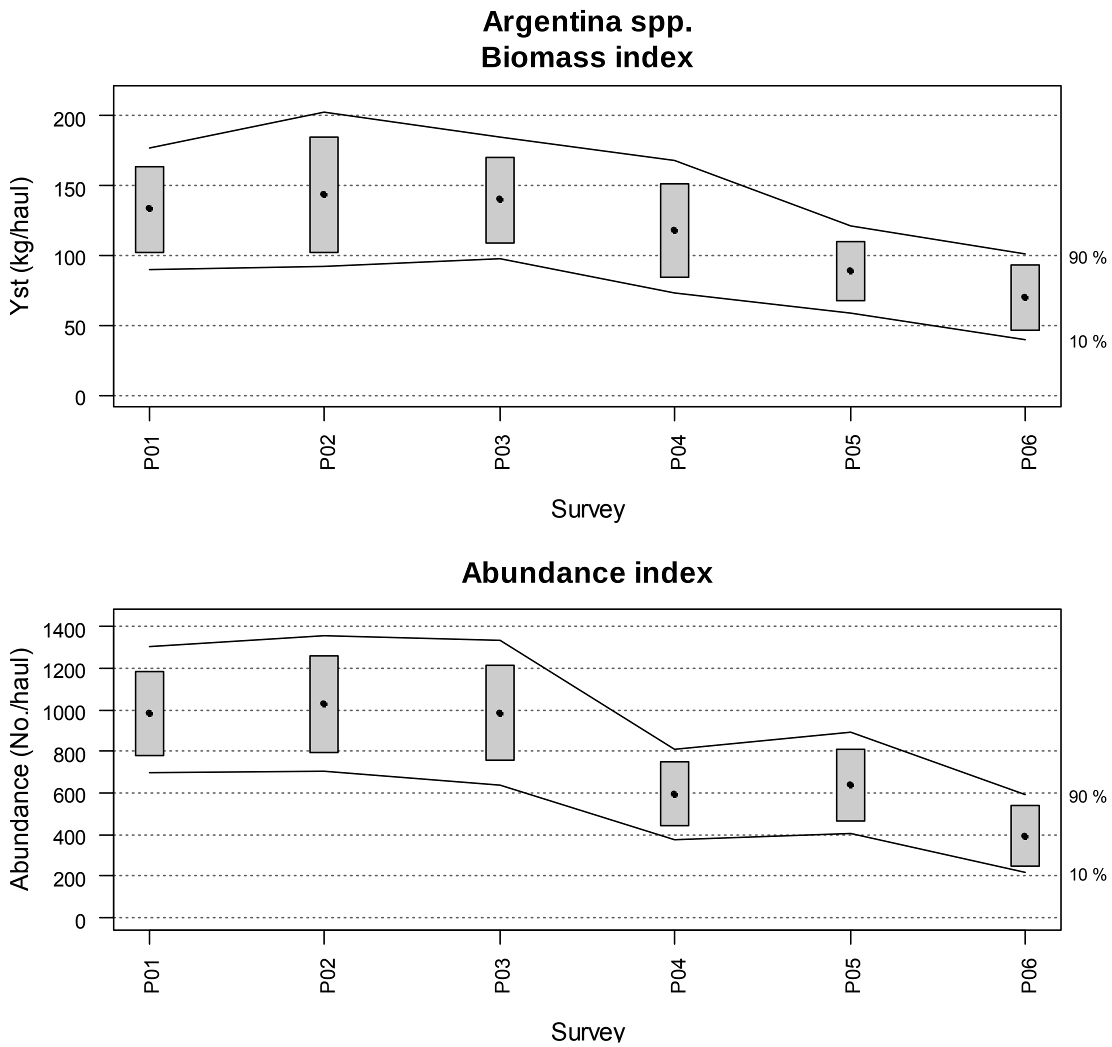


Figure 4.3.40. Changes in *Argentina* spp. biomass and abundance index during Porcupine Survey time series (2001-2006). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000) (F. Velasco, *pers. com.*) .

4.3.6 Black scabbardfish (*Aphanopus carbo*)

4.3.6.1 Current ICES stock structure

The species is distributed on both sides of the North Atlantic and on seamounts and ridges south to about 30N. It occurs only sporadically north of the Scotland-Iceland-Greenland ridges. Juveniles are mesopelagic and adults are benthopelagic.

The stock structure of the species is still unknown, some of the results from BASBLACK EC Study Contract (Anon 2000), namely length distribution and reproductive behaviour, are suggestive of migratory processes of components of the population.

Given the paucity of information on the stock structure for assessment purposes the stock is divided into a northern and southern component. The northern component comprises fish exploited by trawl fisheries in Sub-areas V, VI, VII and XII, the southern component being exploited by a longline fishery in Sub-area IX.

These assessment units were proposed on the basis of available information on the geographical distribution of international landings of the species and the similarity of catch-rate trends between ICES Sub-areas, and differences in fishing gear between fisheries.

4.3.6.2 Literature review

Genetic studies

A genetic study on the species was initiated during the BASBLACK project. In a first stage it aimed to optimize RFLP (Restriction Fragment Length Polymorphism) technique. The DNA was extracted and afterward three universal primers were tested which amplify distinct zones of the mitochondrial DNA. One of the primers, Taberlet primer, which amplifies a 411 bp fragment of the gene codifying for citochrome b, was used. Some of the amplified fragments were sequenced automatically, and the resulting sequences were compared with GCG database to confirm the amplification product and to obtain the map of restriction enzymes that cut the fragment. Of all enzymes obtained, six were chosen and only two presented polymorphic patterns, BsaJ I and Mbo II (Quinta and Santos, 2002). In all, 51 fish from three Northeast Atlantic localities were examined using ten restriction enzymes. Overall nucleon diversity was 0.180 (Quinta et al., 1994). Some genetic polymorphisms were identified but the results were inconclusive due to the small sample size (Quinta and Santos, 2002).

In a recent genetic study two phylogroups were identified for the genus *Aphanopus*: All sequences from the Mid-Atlantic Ridge (Faraday seamount), mainland Portugal and Madeira were clustered together while all the sequences from the southern coast of Pico island (Azores, central group) were grouped. The remaining sampling localities in Azores had sequences represented in both phylogroups. The outcome from the comparison of the same mtDNA regions of the closely related *Aphanopus intermedius* from Angola clustered with the ones from phylogroup from the southern coast of Pico island, Azores (Stefanni and Knutsen, 2007).

Otolith chemistry analysis

Under BASBLACK project analyses of whole otolith microchemistry were made under the scope of stock ID. The elemental composition of the otoliths was determined using solution-based Inductively Coupled Plasma Mass Spectrometry (ICPMS). ICPMS is a highly sensitive technique that enables simultaneous measurement of a wide range of elements (Anon, 2000). The sagittal otoliths were obtained from six different locations (Rockall Trough, Hatton Bank, Reykjanes Ridge, Mid-Atlantic Ridge, Portugal (mainland) and Madeira) throughout the Northeast Atlantic. The major element was Ca, with Sr and Fe present at concentrations greater than 1000 ppm. All other elements measured were present at concentrations varying between 0.1 to 7 ppm. The discriminant analysis applied to the results was able to classify well 88% of samples by area. The Reykjanes Ridge formed a distinct cluster (clearly separated along Axis 1). (Swan *et al.*, 2001).

Meristics

Under BASBLACK Project morphometric measurements were taken from specimens sampled at different fishing regions (Madeira, Sesimbra and Rockall Trough). Cluster analysis of variables was applied to further understand the influence of the different morphometric measurements, and to select the variables to be used on the subsequent discriminant analysis. Each variable was standardised, and then the Euclidean distance was taken as the dissimilarity measure to apply the Ward´s hierarchical method. The analysis of the morphometric data did not_ discriminated between the three regional groups, it only reinforced the division of the northern group from the southern ones. In fact, specimens from Madeira and Sesimbra were clearly separated from the Rockall Trough ones.

The separation between Sesimbra and Madeira was much less adequately expressed. The high percentage of variance explained by the first discriminant function reflected the important role played by total length, which appears to be the underlying significant component of the among-group differences. At Madeira and Rockall Trough, the most distinguishable regions, the majority of incorrectly classified specimens were either small individuals from Madeira or large individuals from Rockall Trough (Anon, 2000).

Parasites

Up to the moment there are few parasitic studies most of them were based on Madeiran specimens (Costa et al., 1996, 2000, 2003a, 2003b).

Age

At present, age data are not suitable for stock identification purpose (Section.XXX.)

Maturity

Under BASBLACK Project the evolution of maturity of both sexes throughout the year was studied based on the macroscopic and microscopic analysis of the gonads collected at three different locations of the NE Atlantic—NW of Scotland, Sesimbra (mainland Portugal) and Funchal (Madeira). Specimens with the largest total length were found in Funchal, whereas the smallest size was recorded in the NW of Scotland. Neither spawners nor post-spawners were ever observed in NW of Scotland and Sesimbra. In Sesimbra, only a few individuals attained pre-spawning stage and most of the early developing females exhibited atresia in their ovaries (Anon, 2000). In Funchal, all the maturity stages were found; spawners occurred from September to December (females) and from August to December (males). Length of first maturity for females was estimated to be around 1000 mm. (Figueiredo et al., 2003).

Two groups of spawners with different sizes were observed during the spawning period off Madeira (Bordalo-Machado et al. 2001):

a) a) A first group of individuals with TL smaller than 1250 mm began to spawn early in the spawning season (between September and December);

b) b) A second group of individuals with TL larger than 1250 mm spawn preferentially in January and February.

This fact is corroborated by the trend observed on the monthly distribution of GSI values of maturity post spawners females: an increasing trend on the GSI values from October to December followed by a decreasing trend that lasts until May. In June the GSI variability raised again.

Toxins

Under BASBLACK Project bioaccumulation studies were initiated but results were not spatially discriminated (Anon, 2000). The most pressing concern was the occurrence of mercury but the work was extended into other heavy metals, e.g., arsenic, cadmium, copper, lead and zinc. Initial results indicate that there is a seasonal level of mercury which exceeds European guidance levels, this is particularly true of liver tissue.

The mean levels of cadmium were approximately 30 fold above the recommended safe level (the worst cases were 100 fold above the limit). On occasion the zinc and copper levels also breached guideline levels in the livers although all samples for lead were well within the safe levels. All levels of organic contaminants in the liver and muscle were found to be at least five times lower than the strictest European dietary guidelines.

4.3.6.3 Information available on candidate stock structure indicators

Length distribution

Under BASBLACK Project a detailed analysis on length distribution was carried on and this indicated that black scabbardfish individual size ranged from 60 cm (Rockall Trough) to 150 cm (Madeira waters). Small individuals were caught in northern regions (Rockall Trough, Hatton Bank), intermediate size fish in the Azores and Sesimbra regions (mid-latitudes), and the larger ones were caught in southern regions (e.g., Madeira waters).

The spatial analysis of length data from different geographical areas showed that significant differences between the north and the south length distributions occurred and those could be caused by two distinct phenomena acting alone or together (Figure 4.3.41):

- the two corresponding components are different; the southern one is larger than the northern;

- the two fishing gears exploit different parts of the population; the bottom longline, the upper part and the bottom trawl, the lower one.

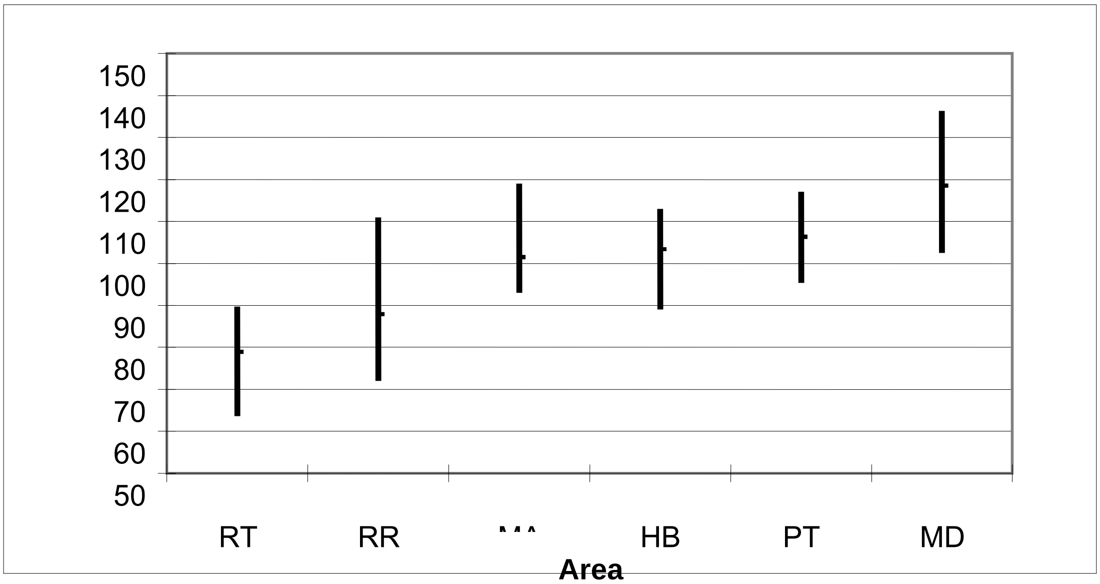


Figure 4.3.41. Mean total length(cm) +/- maximum and minimum length (y_axis) by area for all fish from which otoliths were collected for microchemical analysis: HB- Hatton Bank; MA – Mid-Atlantic Ridge; MD-Madeira; Portugal Mainland; RR- Reykjanes Ridge; RT- Rockwall Trough (Extracted from Anon, 2002).

CPUE

Information on the French CPUE series was available from log-books database from 1989 to 2005, (Biseau, 2006 WD11 in ICES, 2006) however the trends on French CPUE were difficult to interpret and understand (ICES, 2006).

CPUE data of the Portuguese longline fishing fleet targeting black scabbardfish was presented in previous WGDEEP reports (ICES, 2001; ICES, 2002; ICES, 2003; ICES, 2004) During 2005 and 2006 data on the nominal annual effort from this fleet has been collected by IPIMAR since 2000. The CPUE trend is characterized by a great stability. The Portuguese licensing scheme adopted for deep-water species and implemented since 2002 avoid changes on total nominal effort (ICES 2006).

Due to difficulties on the interpretation of French CPUE time series the use of the two CPUE series were considered inappropriate for stock id purposes.

Genetic studies

A new study on genetics of black scabbardfish was initiated and it is expected that a microsatellite DNA primer development will be soon completed. This study has been funded by the Norwegian Ministry of Fishery and Coastal Affairs and by Grant MAR-ECO (www.mar-eco.no), a field project under the Census of Marine Life programme. Further, samples from several parts of the species distribution range will be collected and DNA analysis will be initiated 2008, funded by the European Science Foundation.

Parasites

Under a Portuguese national project a study on parasites was initiated in 2006. During the first year parasites from specimens caught at the different areas (Portugal Mainland, Azores and Madeira) were collected and first identifications were made. In specimens already examined seven metazoarian species, one Myxozoa, one Monogenea, three Eucestoda, one Acanthocephala and one Nematoda were identified Despite the results on incidence of parasites are still preliminary it is important to note that differences on species between areas have been already detected.

4.3.6.4 Recommendations

The data available are inadequate to revise our understanding of current assumptions of stock structure. It is recommended that:

- a wide sampling area coverage of the genetic study that is now undertaken under the EURODEEP Project;
- in parallel with that study that aims the identification of genetic stocks further cooperative investigation should be carried on in order to support the conclusion of that project. In particular, life history traits and ageing studies, should be implemented both at the northern and southern areas. A standardization of techniques should be firstly defined a joint workshop should be held to jointly analyse the results.

4.3.7 Red (black spot) seabream (*Pagellus bogaraveo*)

4.3.7.1 Current ICES stock structure

As indicated in WGDEEP06

"*Stock limits are generally determined not only by biological considerations but also by agreed boundaries and coordinates. 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) seabream, but it offers a better way of recording the available information.* "

The inter-relationships of the (blackspot) seabream 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 show 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.

4.3.7.2 Relevant literature review for stock identification

The blackspot seabream is found in the northeast Atlantic, from south of Norway to Cape Blanc, in the Mediterranean Sea, and in the Azores, Madeira, and Canary Archipelagos (Desbrosses, 1938**)**. Hareide and Garnes (2001) reported the occurrence of this species along the Mid-Atlantic Ridge (north and south of the Azores).

This is a benthopelagic species that inhabits various types of bottom (rock, sand, and mud) down to depths of 700 m and that aggregates for spawning. The vertical distribution of this species varies according to size, and to season of the year. In Azores it has been observed a direct correlation between the distribution different life stages and depth; juveniles inhabit littoral and shallow waters (0-30 m), young immature individuals live in depths less than 300 m, and large adults occur in areas with depths varying from 300-700 m (Silva *et al.*, 1994).

Similar general distribution patterns seems to be observed on the strait of Gibraltar (Gil, 2006) and northern areas (IXa, VIII, VII and VI ICES areas) (Guegen, 1974 and Desbrosses, 1938).

Growth

Aging data is collected annually from the Azores and growth information has been reported to ICES (Fig. 4.3.42) (ICES, 2006). Growth rate parameters of red (blackspot) seabream are shown in Table 4.3.9 across a variety of areas. Table 4.3.9 suggests differences between areas. However, it was not possible to establish whether these were due to differences in stock structure, environmental factors or the methodological approach.

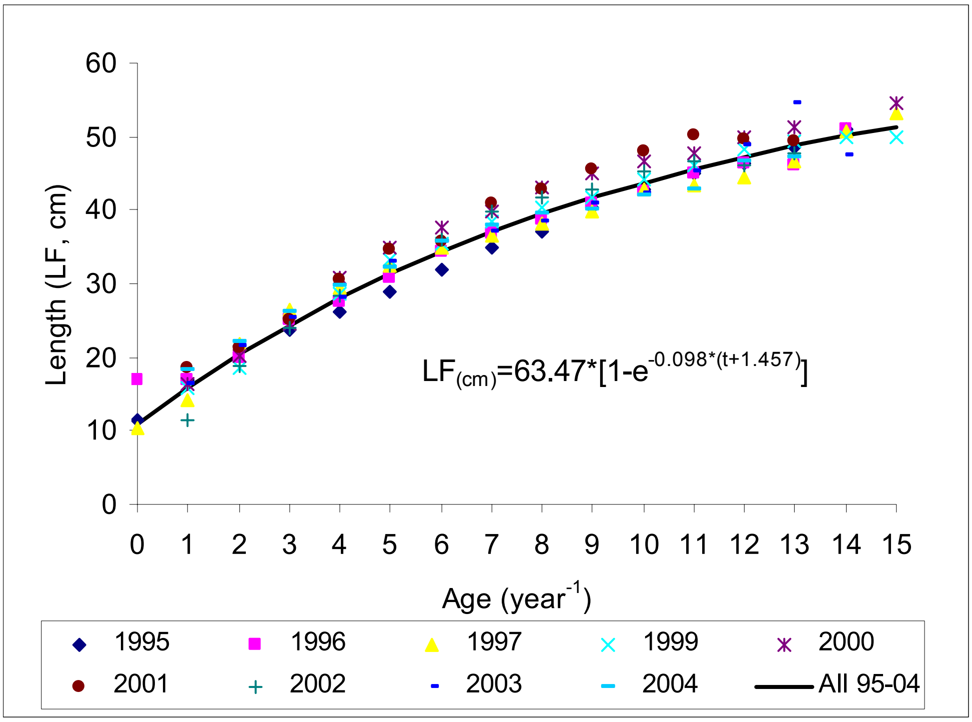


Figure 4.3.42. Estimated von Bertalanffy growth curve, for sexes combined, of *Pagellus bogaraveo* from the Azores. Growth curves were obtained by combining mean length at age data for all survey years (1995-2005).

Table 4.3.9. Resume of some growth parameters from the literature.

Year	Loo (cm)	K (ano-1)	To (ano-1)	Author	Area	Range (cm)	Lenght	Ages
1967	53,86	0,13	-1,02	Ramos and Cendrero (1967)	Cantabrian Sea	18–45	FL	2–12
1969	56,80	0,09	-2,92	Gueguen (1969)	Bay of Biscay	17–50	FL	1–20
1983	51,56	0,21	-0,53	Sanchez, 1983	N. Western Atlantic	14–50		1–12
1987	48,66	0,20	-0,47	Alcazar et al. (1987)	Asturian waters	15-47	TL	1-13
1987	48,66	0,20	-0,47	Alcazar et al. (1987)	Asturian waters	15-47	TL	1-13
1989	58,50	0,12	-1,55	Krug (1989)	Azorean waters	15-49	FL	1-14
1989	57,45	0,10	-1,13	Krug (1989)	Azorean waters	11-45	FL	1-14
1995	25,12	0,19	-2,72	Mytilineou and Papaconstantinou (1995)	N. Aegean Sea	7-18	FL	0-3
2001	58,00	0,17	-0,67	Sobrino and Gil (2001)	Strait of Gibraltar	11-54	TL	0-8
2003	62,24	0,10	-1,29	Pinho (2003)	Azorean waters	8-60	FL	0-15

Genetic studies

Recent studies show 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).

Tagging

Seasonal migrations of the species between ICES areas IX, VIII, VII and VI have been reported based on tagging experiences (Gueguen, 1974).

A tagging programme was carried out in sub-area Xa2 during the last five years under the framework of the annual Azorean deep-water longline survey. Based on the results obtained up to now, no significant movements between areas (coastal, banks, seamounts) have been reported but local seasonal migrations are observed (Pinho, 2003). Tagging has been done also in the Strait of Gibraltar (south part of ICES area IXa) and no significant movements are reported, although local migrations are also observed (Gil, 2006).

4.3.7.3 Information available on candidate stock structure indicators

Length distribution

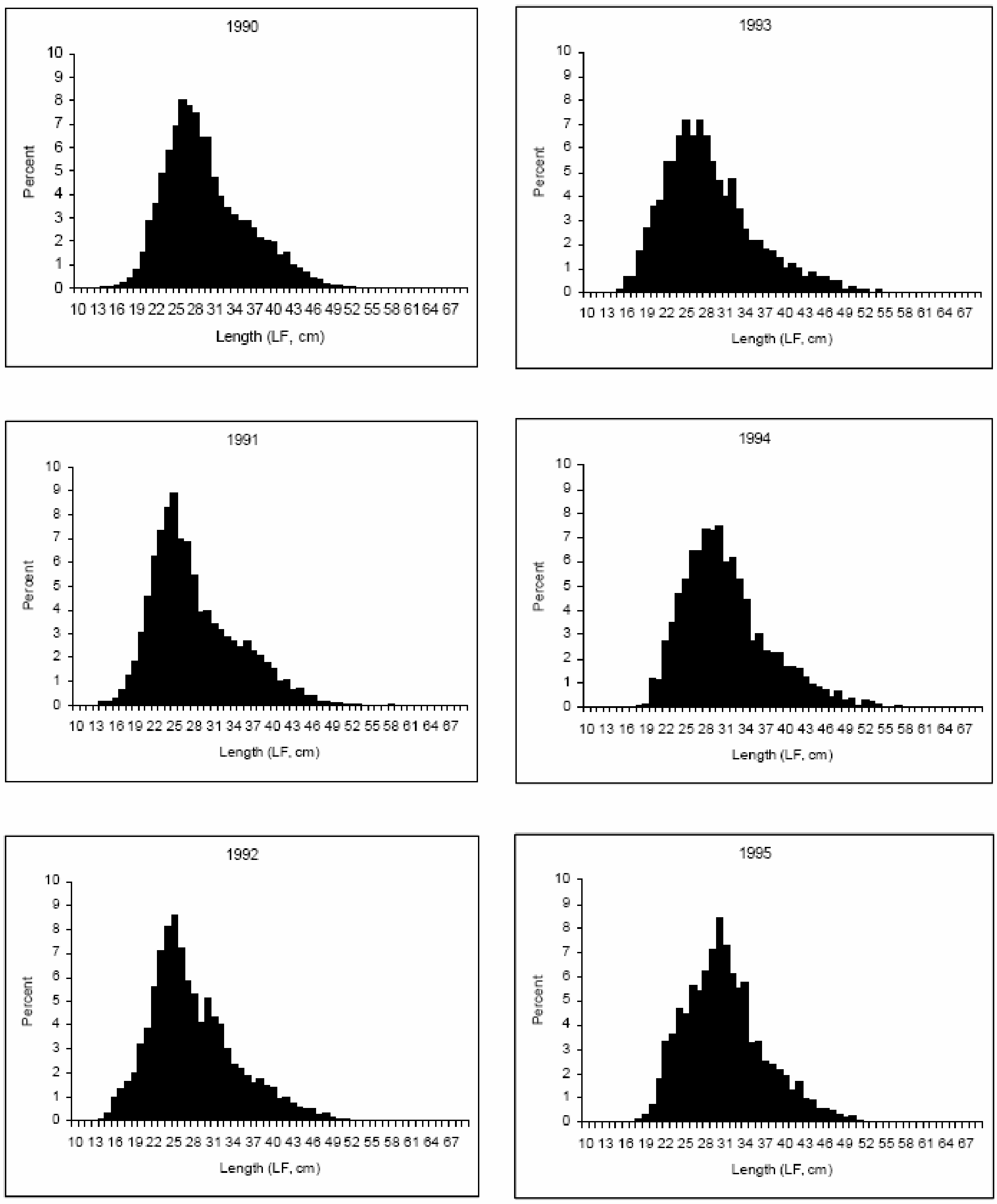
The annual length frequency distributions based on commercial samples taken in Azores have been stable for the last 15 years, with minimum length of 10cm, maximum of 70cm and a mode around 30cm (Fig. 4.3.43) (ICES, 2006). Length compositions are also available from The Azorean longline surveys since 1995 (ICES, 2006).

In the Strait of Gibraltar the annual length frequency distributions varied along years in some years only one mode was observed while in others two or even three were observed. The minimum total length was 25cm and the maximum 58cm (ICES, 2006) (Fig. 4.3.44).

In Azores the mean length of landed specimens present an increased pattern along time (Fig 4.3.45). This observation is also supported from the surveys data.

Mean length at the landings from the Gibraltar strait decease from 42cm in 1983 to 35cm in 1998 and start to increase thereafter due to management measures implemented (Fig. 4.3.46).

Although some length information is available from the two areas where the fishery occurs it is not enough for stock identity because it is not possible to establish whether the observed differences in the stock structure were due to gear type, gear configuration, selectivity, fishing strategy, environmental factors, the methodological approach for sampling or state of the stock.


1990
1993
1991
1994
1992
1995
Percent
0 1 2 3 4 5 6 7 8 9 10
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)

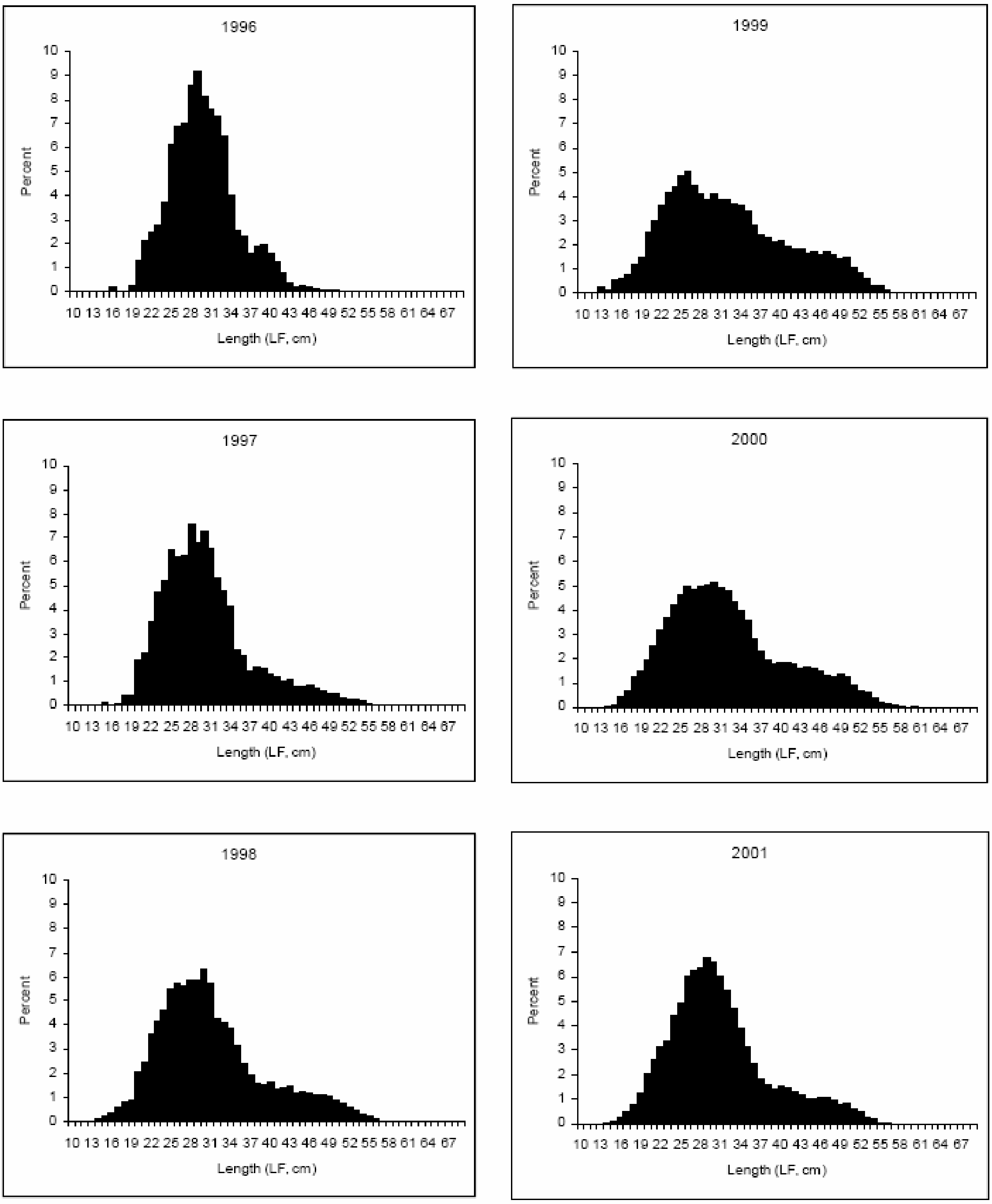


Figure 4.3.43. Length composition from the Azores area (ICES area X)

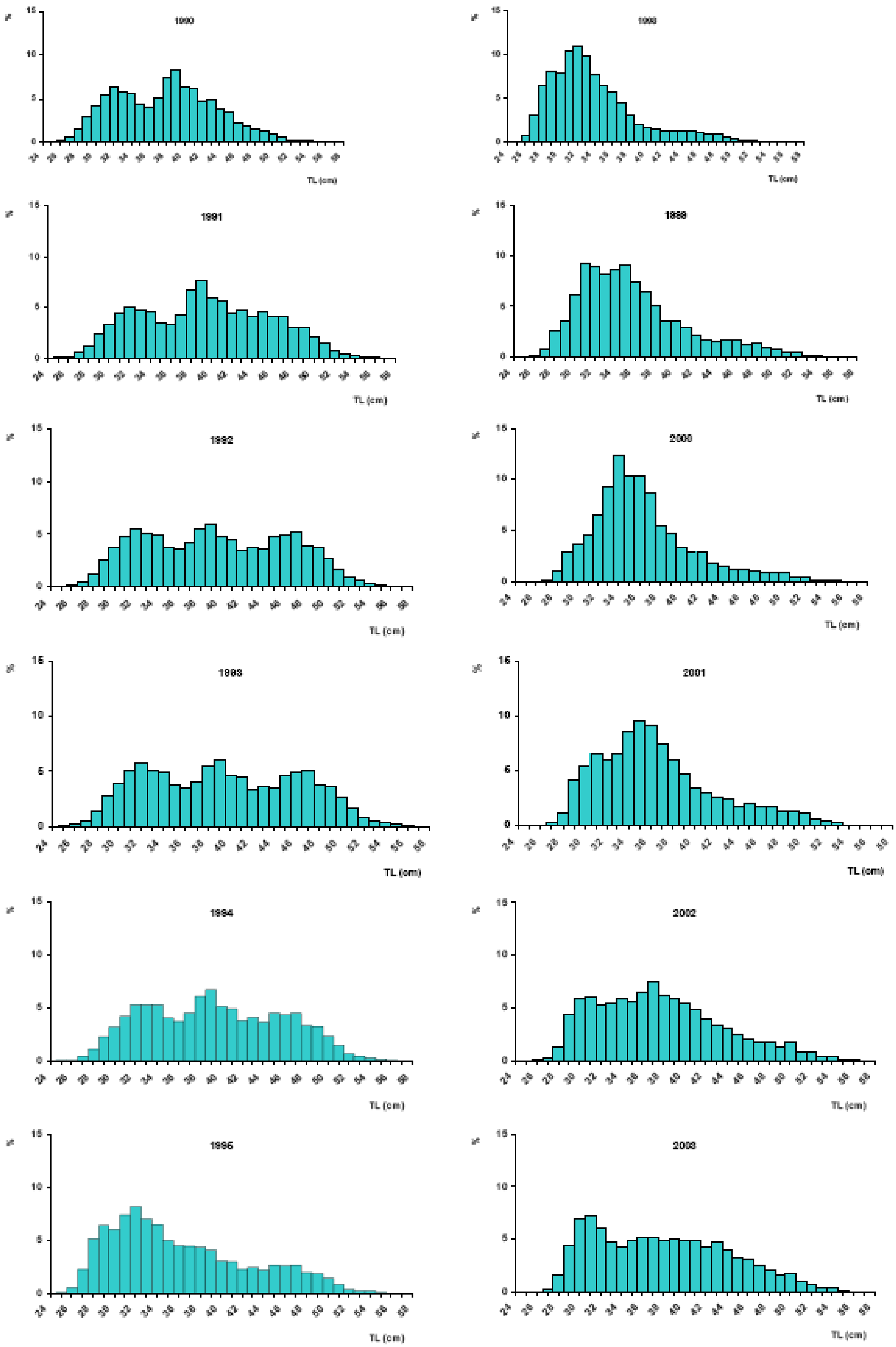


Figure 4.3.44. Length composition from Gibraltar strait (ICES area IX)..

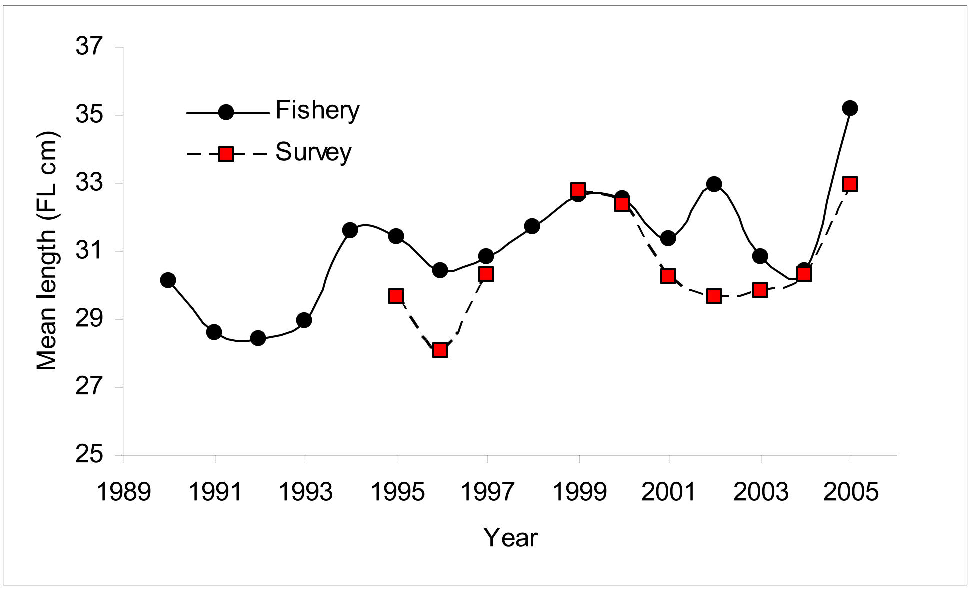


Figure 4.3.45. Fishery and survey annual mean length (fork length) of *Pagellus bogaraveo* from the Azores (1990-2005).

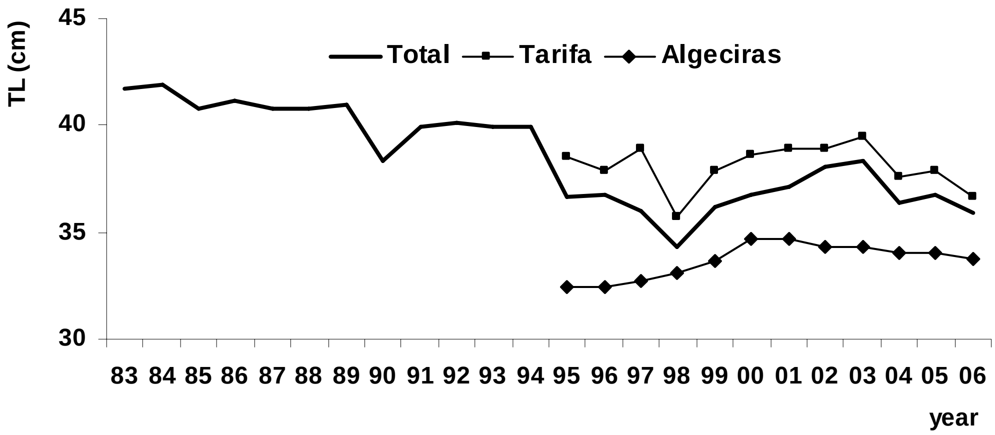


Figure 4.3.46. Annual mean length by landing port (1983-2006) of Pagellus bogaraveo for the strait of Gibraltar (Gil *et al*, WD4).

CPUE

Standardized cpue was estimated for area Xa2 for the period 1990-2005, based on landings and effort by trip from the Azorean longliners (ICES, 2006) (Figure 4.3.47). CPUE in weight is very stable and is around 20Kg per 1000 hooks.

Time-series abundance data are also available from Azores fisheries-independent longline survey (1995-2005) (ICES, 2006).

Nominal CPUE from the Gibraltar strait (ICES area IXa) is also available (Gil et al., WD4 2007) (Fig. 4.3.48). No survey data is available for this area. Abundance indices available from areas Ixa and Xa2 are not directly comparable.

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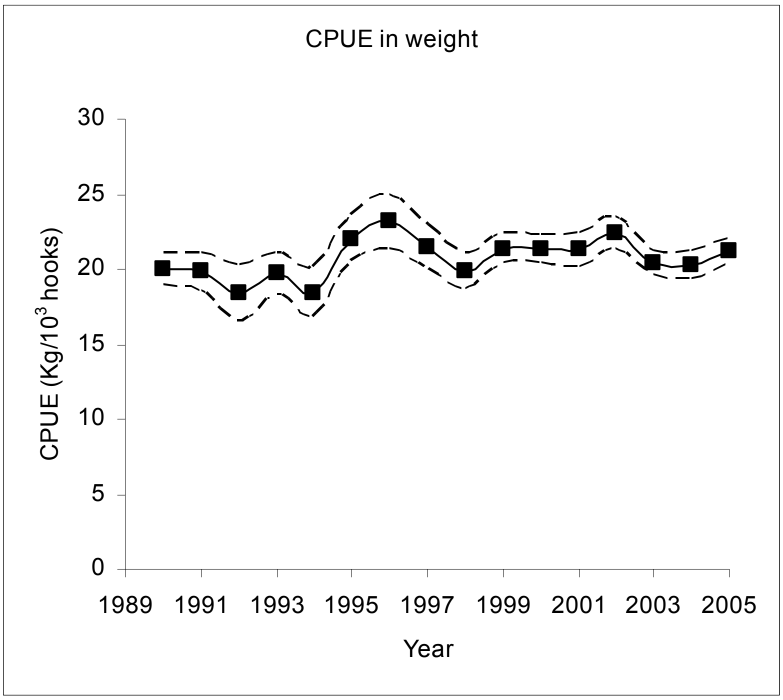


Figure 4.3.47. Standardised cpue from the Azores hook and line fisheries.

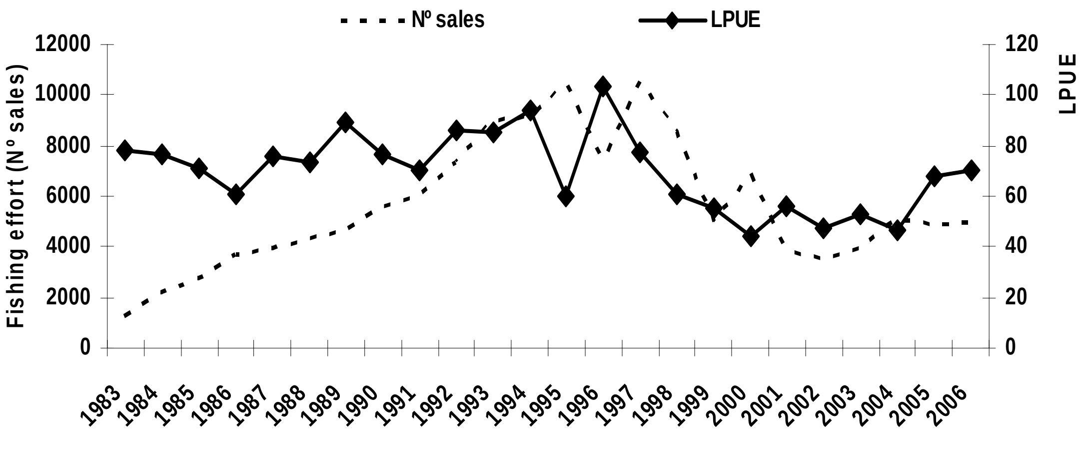


Figure 4.3.48. ***Pagellus bogaraveo*** **of the Strait of Gibraltar. Effort and LPUE (1983-2006) (Gil** ***et al.,*** **WD4 2007).**

4.3.7.4 Recommendations

Available information, particularly genetics and tagging, seems to support the current assumption of three assessment units (VI – VIII, IX and X).

4.3.8 Roundnose grenadier (Coryphaenoides rupestris)

4.3.8.1 Current ICES stock structure

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 MAR (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.

4.3.8.2 Literature review

At the beginning of the commercial fisheries for roundnose grenadier off Canada and the northern Mid-Atlantic Ridge, several hypotheses were proposed to account for differences in body size and reproductive maturity between areas (see Atkinson, 1995 for a review). Further studies allowed to observe fish in all maturity stages in all the distribution area (Allain, 2001; Kelly et al. 1996,1997; Shibanov 1997; Vinnichenko et al., 2004). There is no evidence of long distance migration of adult fish, which are considered to be rather poor swimmers, based on morphological and metabolic knowledge.

4.3.8.3 Information available on candidate stock structure indicators

Spatial distribution

Roundnose grenadier is widely distributed in the North Atlantic. Its area stretches from Norway to northwest Africa in the east to the Canadian-Greenland coasts and the Gulf of Mexico in the west, and from Iceland in the north to the areas south of the Azores in the south (Parr 1946; Andriyashev, 1954; Leim and Scott 1966; Zilanov et al., 1970; Geistdoerfer 1977; Gordon 1978; Parin et al. 1985; Pshenichny et al. 1986; Sauskan 1988; Eliassen 1983). Aggregations of this species are found on the continental slope of Europe and Canada, on the MAR seamounts, in the Faroe-Hatton area (banks Hatton, Rockall, Louzy, Bill Baileys etc.) and in the Skagerrak and Norwegian fjords.

So far, natural boundaries to the dispersal of all life stages have been used to infer an hypothetical stock structure.

Length distribution

Total length of the species in the trawl catches ranges from 3 to 123 cm. The bulk of catches taken at the Canadian continental slope is made up by fish of 50-70 cm length (Figure 4.3.49), on the MAR by fish of 70-90 cm and in the Faroe-Hatton area – of 45-92 cm length (Savvatimsky 1969; Shibanov 1997; Vinnichenko et al. 2004).

However, such length distribution are aggregated over depth, and years. The difference cannot be ascribed to stock dynamics without an analysis of all possible factors. Detailed data was not available to the working group. The working group requests members to extract raw data with all relevant information on sampling area, year, depth, fishing gears, etc.

Times series of commercial catch

The times series of commercial catches by large areas (Figure 4.3.50) do not conflict with the current ICES stock structure. However, this has been completely driven by fleet dynamics and does not allow to assess whether the catch in one area had any effect on the biomass and densities in others.

Age

Age estimates obtained from otoliths have been validated for juveniles roundnose grenadier (Gordon and Swan, 1996), age readings by scales is questionable (Bergstad 1990), and the annual periodicity of the formation of growth increments observed on otoliths thin slice was validated by radiometric method for the related pacific grenadier, *Coryphaenoides acrolepis*, (Andrews et al., 1999). Age estimated from otoliths reading indicate that roundnose grenadier is a slow growing long living species. The oldest age ever estimated is 72 years (Bergstad 1990). The proportion of older fish varies between studies, with fish of age ≥ 50 years being more frequent in a study of the Skagerrak population (Bergstad 1990) than to the west of the British Isles (Kelly et al. 1997; Allain and Lorance 2000). It is unclear whether this reflects variations in the local longevity, changes in population structure due to exploitation, or variations in the readings methods and interpretation of growth rings. Differences in age composition may then not be useful as indicators of stock structure.

Maturity

Published results on length (11.5-12.5 cm pre-anal fin length, PAFL) and age (9-14 years) at first maturity of females to the West of British Isles and in the Skaggerak (Allain, 2001; Bergstad, 1990; Kelly et al., 1996,1997) do not seem to clearly discriminate these two groups, although they are most likely to be demographically different unit.

Reproduction

Reproductive area stretches from Iceland to 38°N on the MAR and from Central Norway to the Bay of Biscay in the European waters (Allain, 2001; Kelly et al. 1996,1997; Shibanov 1997; Vinnichenko et al., 2004). In the Northwest Atlantic, insignificant numbers of spawning grenadier were found (Zilanov et al. 1970; Zaharov and Mokanu 1970; Grigoriev 1972). Males spawning is extended and portioned; females have short-term portioned spawning (Grigoriev 1972; Alekseev 1982). Spawning occurs in the Northeast Atlantic-bottom layer throughout the entire year, being the most active in summer and autumn (Shibanov 1997; Vinnichenko et al. 2004) To the west of the British Isles, females with maturing ovaries have been observed from February to December but they were more abundant from May to October, and spawning appears to extend at least from May to November (Kelly et al. 1996; Allain 2001). Studies in Icelandic waters indicate year- round spawning, with no obvious peaks (Magnússon et al. 2000).

The diversity of spawning grounds and differences in the timing of spawning between areas may suggest the existence of more than one stock.

Genetics

Some studies have detected genetic differentiation in at least parts of the species range and indicating the presence of distinct populations within the species (Logvinenko *et al.* 1983, Duschenko, 1989).

Migrations

Roundnose grenadier is a slow-moving species which prefers grounds with slow currents. Vertical diurnal migrations are also observed, the pattern of which depends on feeding (Savvatimsky 1969) and water circulation and meteorological processes (Shibanov and Vinnichenko in press).

There is no direct evidence of long distance migrations made by adult fish in the high seas. The distribution and dispersal of the eggs and larval stages is poorly know, except in the Skagerrak (Bergstad and Gordon, 1994). Juveniles grenadier of 2-8 cm pre-anal length (PAL) were caught in the mid-water by 120-840 m over bottoms of 1200-3200m along Greenland slope, on the Mid-Atlantic Ridge, Hatton bank, in the Irminger and Labrador seas suggesting that some passive migrations of juveniles in the open ocean occurs (Vinnichenko and Khlivnoy in press).

CPUE/LPUE trends

There is information for MAR from the Soviet/Russian data (Figure 4.3.51). The CPUE varied strongly, but generally declined in the 1978, then the level appears to have remained comparatively stable till to 1990. Further declining took place in 1991-1993 and 1998-2000. There is some increasing of CPUE in the recent years but it remains at a low level, almost half that observed in the early 1970s at the onset of exploitation. CPUE data from the MAR should be considered with caution because catch rates depend upon distribution of pelagic concentrations, experience of vessel crew, environmental factors, local densities. Although, CPUE from the MAR area suggest an overall decline in catch rates since the 1970s CPUE series may not track actual fish abundance at population level.

There are the LPUE for the whole French trawling fleet in the areas west of British Isles (sub-areas V, VI and VII). The data showed stable or increasing trend over time (Figure 4.3.52). The same trend was observed when selecting different fishing sequences. The interpretation of these LPUEs proved problematic. Results of previous observation showed that LPUE of roundnose grenadier depends very much of depth, location of trawling and some other factors (Anon, 2006a). The LPUE series are considered to be uninformative with respect to stock trends without further detailed analysis of spatial trends in the fishery.

The problems that make CPUEs difficult to use for stock assessment purposes do not allow any inferences to be made on stock structure.

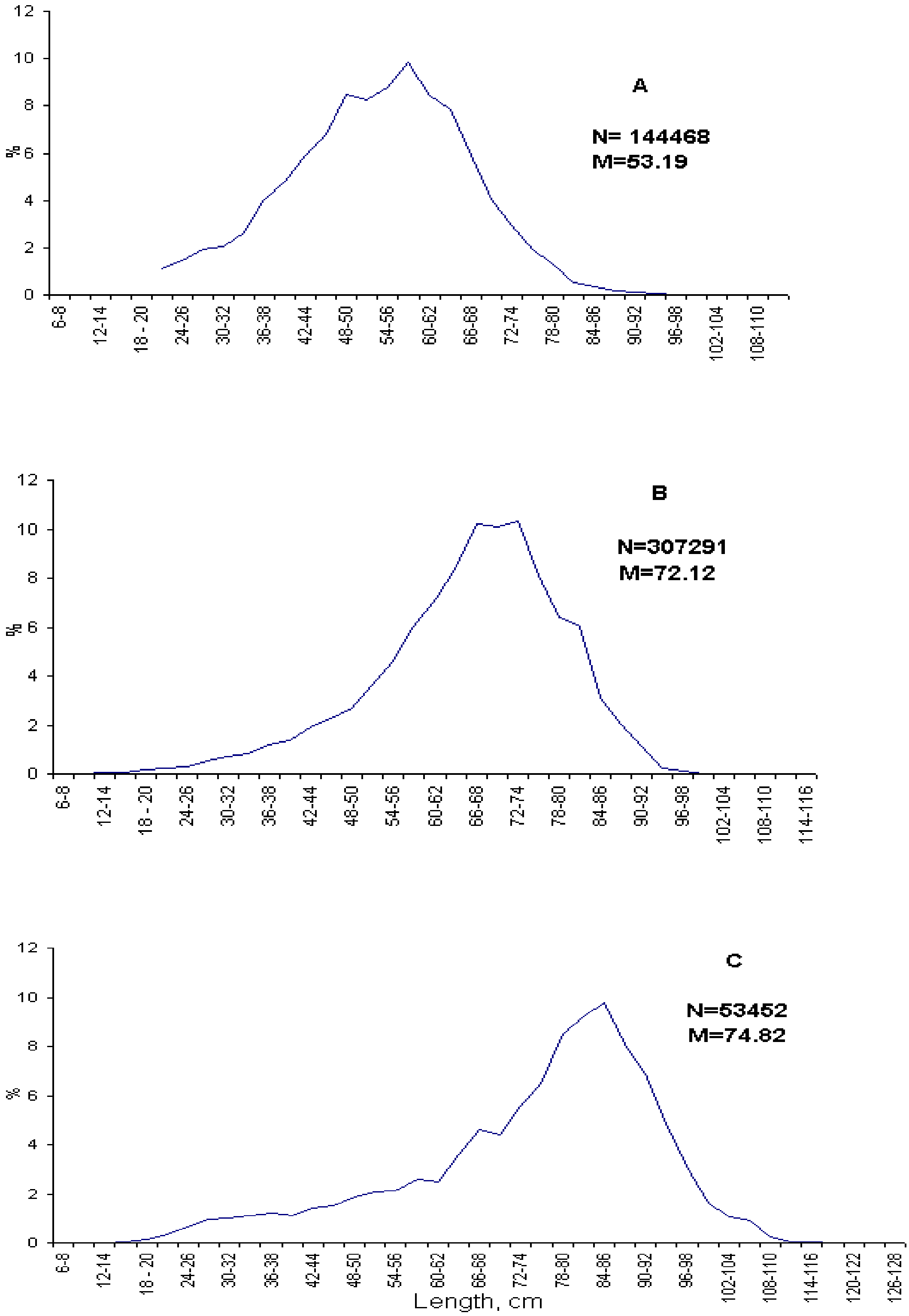
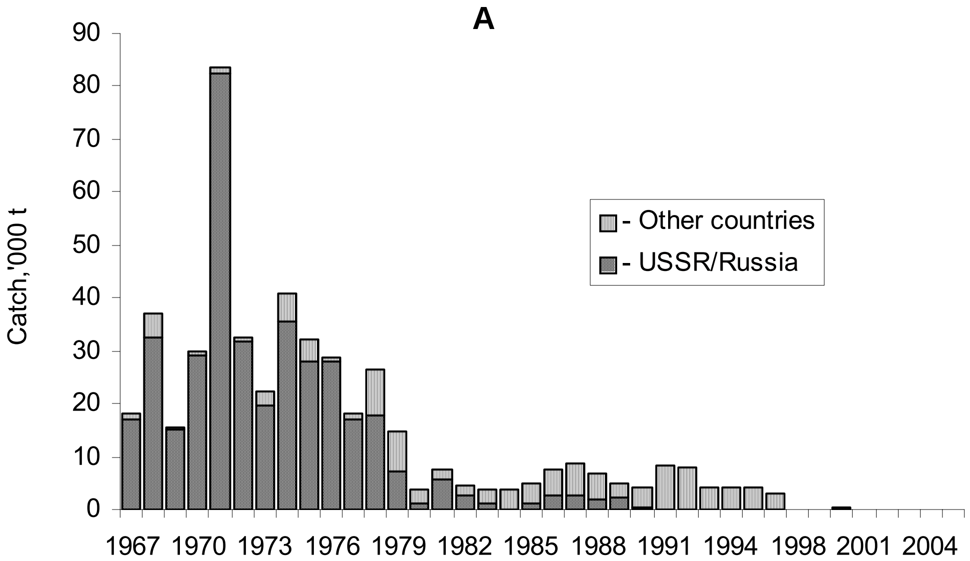
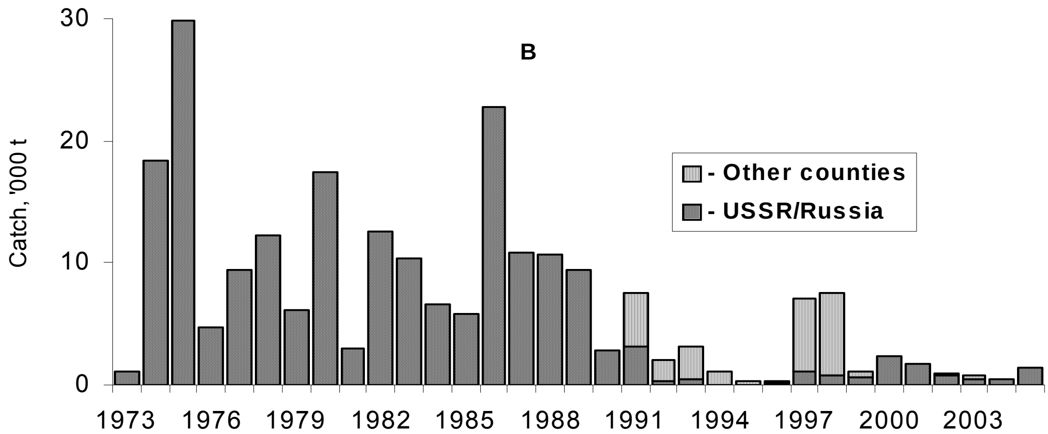


Figure 4.3.49. Length distribution of roundnose grenadier in the Northwest Atlantic (A), on the MAR (B) and in the Faroe-Hatton area (C) by PINRO data from 1970 to 2005





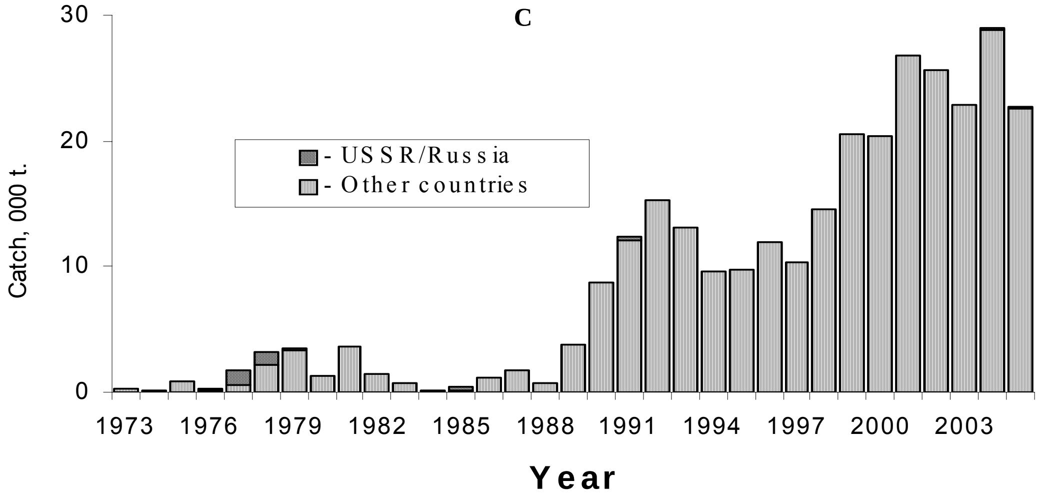


Figure 4.3.50. Time series of Catch of roundnose grenadier in the Northwest Atlantic (A), on the MAR (B) and in the Northeast Atlantic (C)

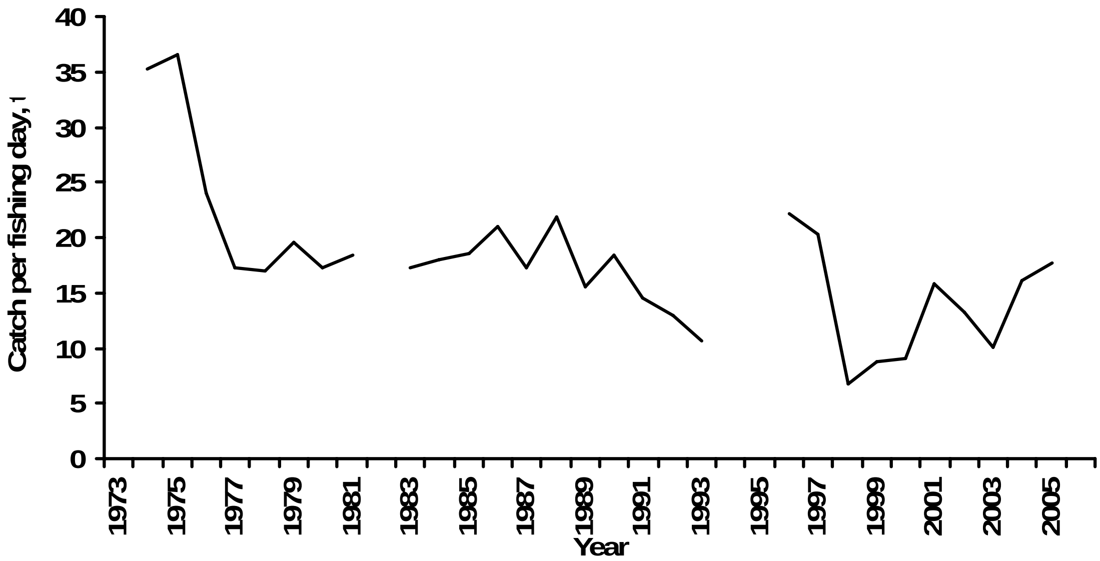


Figure 4.3.51. Soviet/Russian CPUE of roundnose grenadier on the MAR in 1973-2005

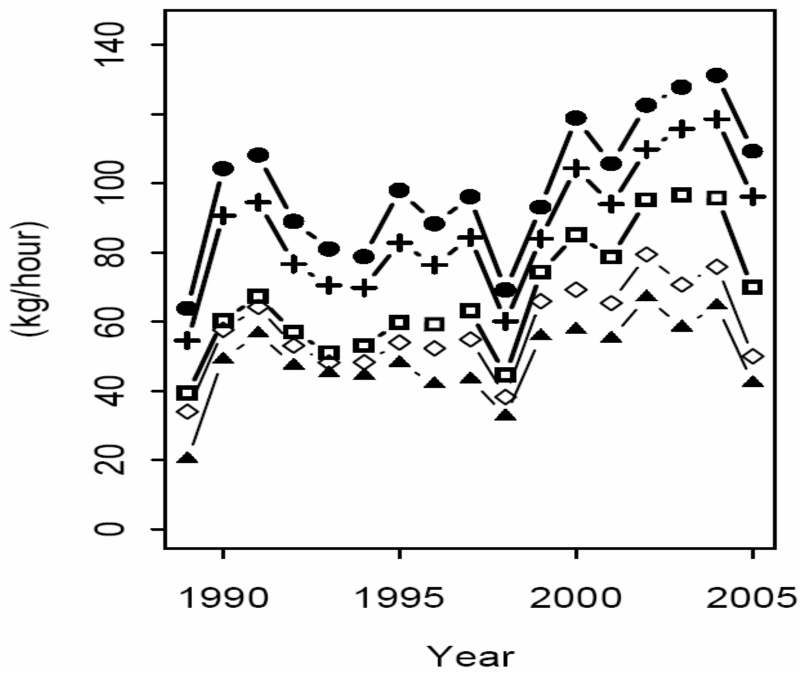


Figure 4.3.52. LPUE of the French trawlers in Vb,VI and VII, for different selection of fishing sequences: black circle =sequences with more than 10% roundnose grenadier; cross=sequences with more than 5% roundnose grenadier; white square sequence with roundnose grenadier present; white diamond=sequences with the three species roundnose grenadier, blackscabbardfish and deepsea sharks present; black triangle all deep water fishing sequences.

4.4 Conclusions and recommendations

The WG was of the opinion that meeting back to back with SIMWG was fruitful. The WG recommends:

- To hold the next WGDEEP/SIMWG when new genetics results are available. Such results are expected to be available soon for ling and, later, black scabbardfish;
- To carry out in first priority a genetics project on orange roughy, blue ling and greater argentine. This is to the depleted status of these species, and also to their aggregating behaviour, which could be consistent with the assumption of more than one stock;
- To carry out in second priority genetics projects on roundnose grenadier and alfonsinos

5 Stocks and fisheries of Greenland and Iceland Seas

5.1 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 by catches 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 characterised 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 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 while the pelagic fisheries use pelagic trawls and purse seines. According to information from the Directory of Fishery there are almost 1400 vessels that have license to fish and landed catches in 2006, whereof around 1200 are within the TAC system, but about 200 small boats are operating within an effort system. 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 fishes during different time of the year.

The total catch in Icelandic waters in 2006 amounted to 874 thousands tonnes where pelagic fishes amounted to 357 thousands tonnes, and deep sea species amounted to around 18 000 tonnes (Figure 5.1.1; Table 5.1.1).

Total of 603 vessels reported landed of deep sea species in 2006, from less than 10 kg to more than 1 100 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

5.1.1 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 1 000 tonnes. In 2006 about 7 600 tonnes of deep water species were caught in bottom trawl, whereof 4 800 were greater silver smelt. After a reduction in the landings in recent years, there was an increase in the landings for above mentioned species in 206, compared to 2004 and 2005. Table 5.1.1 gives the catches the most important deep-sea species taken by different gears in recent years and Table 5.1.2 gives the total landings of deep-sea species from sub-division Va since 1988.

5.1.2 Technical interactions

Table 5.1.1 shows landings by gear and by species.

Demersal fisheries usually target a mixture of roundfish species or a mixture of flatfish species with various amount of non-targeted species (such as ling, blue ling, tusk and redfish) as a bycatch. A fishery directed towards redfish exists along the shelf edge from Southeast to Northwest of Iceland with several deep-sea species as by catch. The saithe fishery is also along the shelf edge, often in the same areas as the redfish fisheries, but the fleets are often targeting at redfish during daytime and saithe during nights. Therefore the fishery for one of those species is relatively free of bycatch of the other species even though they take place in the same area. Targeted fishery for deep-sea species (mainly tusk and ling) sometimes takes place from the southeast to the southwest coast, often with cod and haddock as bycatch. Other deep-sea species such as blue ling are nearly entirely caught as a bycatch, specially after the closure of known spawning areas for blue ling in 2003.

Some of the species caught in Icelandic waters are caught in fisheries targeting only one species, with very little bycatch. An example of this is directed Greenland halibut fishery which is fished in waters deeper than 500 m west and southeast of Iceland. The bycatch in the Greenland halibut fishery in these areas show that it is very clean fishery with Greenland halibut as over 90% of the total catches in the western area where over 16 thous. tonnes are caught with deep-sea redfish being the most important bycatch species with less than 9% of the total catch in that area. Other species such as tusk, ling blue ling and are more like an "bycatch species" in the where these species are usually minority of the catches (Figures 5.1.2 and 5.1.3).

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 cod 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 fishes like plaice, dab, lemon sole and witch.

The spatial distribution of the trawlers, gillnet- and the longline fleets effort is shown in 5.1.4 – 5.1.6. In general, the trawlers operate further away from the shore than the longliners and the gillnetters.

5.1.3 Ecosystem considerations

A number of recent initiatives have attempted to map the presence of cold-water corals in Icelandic waters through questionnaires to fisherman and ROV surveys (ICES 2004, 2005 and 2006). *Lophelia pertusa* occurs near the shelf break off the south and western coasts at a depth range of 100-800m 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 80km^2 have been closed to all fishing except those targeting pelagic fish.

5.1.4 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 operates 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 5.1.5). 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 on the biology of various stocks, many areas have been closed temporarily or permanently aiming at protect juveniles. Figure 5.1.7 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 5.1.1. Overview of the deep-sea fishery in Icelandic waters (Va) in 2006 by gear type (t).

Species and gear		Landings (tonnes)
Ling	Bottom trawl	1264
	Danish seine	212
	Gillnet	628
	Hook	8
	Lobster trawl	441
	Long-line	3734
Ling Total		**6288**
Blue ling	Bottom trawl	1460
	Danish seine	93
	Gillnet	13
	Lobster trawl	19
	Long-line	150
Blue ling Total		**1736**
Tusk	Bottom trawl	92
	Gillnet	40
	Hook	7
	Lobster trawl	8
	Long-line	4912
Tusk Total		**5060**
Greater silver smelt	Bottom trawl	4768
Greater silver smelt, Total		**4769**

Table 5.1.2. 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
ALFONSINOS (Beryx spp.)																			
ARGENTINES (*Argentina silus*)	206	8	112	247	657	1255	613	492	808	3367	13387	6704	5657	3043	4960	2683	3645	4401	4769
BLUE LING (*Molva dypterigia*)	2171	2533	3021	1824	2906	2233	1632	1635	1323	1344	1154	1877	1711	941	1377	1158	1204	1565	1807
BLACK SCABBARDFISH (*Aphanopus carbo*)							1			1		9	18	8	13	14	19	19	23
BLUEMOUTH (*Helicolenus dactylopterus*)																			
GREATER FORKBEARD (*Phycis blennoides*)																			
LING (*Molva molva*)	5861	5612	5598	5805	5116	4854	4604	4192	4060	3933	4302	4647	3743	3346	4518	4264	4606	5065	7243
MORIDAE																			
ORANGE ROUGHY (*Hoplostethus atlanticus*)				65	382	717	158	64	40	79	28	14	68	19	10	1	28	9	2
RABBITFISHES (*Chimaerids*)				499	106	3	60	106	21	15	29	2	5						
ROUGHHEAD GRENADIER (*Macrourus berglax*)									15	4	1		2	1	4	33	3	5	7
ROUNDNOSE GRENADIER (*Coryphaenoides rupestris*)	2	4	7	48	210	276	210	398	140	198	120	129	67	57	60	57	181	76	62
RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*)																			
SHARKS, VARIOUS		31	54	58	70	39	42	45	65	70	87	45	45	57	47	62	66	54	29
SILVER SCABBARDFISH (*Lepidopus caudatus*)																			
SMOOTHHEADS (*Alepocephalidae*)					10	3	1	1											
TUSK (*Brosme brosme*)	6855	7061	7291	8732	8009	6075	5824	6225	6102	5394	5171	7264	6391	4823	5578	5596	4654	4819	6281
WRECKFISH (*Polyprion americanus*)																			

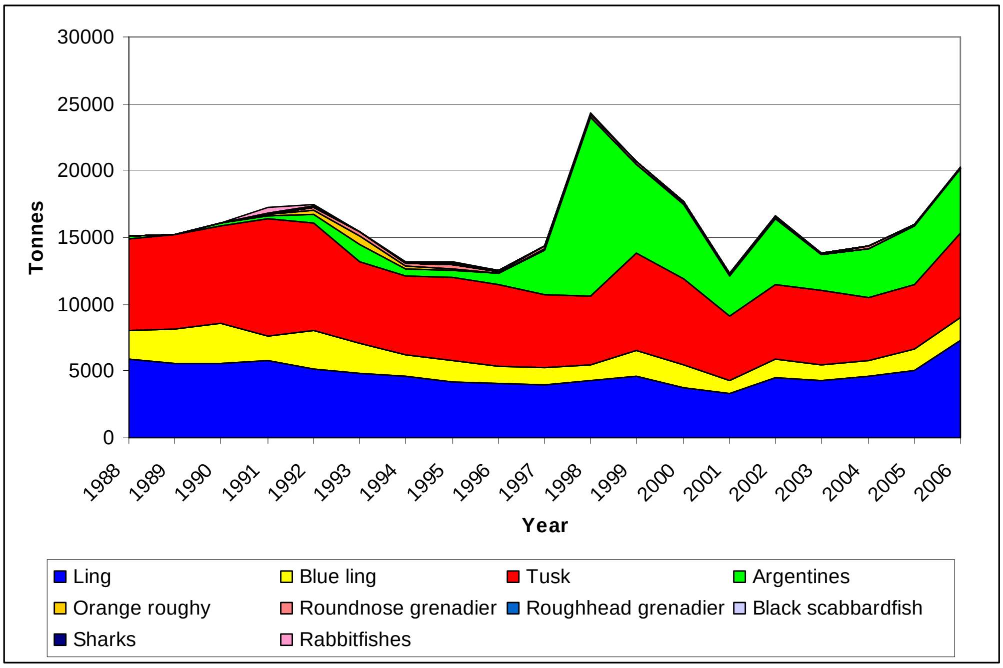


Figure 5.1.1. Fishery of deep-sea species in sub-Division Va 1988-2006, by species.

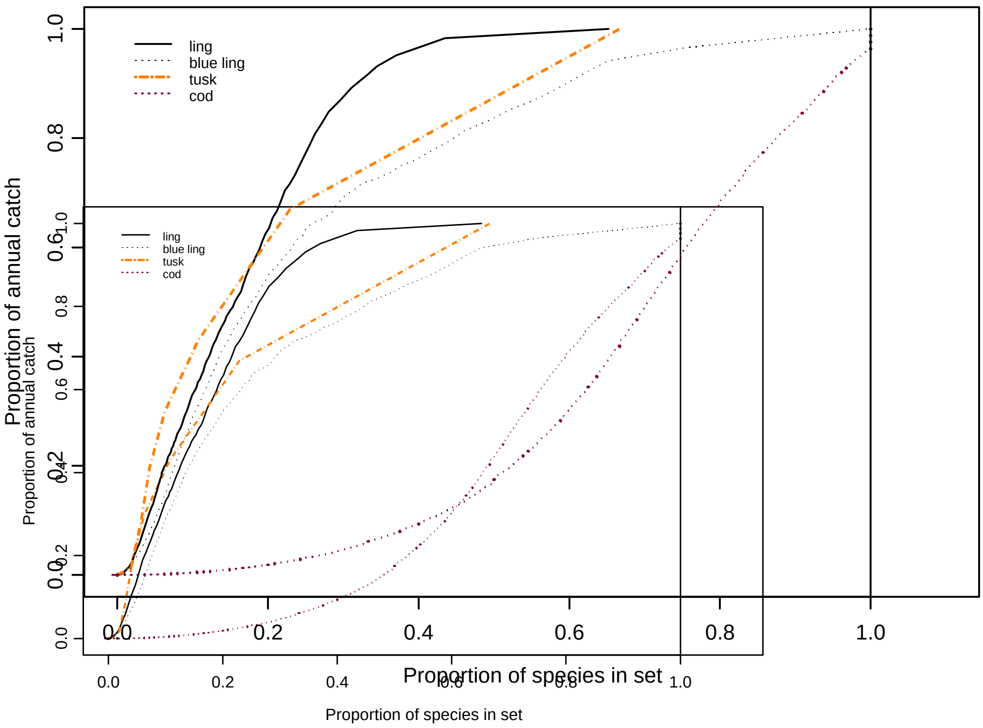


Figure 5.1.2. Cumulative plot for long line in 2005. An example describes this probably best. Looking at the figure above it can be seen from the solid line that 50% of the catch of ling comes from sets where tusk is less than 15% of the total catch while only unsignificant % of the catch of cod sets 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 omparioson, only around 15% of cod is caught in sets where cod is less than 50 % of the total catch.

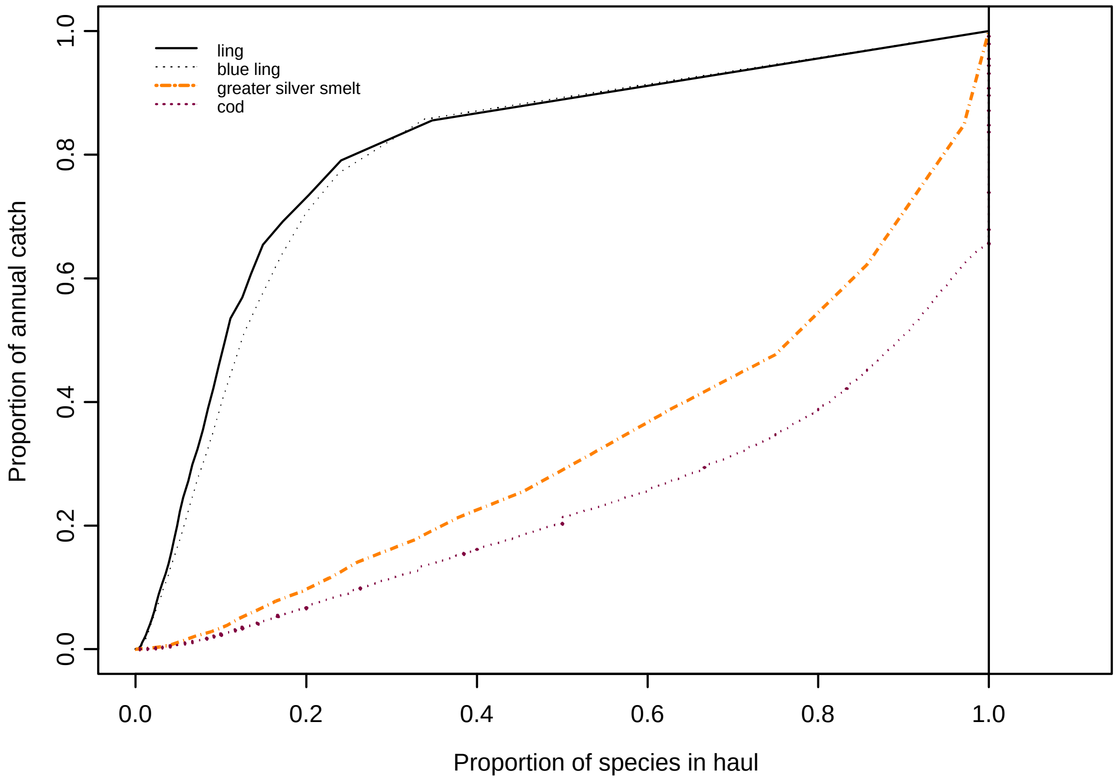


Figure 5.1.3. Cumulative plot for bottom trawl in 2005. See Figure 5.1.2 for explaination.

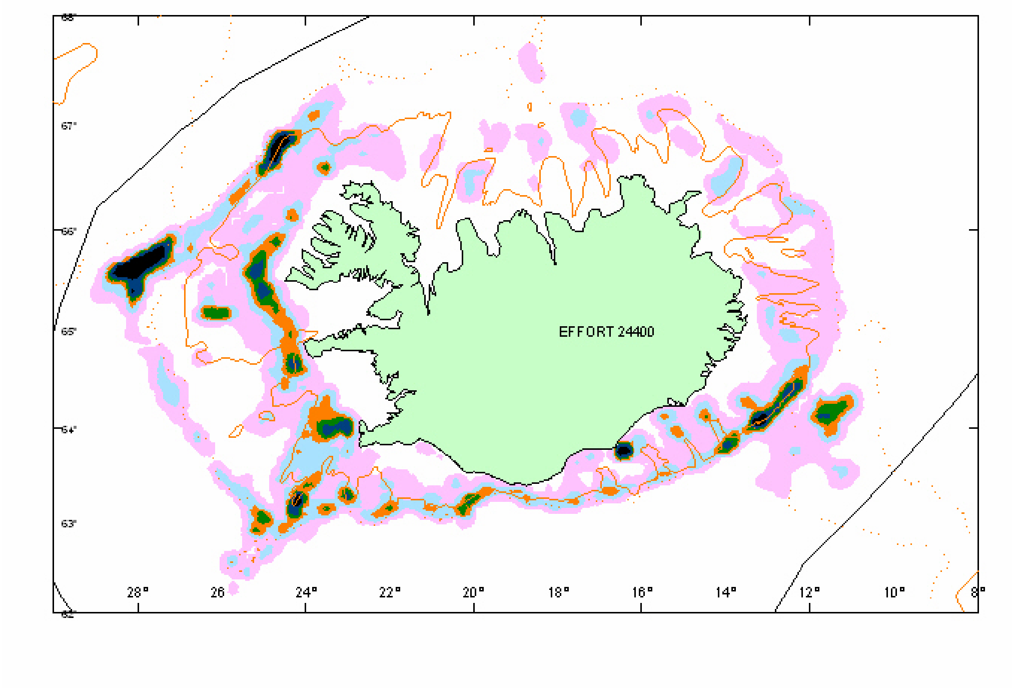


Figure 5.1.4. Effort of the trawler fleet in 2005. The dark colours show the areas of the greatest fishing effort to be off the southeast to the west coast and off Northwest Iceland.

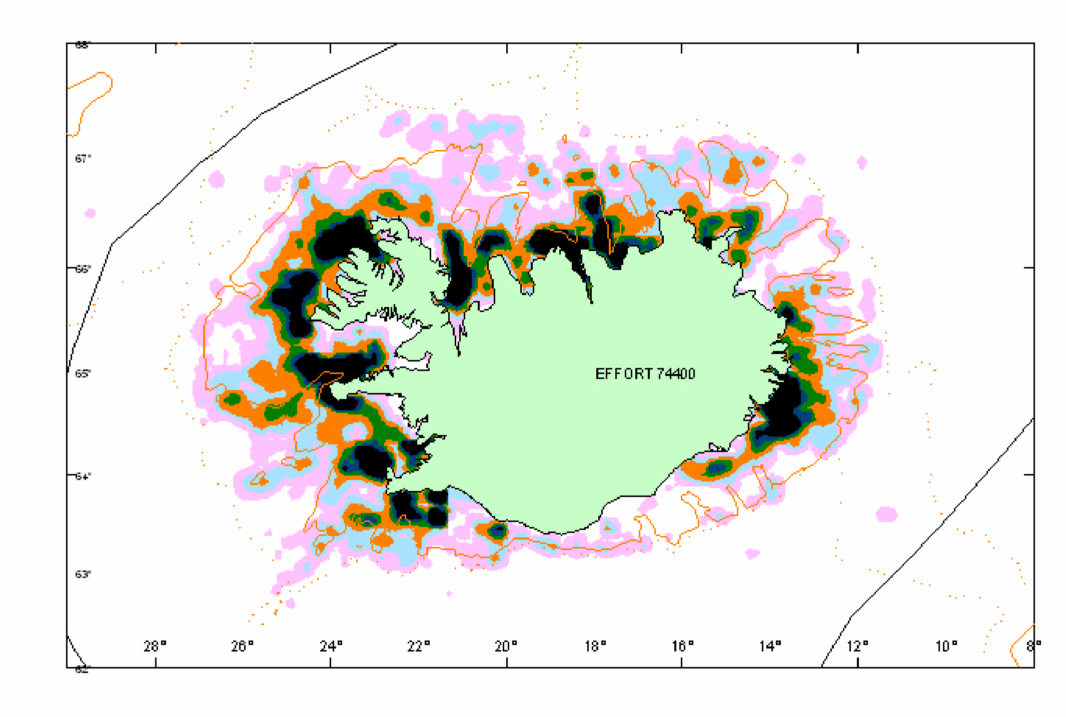


Figure 5.1.5. Effort in the longline fleet in 2005. The dark colours show the areas of the greatest fishing effort to be off the northwest and west coast but fishing is also concentrated along the entire southwest and south coast. The main targeted species for longline fishing are cod, haddock, catfish and in few instances tusk.

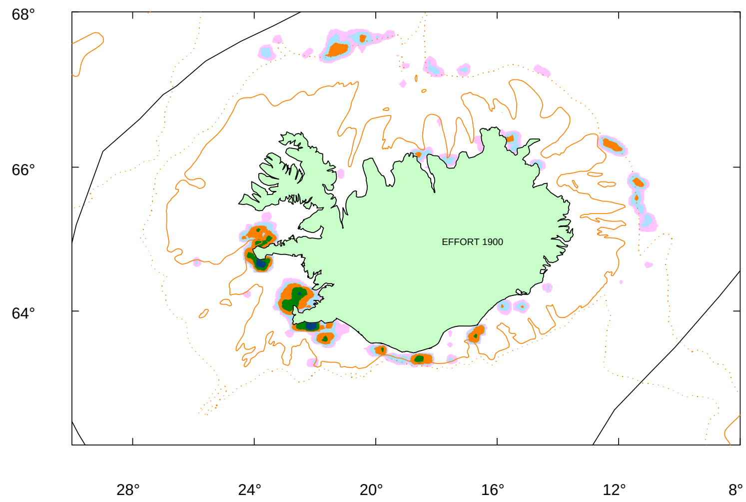


Figure 5.1.6. Effort in the Icelandic gillnet fleet in 2005. The dark colours show the areas of the greatest fishing effort to be off the southwest and west coast. The main targeted species for gillnet fishing are cod, haddock and Greenland halibut.

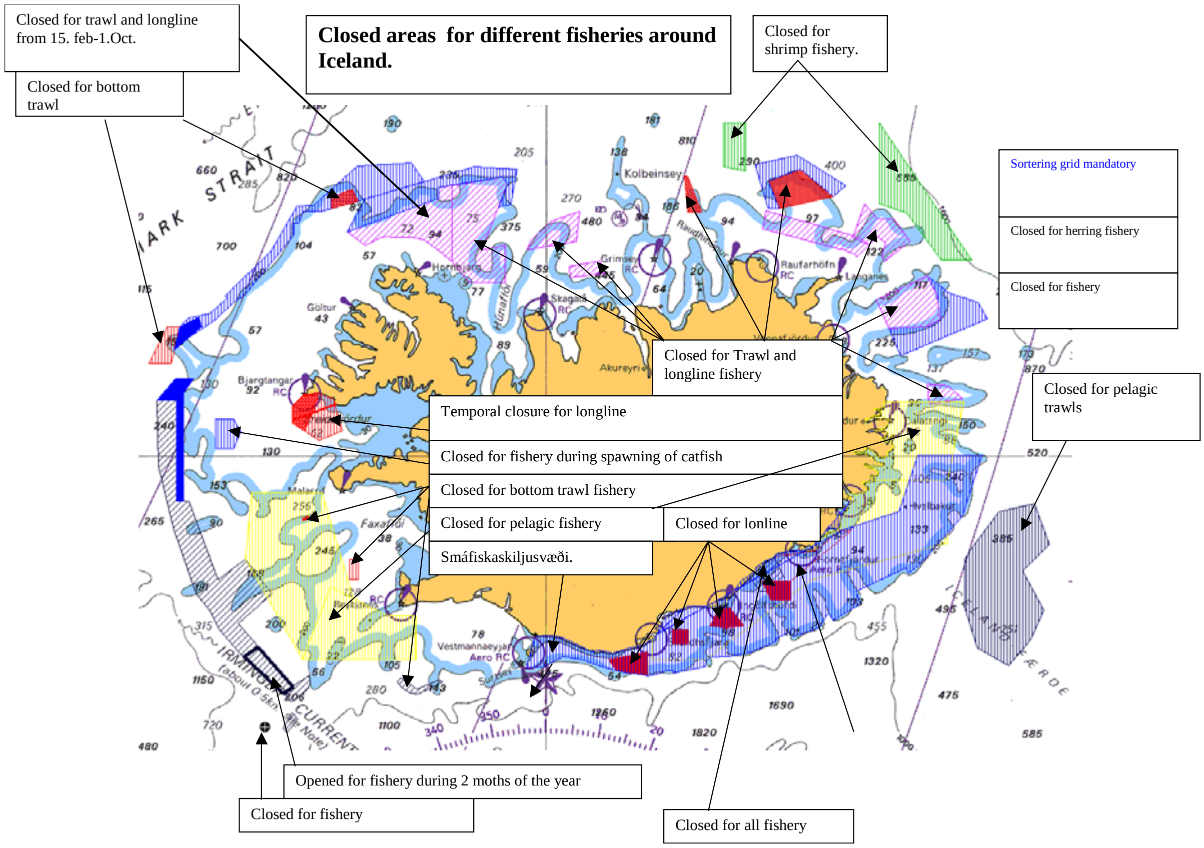


Figure 5.1.7. Overview of closed areas around Iceland. The boxes are of differnt nature and can be closed for differnt time period and gear type.

5.2 LING (*MOLVA MOLVA*) IN DIVISION Va

5.2.1 The fishery

The fishery for ling in Va has not changed substantially in recent years. Ling has been a by-catch where the main target species are cod, tusk and other demersal species. In recent years, over 550 vessels have been reporting catches of ling, from less than 0.1 t to over 170 t. Ling is taken by many gear type but in recent years, around 50% is caught by longline, 25% by trawlers and about 20% by gillnets.

Since 1980’s, 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 2000, 2003 and 2006, as recorded in logbooks, are shown in Figure 5.2.1.

5.2.1.1 Landings trends

In 1950’s and 1960’s, the total international landings in Va were between 9 000 and 15 000 tonnes but after 1972 it declined to a level of between 3 000 and 7 000 t. Since 1980, the catches have been varied between 3 200 t and 5 200 t, lowest in 2002 (Tables 5.2.0 and 5.2.1). In 2006, total of 6 287 tonnes were landed by 528 Icelandic vessels, whereof 3 734 tonnes with logline, 628 tonnes with gillnets and 1 264 tonnes with bottom trawl. In addition to above mention landings, there are reported 956 tonnes of ling in Icelandic waters taken by Faroe Islands and Norwegian vessels. The preliminary total international landings in 2006 amounted therefore to 7 243 t.

5.2.1.2 ICES advice

The latest advice is from ICES ACFM in October 2005.

ICES has advised reduction of 30% compared to the 1998 effort level.

5.2.1.3 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 ling, the national TAC for the quota year 1. September 2006 – 31. August 2007 was set to 5 000 tonnes. 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 have varied between 500 and 1 000t tonnes in last 5 years.

5.2.2 Stock identity

No new information on stock separation was available. Relevant data were presented and discussed in reports of previous Norwegian and Nordic projects and summarised in the 1998 report of the study group (ICES C.M. 1998/ACFM:12). 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.

5.2.3 Data available

5.2.3.1 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 in the Icelandic demersal fishery and there are no information on possible discard of ling.

5.2.3.2 Length compositions

Table 5.2.2 gives the overview of measured fishes in Va by gear type and surveys. The length distributions from the catches and the Icelandic spring and autumn surveys are shown in Figure 5.2.2 and Figure 5.2.5, respectively.

5.2.3.3 Age compositions

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

5.2.3.4 Weight at age

No data available.

5.2.3.5 Maturity and natural mortality

The estimated length at which 50% of the ling becomes mature (L_{50}) was estimated 75.7 cm (Figure 5.2.3). All available data since 1986 was used in the analysis.

5.2.3.6 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. In total, about 550 stations are taken annually at depths down to 500 meters. Therefore, the survey area does cover the most important distribution area of ling. Number of stations with the species differs from year to year. In addition, the autumn survey has been conducted annually in October since 1996 on the continental shelf and slopes in Va, covering depths down to 1 200 m. In total, 381 stations are taken. Figure

The survey index for each species is a biomass index of the fishable stock, computed by using a fishable stock ogive. The index (see Pálsson *et. al*, 1989) is depth stratified.

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

Figures 4.2.8 shows catch per unit of effort of ling in the Icelandic long-line fishery. The CPUE is calculated using all long-line data where catches of the species was registered (Table 5.2.3).

5.2.4 Data analyses

The mean length in the catches has been from 83-93 cm since 1996, highest in 2002 and 2003. Based on the length distributions there are no indications of any significant recruitment to the fishable stock; the peaks in the length distributions are usually varying between 75 and 110 cm.

Ling CPUE has been rather stable in the long-line fishery from 2000, since the decrease in 1998-1999. There are however very few recordings of ling where ling is more than a small fraction of the total catches in each set. Therefore, the CPUE data are considered more uncertain than the survey data.

Both the total biomass index and the index of the fishable biomass in the March survey varied from 1985 to 1989, but gradually decreased until 1995 (Figure 5.2.4 a and b). In the years 1995 to 2003 the indices were half of the mean from 1985-1989. Since 2003, the indices have increased sharply and are now the highest observed and is now about 2 times higher than in 1986. The index of the biggest ling (90 cm and bigger) shows similar trend as the total biomass index (Figure 5.2.4. c). The recruitment index of ling, defined here as ling smaller than 40 cm, also shows a sharp increase in recent years and is now about 4 times higher than it was in 1987 (Figure 5.2.4. d).

The autumn survey shows that biomass indices were low from 1996 to 2000, but have increased since then (Figure 5.2.4 a, b, c). There is a consistency between the two survey series except for the recruitment indices where the autumn survey show much lower recruitment than the spring survey (Figure 5.2.4 d). This discrepancy is due to the survey design as the autumn survey covers badly the areas of south and southwest Iceland where most of the juveniles in the spring survey are coming from. Due to the above mentioned problems with the cpue series and the consistency in the survey indices, the working group suggest using the fishery independent data as an indicator of stock trend.

Length distribution of ling in both surveys are wide or from 20-140 cm, but ling between 50-100 cm is most abundant (Figure 5.2.5). Little is caught of ling smaller than 40 cm, especially in the autumn survey. In the March survey there has been an increase in the smallest ling 2004-2007.

Ling in both in the spring and autumn surveys are mainly found in the deeper waters south and west off Iceland (Figures 4.2.6 and 4.2.7).

5.2.5 Comments on the assessment

No analytical assessment could be conducted. Both the Icelandic March and October surveys series suggest that ling abundance has been increasing considerable since 2001.

As mentioned in chapter 4.2.4, the group suggest using survey indices as indicators of stock trends. There is a consistency between the two survey series except for the recruitment indices where the autumn survey show much lower recruitment than the spring survey. This discrepancy is due to the survey design as the autumn survey covers badly the areas of south and southwest Iceland where high proportion of the juveniles in the spring survey are caught.

5.2.5.1 Management considerations

The status of the ling stocks are uncertain, but there is a sharp increase of the biomass indices in both surveys, especially in the March Survey. The catches of ling in Va have declined almost continously since early 1970s until 2001 when it was only about 30% of the catches in 1950s to early 1970s. Landings have slowly increased since 2001.

The biomass indices from the March groundfish survey for the years 1985 to 2007 shows a clear icrease since 2001 and is now two times higher than the survey indices in 1986.

Reference points that were previously assigned to ling were:

U_{lim}= 0.2* $U_{max,}$

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

On the basis of existing biomass reference points, the status of the stock is above U_{pa}. However, this evaluation does not take account of earlier exploitation, in years prior to the start of the survey data in 1985, the level of which is uncertain.

Table 5.2.0. LING Va. WG estimates of landings.

Year	Belgium	Faroes	Germany	Iceland	Norway	E & W	Scotland	**Total**
1988	134	619	-	5,098	10			**5,861**
1989	95	614	-	4,898	5			**5,612**
1990	42	399	-	5,157	-			**5,598**
1991	69	530	-	5,206	-			**5,805**
1992	34	526	-	4,556	-			**5,116**
1993	20	501	-	4,333				**4,854**
1994	3	548	+	4,053				**4,604**
1995		463	+	3,729	-			**4,192**
1996		358		3670	20	12		**4,060**
1997		299		3,634	0	-		**3,933**
1998		699		3,603	-	-		**4,302**
1999		542	+	3,980	120	4	1	**4,647**
2000		452	+	3,221	67	3	+	**3,743**
2001		362	2	2,864	117	1		**3,346**
2002		1,629	0	2,844	45	0	0	**4,518**
2003		565	2	3,587	108	2	0	**4,264**
2004		739	1	3,726	139			**4,605**
2005		645	1	4,306	180			**5,132**
2006*								

*Preliminary.

Table 5.2.1. Ling. Landings in ICES division Va since 1950.

Year	*Iceland*	*Other nations*	*Total*
1950	3 551	6 947	10 497
1951	3 278	7 651	10 929
1952	4 420	7 034	11 454
1953	3 325	8 145	11 470
1954	3 442	9 653	13 095
1955	3 972	7 721	11 693
1956	3 823	7 702	11 525
1957	3 591	6 096	9 687
1958	4 195	7 468	11 663
1959	2 681	6 019	8 700
1960	6 774	6 996	13 770
1961	6 032	4 034	10 066
1962	7 073	5 044	12 117
1963	5 607	4 885	10 492
1964	4 976	5 398	10 374
1965	4 811	5 847	10 658
1966	4 559	5 473	10 032
1967	7 531	5 621	13 152
1968	8 697	5 829	14 526
1969	8 677	5 461	14 138
1970	8 345	6 017	14 362
1971	8 867	6 524	15 391
1972	6 085	4 092	10 177
1973	3 564	3 897	7 461
1974	3 868	2 907	6 775
1975	3 748	2 950	6 698
1976	4 538	2 103	6 641
1977	3 433	1 815	5 248
1978	3 439	1 559	4 998
1979	3 759	1 443	5 202
1980	3 149	1 475	4 624
1981	3 348	1 100	4 448
1982	3 733	1 252	4 985
1983	4 256	887	5 143
1984	3 304	574	3 878
1985	2 980	460	3 440
1986	2 948	648	3 596
1987	4 154	820	4 974
1988	5 083	763	5 846
1989	4 833	714	5 547
1990	5 115	441	5 556
1991	5 182	600	5 782
1992	4 546	560	5 106
1993	4 319	521	4 840
1994	4 053	551	4 604
1995	3 729	589	4 318
1996	3 670	607	4 277
1997	3 626	518	4 146
1998	3 603	713	4 316
1999	3 973	536	4 509
2000	3 221	475	3 696
2001	2 863	359	3 222
2002	2 830	426	3 256
2003	3 584	578	4 162
2004	3 718	744	4 462
2005	4 307	750	5 066
2006[1)]	6 287	956	7 243

[1)] *Provisional figures.*

Table 5.2.2. Ling. Overview of sampling. Number of fishes and number of stations by gear type/survey type.

Year	Danish seine	Gillnet	longline	March-groundfish survey	Autumn-groundfish survey	Trawls	Total
1986	/	/	7 / 3	520 / 121	/	186 / 3	713 / 127
1987	/	/	/	374 / 117	/	357 / 21	731 / 138
1988	/	/	/	321 / 113	/	12 / 8	333 / 121
1989	/	/	/	479 / 138	/	12 / 10	491 / 148
1990	/	/	/	328 / 121	/	3 / 1	331 / 122
1991	/	/	/	326 / 131	/	1 / 1	327 / 132
1992	/	291 / 2	/	339 / 126	/	148 / 33	779 / 162
1993	/	/	356 / 1	235 / 94	/	44 / 19	635 / 114
1994	/	/	422 / 3	338 / 96	/	79 / 37	839 / 136
1995	/	462 / 2	1180 / 5	179 / 84	27 / 17	306 / 12	2154 / 120
1996	/	/	2120 / 8	187 / 85	20 / 16	307 / 28	2634 / 137
1997	/	/	2231 / 8	222 / 86	13 / 10	71 / 32	2537 / 136
1998	180 / 1	/	2653 / 10	163 / 83	20 / 11	85 / 29	3101 / 134
1999	/	204 / 2	1932 / 13	224 / 68	23 / 16	170 / 27	2553 / 126
2000	/	566 / 4	1624 / 16	153 / 59	26 / 13	76 / 25	2445 / 117
2001	/	493 / 4	1661 / 12	133 / 70	66 / 17	135 / 30	2490 / 133
2002	/	366 / 4	1504 / 15	209 / 80	54 / 21	134 / 38	2267 / 158
2003	/	300 / 2	2404 / 19	245 / 96	60 / 28	452 / 36	3461 / 181
2004	46 / 1	198 / 2	2640 / 20	303 / 107	70 / 36	506 / 35	3763 / 201
2005	101 / 1	1 / 1	2419 / 43	504 / 136	103 / 46	518 / 34	3646 / 261
2006	/	641 / 6	3381 / 43	515 / 138	66 / 35	1513/51	6116 / 273
2007	/	/	1371 / 10	1023 / 198	/	/	2394 / 208

Table 5.2.3. Effort and cpue in ling as calculated from the Icelandic long-line logbook data 1994-2006. All sets in the log-books where ling is reported in given set.

Year	Effort No. hooks in thous	CPUE g/hook
1994	3401	42.9
1995	4237	30.1
1996	3952	33.6
1997	3255	43.9
1998	2972	50.5
1999	5005	38.5
2000	5558	28.9
2001	4810	33.6
2002	5523	28.4
2003	7046	32.2
2004	7041	29.8
2005	7225	31.3
2006	8683	44.4

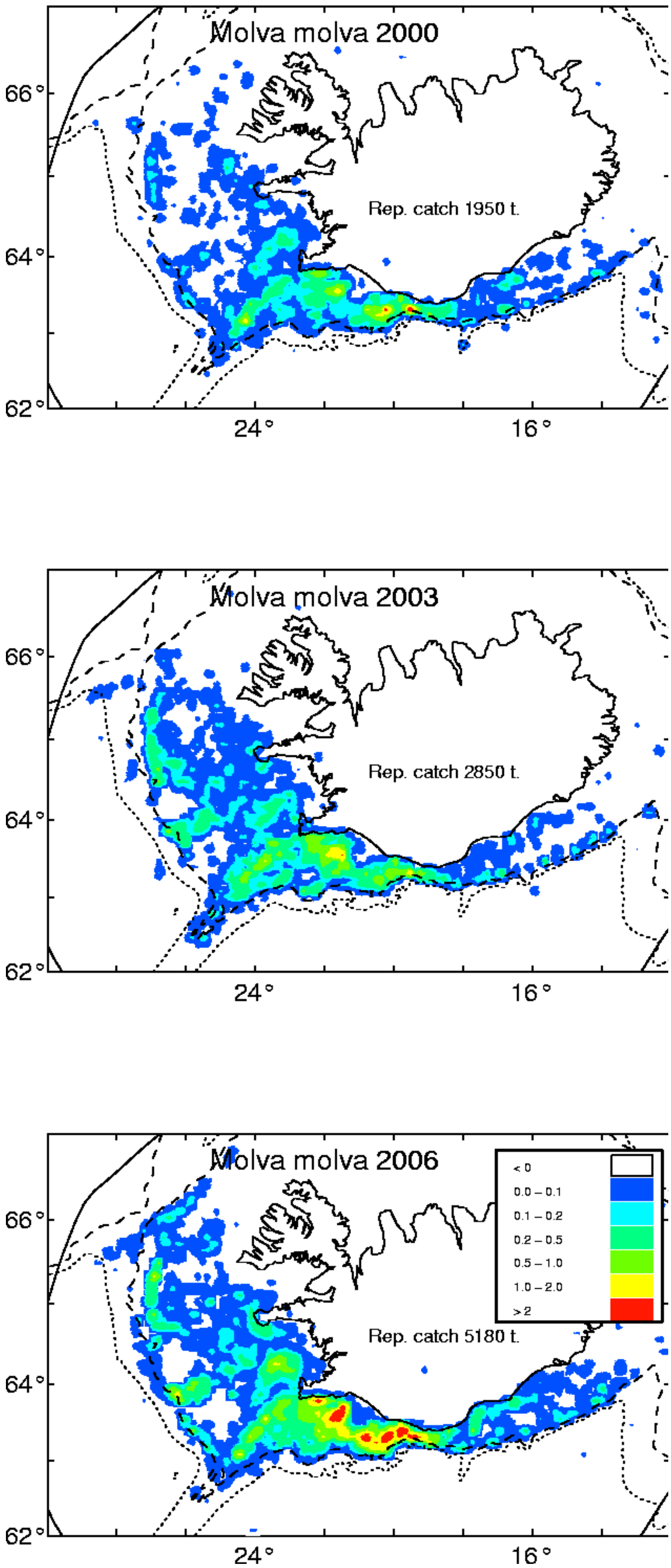


Figure 5.2.1. Ling. Icelandic fishery in 2000, 2003 and 2006 as reported in the logbooks. All gear types combined.

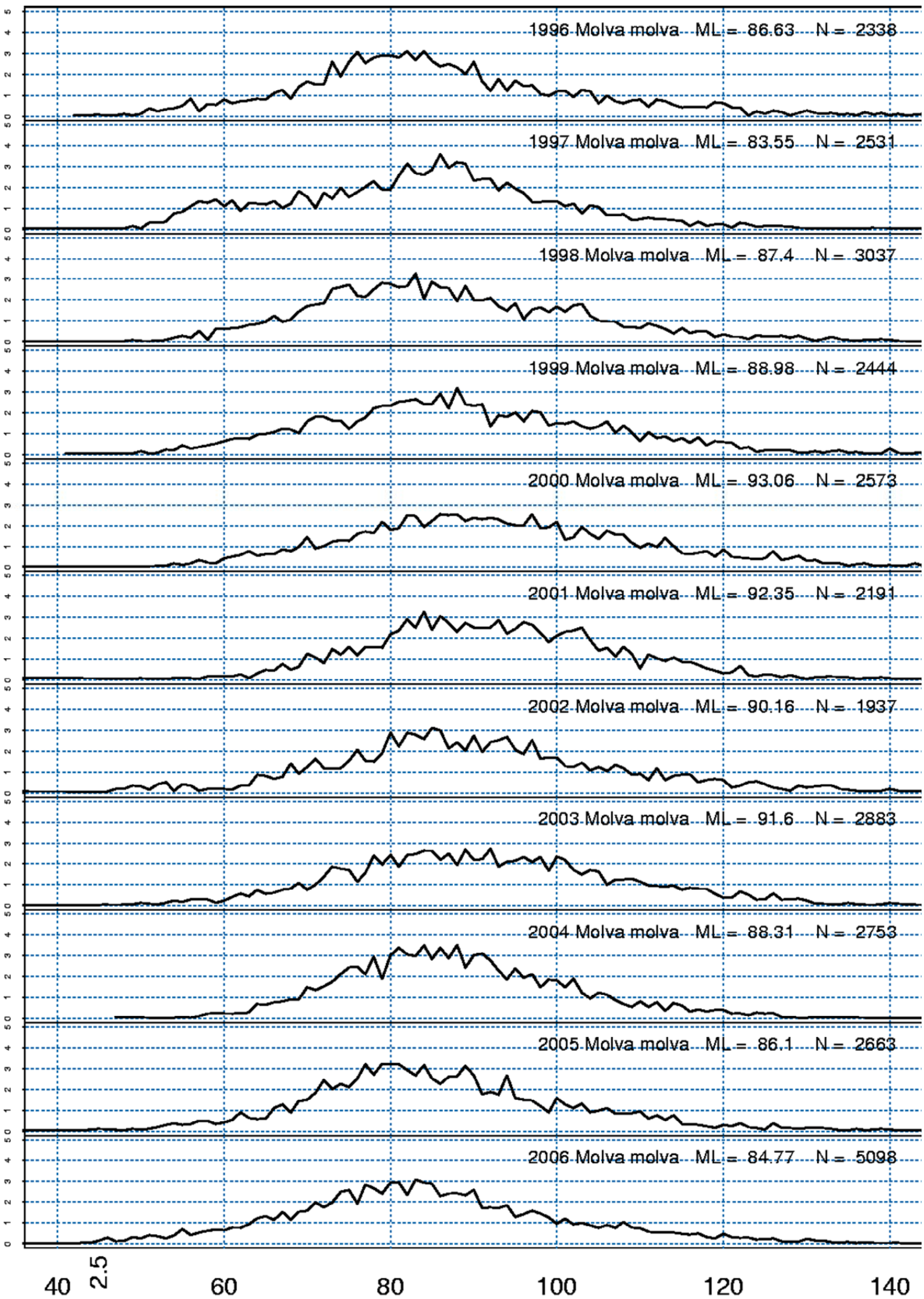


Figure 5.2.2. Length distribution of ling in the Icelandic catches since 1996. The number of measured fishes and mean length is also given.

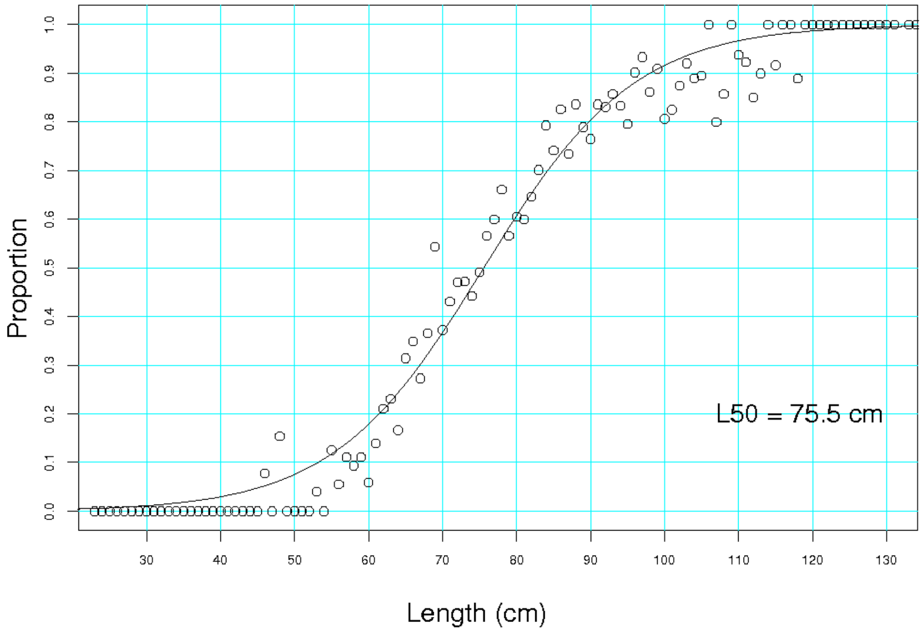


Figure 5.2.3. The proportion of mature of ling as a function of length in the Icelandic catches. The data points show the observed proportion mature and the lines the fitted maturity. Also given is L_{50}.

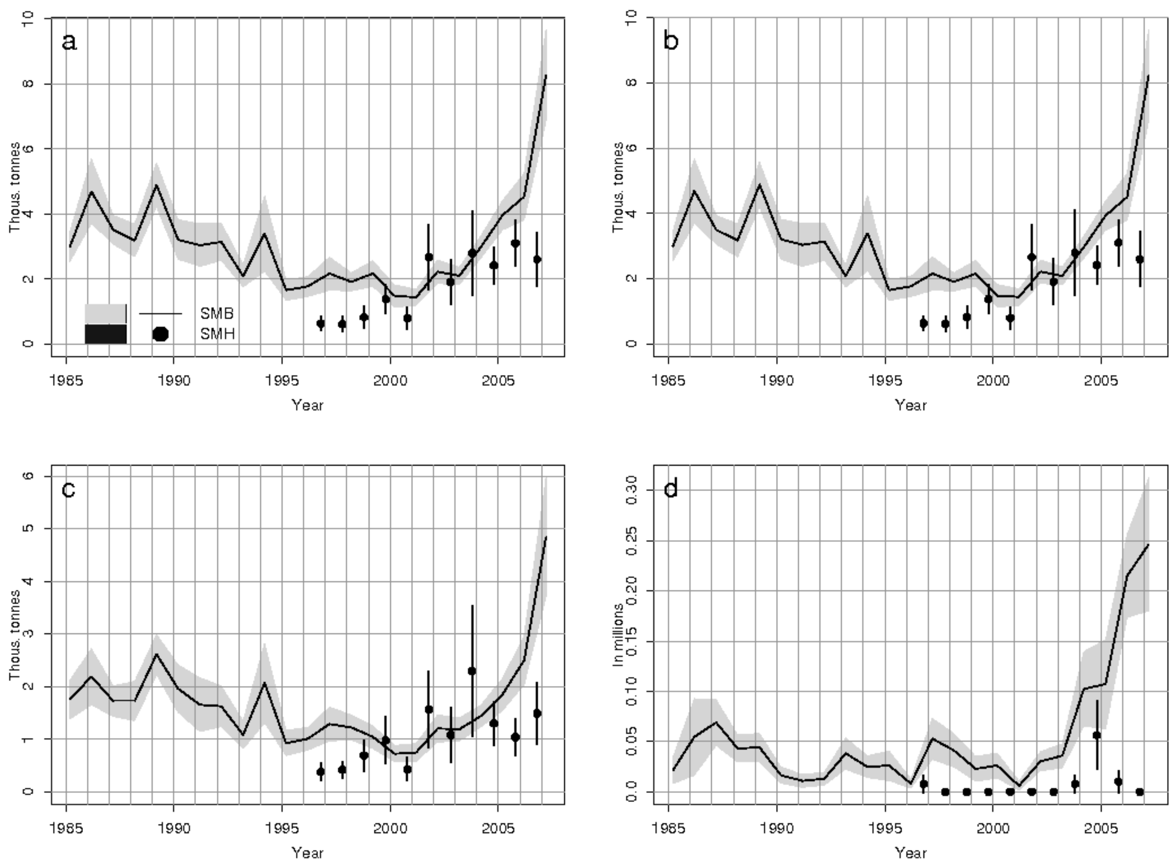


Figure 5.2.4. Ling. Indices form the groundfish survey in March (SMB, line, shaded area) and October (SMH, points, vertical lines). a) Total biomass index, b) Biomass of 40 cm and larger, c) Biomass 90 cm and larger, d) Abundance of < 40 cm. The shaded area and the vertical bar show ±1 standard error of the estimate.

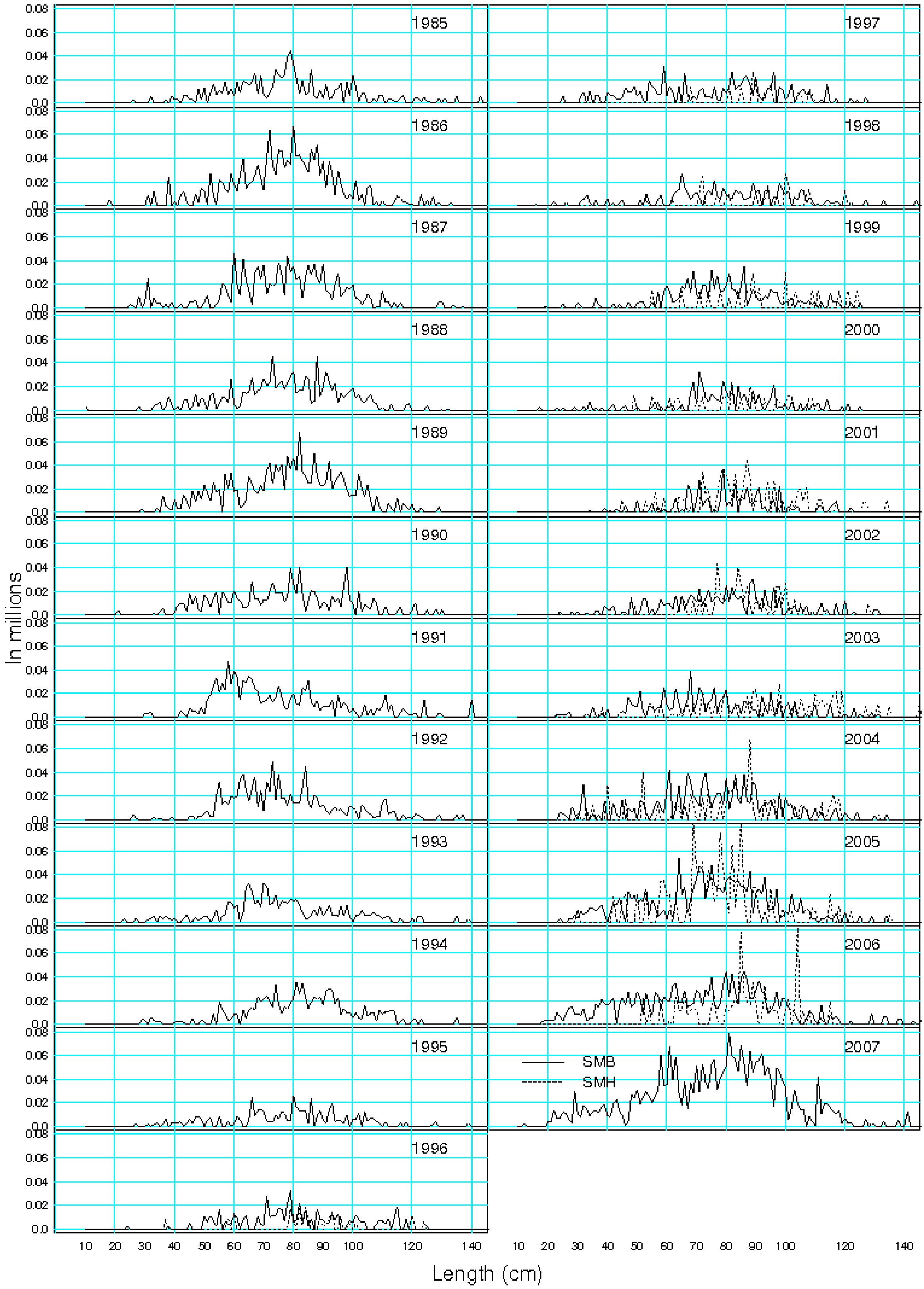


Figure 5.2.5. Ling length distributions in the Icelandic groundfish survey in March (SMB, solid line) 1985-2007 and in October (SMH, dotted line) 1996-2006.

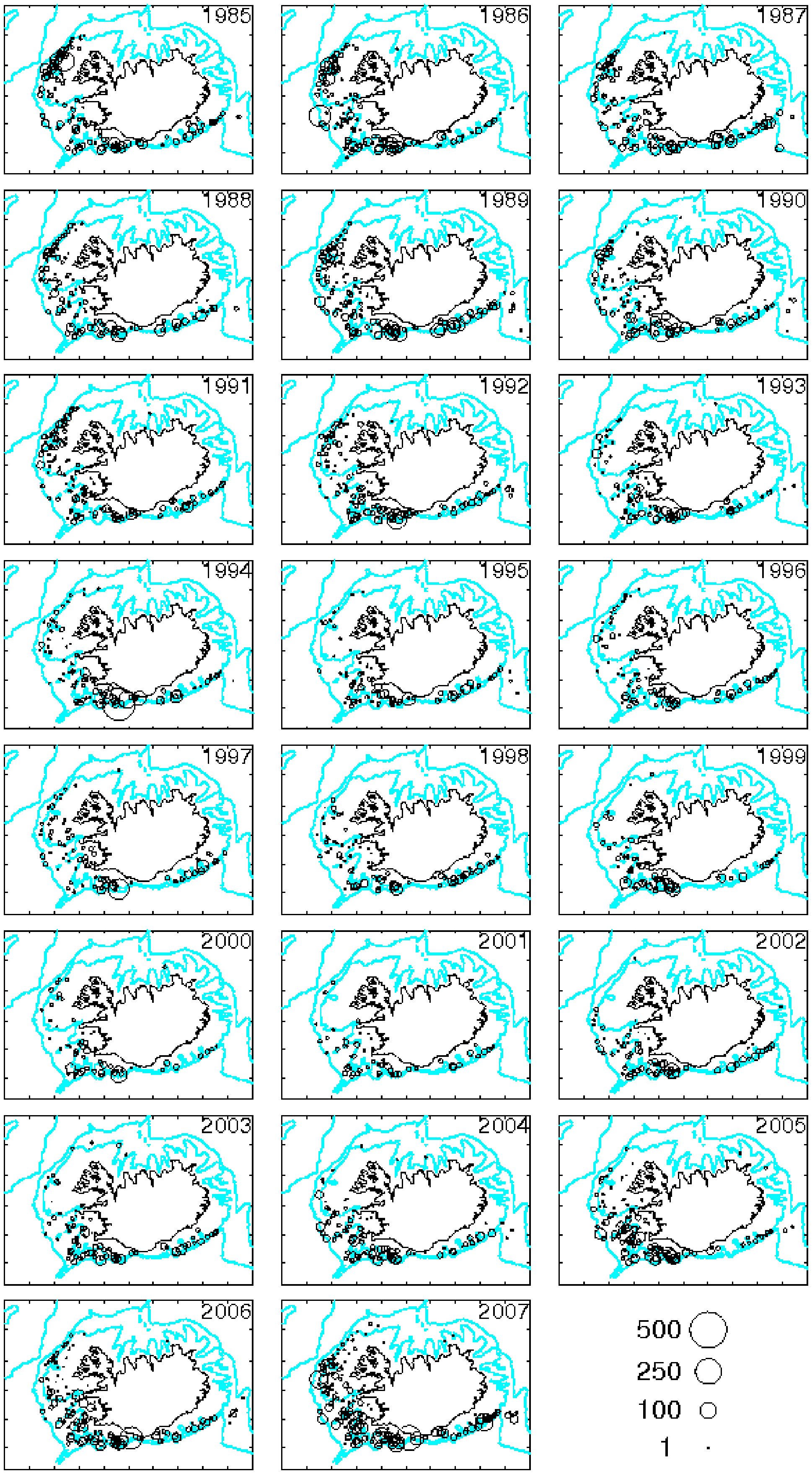


Figure 5.2.6. Ling. Distribution of CPUE in the groundfish survey in March 1985-2007. The size of the circles indicate kg/station.

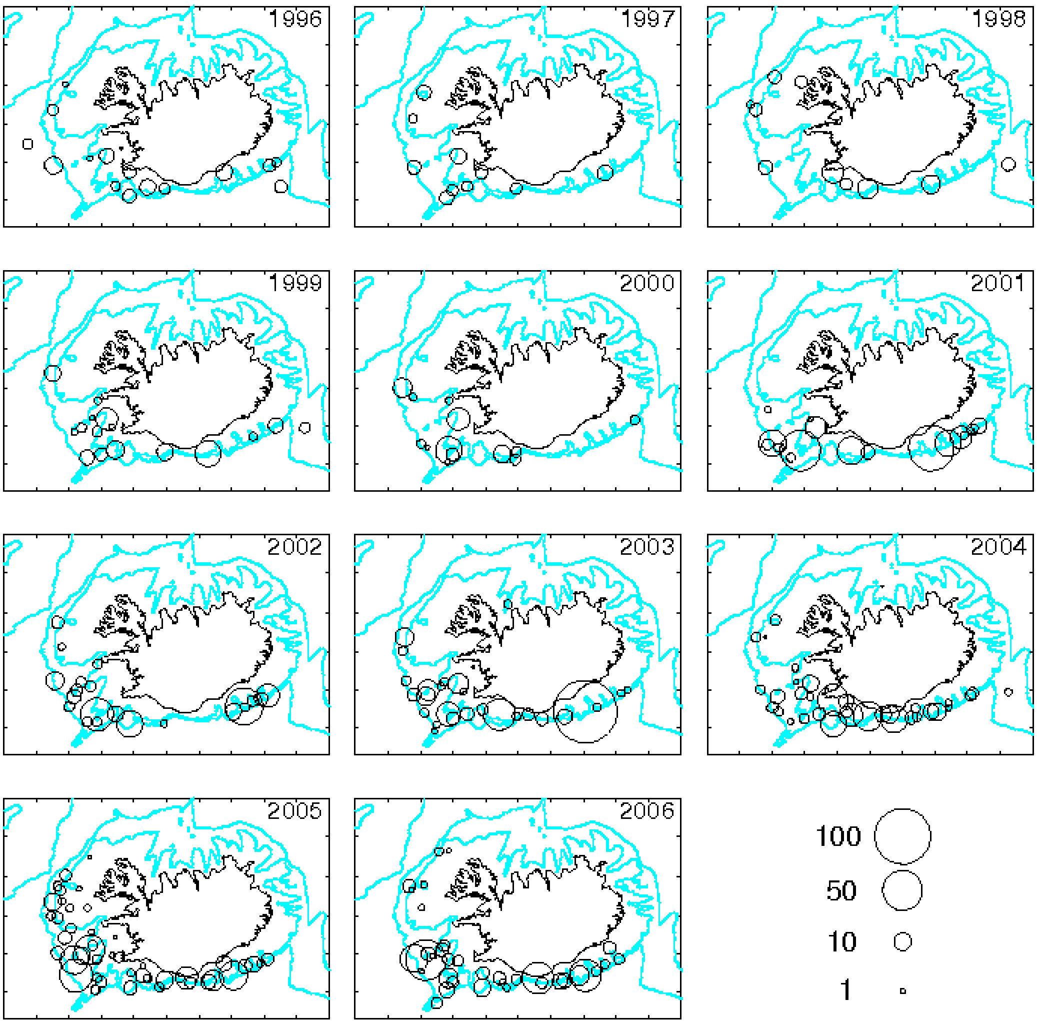


Figure 5.2.7. Ling. Distribution of CPUE in the groundfish survey in October 1996-2006. The size of the circles indicate kg/station.

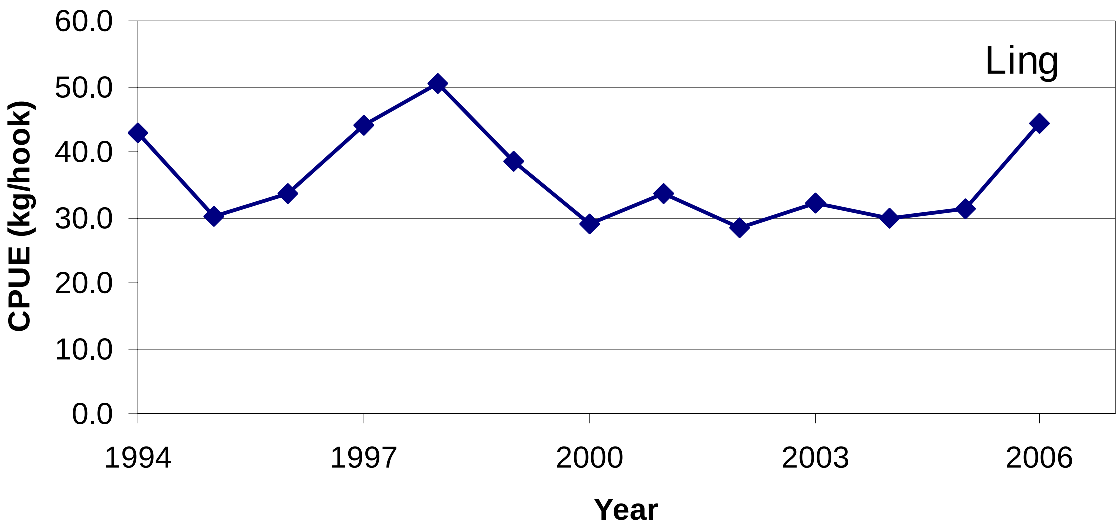


Figure 5.2.8. Ling catch per unit of effort (kg/hook) calculated from the Icelandic long-line fishery 1994-2006.

5.3 Blue Ling (*Molva Dypterygia*) In Division Va and Sub-Area Xiv

5.3.1 The fishery

The fishery for blue ling in Va has changed substantially in nature and extent since the early 1980s. At the start of this period catches were taken mainly from spawning aggregations, but these aggregations started to diminish in the mid 1980s and since then blue ling has mostly been taken as by-catch in the redfish and Greenland halibut fishery. The fishing grounds in 2000, 2003 and 2006, as recorded in logbooks, are shown in Figure 5.3.1.

In 1993, the Icelandic fleet fished on aggregations of spawning blue ling in a small area on the Reykjanes ridge at the border between Sub-areas Va and XIV (Figure 5.3.2). This was a transient fishery that declined rapidly in the years thereafter.

There is currently no fishery in Sub-area XIV.

5.3.1.1 Landings trends

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. Since then landings have further declined and over the last five years annual landings have been around 1000 to 1600 t (Table 5.3.0a). The preliminary total international landings in 2006 were 1 855 t and these included 1460 t and 151 t from Icelandic bottom trawlers and long-liners, respectively

Total international landings from XIV (Table 5.3.0b) 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, 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 2006 were only 2 t.

5.3.1.2 ICES advice

The latest advice is from ICES ACFM in October 2005.

Concerning blue ling, there should be no directed fisheries. Technical measures such as closed areas on spawning aggregations should be implemented to minimize catches of this stock in mixed fisheries.

5.3.1.3 Management

In 2005 there was an EC TAC for EU vessels fishing in EU and international waters in II, IV and V of 119 t per annum. These TACs are set biennially and remain unchanged in 2006. EU landings from II, IV and Va were less than the EU TAC in II, IV and V (see below). The TAC for 2007 and 2008 will be set in December 2006.

EU TAC area	EU TAC in 2005 (t)	EU landings in 2005 (t)
II, IV and V	119	49 (Va)

The Icelandic fishery is not regulated by a national TAC or ITQs. A national management measure specific to blue ling has been the introduction is closed areas to protect the spawning locations shown in Figure 5.3.2. These were introduced in 2003.

5.3.2 Stock identity

No new information is available. Biological investigations in the early 1980s suggested that at least two adult stock components were found within the area, a northern stock in Sub-area XIV and Division Va with a small component in Vb, and a southern stock in Sub-area 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 Sub-areas 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.

5.3.3 Data available

5.3.3.1 Landings and discards

Landings data are given in Tables 4.3.0a-4.3.0c. Discarding is banned in the Icelandic demersal fishery and there are no information on possible discarding of blue ling in XIV

5.3.3.2 Length compositions

Length distributions from the Icelandic trawl catches for the period 1996-2006 is shown in Figure 5.3.3 and from an Icelandic spring groundfish survey in Figure 5.3.6. Sampling levels are summarized in Table 5.3.2.

5.3.3.3 Age compositions

No new data were available. Existing data are not presented due to the difficulties in the ageing of this species.

5.3.3.4 Weight at age

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

5.3.3.5 Maturity and natural mortality

Length at maturity from available data since 1986 is shown in Figure 5.3.4. L_{50} was estimated 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)/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.

5.3.3.6 Catch, effort and RV data

Effort and CPUE data from the Icelandic trawl fleet are given in Table 5.3.1 and Figure 5.3.9.

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 5.3.5) A total of more than 550 stations are taken annually in the survey at depths down to 500 meters. However, the survey area does not cover the most important distribution area of blue ling as their distribution area goes to greater depths.

The Icelandic autumn groundfish survey commenced in 1996 was expanded in 2000 to cover depths down to 1200 m, that is, the entire depth distribution of blue ling. Time-series abundance data from the spring and autumn trawl surveys are compared in Figure 5.3.5.

5.3.4 Data analyses

The number of measurements and mean length in length distributions from the Icelandic commercial trawl catches for the period 1996-2006 are given on the figures for each year (Figure 5.3.3). The number of fishes measured from the catches are low, only about 1 200 fishes per year on average, and therefore this low sampling might not reflect the actual lengths of the catches. Notwithstanding, there is no evidence of an overall trend in the mean length.

Length distribution data from the spring trawl survey (Figure 5.3.6) are very different from those in the commercially fishery, comprising of a greater proportion of younger fish and a low proportion of larger fish (stock abundance for blue ling in Va peaks at depths at around 700 to 900m).

CPUE data derived from commercial trawl trips where blue ling accounts for more than 10% of catch are considered to be a reliable index of abundance and show a persistent decline during the 1990s to a stable but very low level in recent years (Figure 5.3.9). The other indices shown are based on trips directed at blue ling (where blue ling accounts for more than 50% and 70% of the total catch) and these show strong perturbations driven by fisheries on spawning aggregations.

The spring trawl survey index for blue ling (Figure 5.3.5), which has a high variance compared with other species taken in the survey, decreased by 90% from 1985-1995. It remained very low until 2003, but in three last surveys (2004-2007) the index has increased from being 20% of the 1985 value to be similar to what it was in the 1980's. This increase should be treated with caution because the survey covers only a small part of the depth range of this species (see above) and there is no evidence of increased recruitment entering into commercial catches (Figure 5.3.3). However, neither is it driven by isolated large catches at a few survey stations (Figure 5.3.7). An important fact is that this trend in recent years is not seen in the results from the Icelandic autumn trawl survey from 2002 onwards (Figure 5.3.4).

This year no analytical assessments were attempted.

5.3.4.1 Comments on the assessment

At the 2004 WG, exploratory runs of Delury, surplus production and stock reduction models were carried out using total international catch data for Division Va and Subareas XIV combined (1966-2003) and CPUE data from Icelandic spring groundfish trawl survey (1985 – 2003) (see above). Although the survey data are fisheries independent and are considered to be a better indicator of changes in stock abundance than long-line and trawl data from Icelandic commercial vessels, the fits from the models were generally poor reflecting a high variability in the survey series, particularly in the early years

The Icelandic autumn groundfish survey covers the full depth range of blue ling and should in years to come provide a reasonable basis for the assessment of this stock. Suitable assessments methods may be stock reduction or possibly CSA.

5.3.5 Management considerations

The view was expressed that CPUE from commercial fishing vessels, which is derived largely from data from spawning aggregations, is not a reliable indicator of exploitable biomass for this species because of sequential depletion. The Group were aware of this problem but felt that the important issues were the large scale of the decline in CPUE in some areas and the fact that under the Precautionary Approach we have a responsibility to interpret the available data.

CPUE data from the Icelandic trawl fleet suggest that the abundance of blue ling in Va in recent years is about 25% of that observed at the start of the series in the early 1990s. These data and those from the autumn groundfish survey from 2002 onwards show no evidence of a recovery in stock.

At previous Working Groups, available evidence has indicated that blue ling in Va is at a low level. Taking into account the relative merits of available abundance indices, and the uncertainty regarding estimates of abundance in recent years, this view is unchanged. Blue ling in Va and XIV may be close to U_{lim}.

The current ACFM advice for no directed fishing should be maintained and further measures should be taken to reduce exploitation by 30%.

Closed areas to protect spawning aggregations should be maintained and expanded where appropriate.

Table 5.3.0a. Blue ling Va. WG estimates of landings.

Year	Faroes	Germany	Iceland	Norway	E & W	Scotland	Total
1988	271		1893	7			2171
1989	403		2125	5			2533
1990	1029		1992				3021
1991	241		1582	1			1824
1992	321		2584	1			2906
1993	40		2193				2233
1994	89	1	1542				1632
1995	113	3	1519				1635
1996	36	3	1284				1323
1997	25		1319				1344
1998	59	9	1086				1154
1999	31	8	1819	8	8	3	1877
2000	36	7	1636	25	7		1711
2001	95	12	762	49	22	1	941
2002	28		1265	74	6	4	1377
2003	16	15	1098	6	15	8	1158
2004	37	9	1090	49	20		1205
2005	24	20	1495	20	19	5	1583
2006*	62	23	1736	27	7	2	1857

*Preliminary.

Table 5.3.0b. Blue ling XIV. WG estimates of landings.

Year	Faroes	France	Germany	Greenland	Iceland	Norway	E&W	Scotland	Spain	Total
1988	21		218	3						242
1989	13		58							71
1990			64	5			10			79
1991			105	5			45			155
1992			27	2		50	27	4		110
1993		390	16		3124	173	21	1		3725
1994	1		15		300	11	57			384
1995	0		5		117		16	3		141
1996	0		12				2			14
1997	1		1				2			4
1998	48					1	6			55
1999						1	7			8
2000					4		2		526	532
2001	1						6		91	98
2002						1			18	19
2003						36	4		909	949
2004						1	3	4	177	185
2005	2					1		18		21
2006*						2				2

*Preliminary

Table 5.3.0c. Blue ling Va&XIV. WG estimates of landings.

Year	Va	XIV	Total
1988	2171	242	2413
1989	2533	71	2604
1990	3021	79	3100
1991	1824	155	1979
1992	2906	110	3016
1993	2233	3725	5958
1994	1632	384	2016
1995	1635	141	1776
1996	1323	14	1337
1997	1344	4	1348
1998	1154	55	1209
1999	1877	8	1885
2000	1711	532	2243
2001	941	98	1039
2002	1377	19	1396
2003	1158	949	2107
2004	1205	185	1390
2005	1583	21	604
2006*	1857	2	1859

*Preliminary

Table 5.3.1. 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 (KG)	HOURS	CPUE
1991	514700	963	534
1992	643129	1197	537
1993	3586509	2805	1279
1994	658941	1571	419
1995	405686	1135	357
1996	184792	764	242
1997	186010	924	201
1998	267140	1015	263
1999	710714	2048	347
2000	235869	1485	159
2001	132391	979	135
2002	228278	1834	124
2003	201215	1518	133
2004	199109	1327	150
2005	297542	2205	135
2006	334839	2769	121

Table 5.3.2. Blue ling. Overview of Icelandic sampling. Number of fishes and number of stations/samples by gear type/survey type

YEAR	LONGLINE FISHERY	SPRING TRAWL SURVEY	AUTUMN TRAWL SURVEY	TRAWL FISHERY
1986	/	320 / 44	/	345 / 4
1987	/	332 / 47	/	2739 / 85
1988	/	563 / 62	/	2414 / 82
1989	/	687 / 74	/	/
1990	/	223 / 48	/	585 / 24
1991	/	353 / 59	/	/
1992	/	325 / 53	/	1659 / 33
1993	/	229 / 33	/	2035 / 37
1994	/	219 / 42	/	321 / 42
1995	42 / 6	92 / 26	55 / 18	419 / 13
1996	356 / 2	155 / 25	183 / 53	305 / 4
1997	711 / 3	107 / 24	118 / 46	259 / 37
1998	/	243 / 32	108 / 48	925 / 39
1999	1674 / 12	531 / 47	257 / 61	288 / 49
2000	931 / 8	313 / 41	863 / 91	400 / 38
2001	39 / 1	411 / 48	1280 / 112	523 / 51
2002	399 / 4	215 / 39	1123 / 109	317 / 51
2003	295 / 3	399 / 51	957 / 118	973 / 49
2004	150 / 1	556 / 40	938 / 108	1179 / 42
2005	94 / 1	460 / 56	824 / 125	342 / 26
2006	/	555 / 64	1185 /129	391 / 35
2007	/	811 / 73	/	

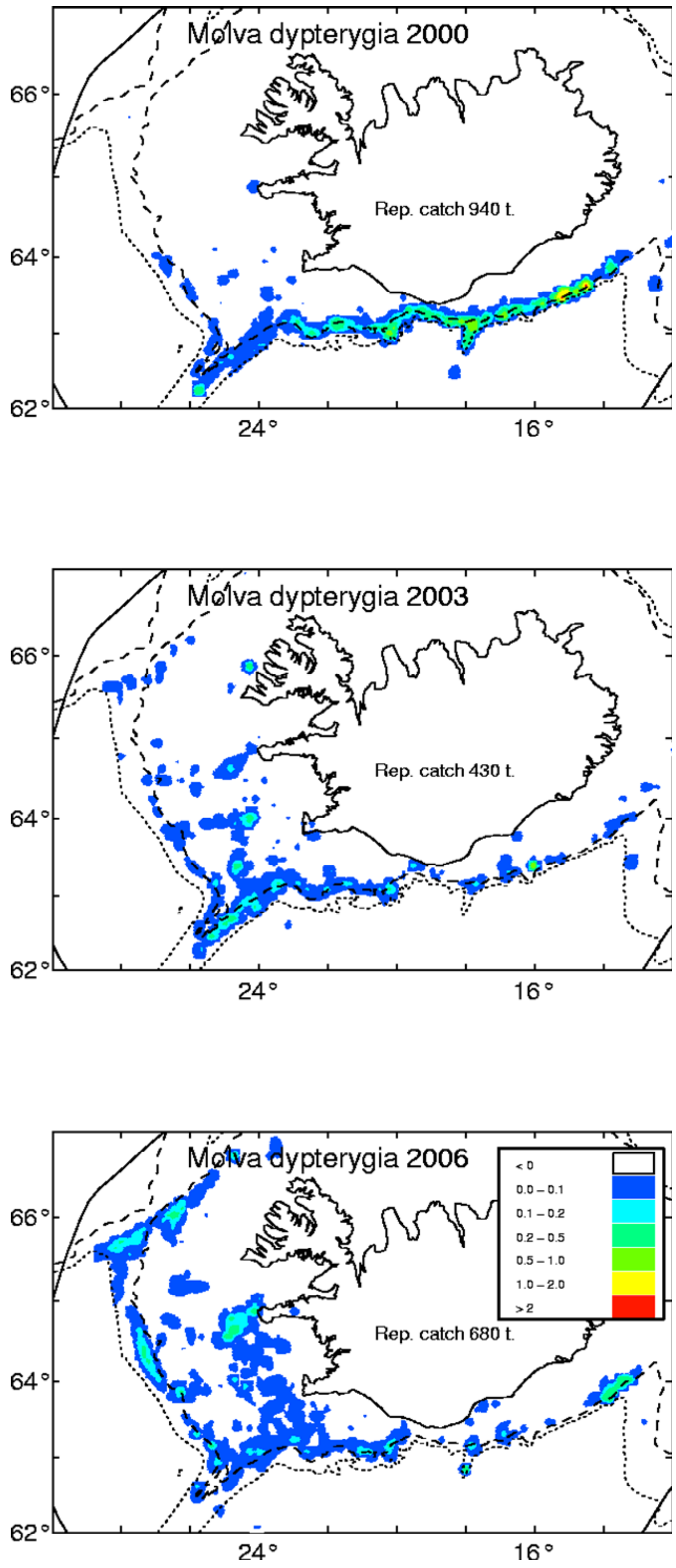


Figure 5.3.1. Icelandic fishery for blue ling as reported in logbooks (all gear types combined)

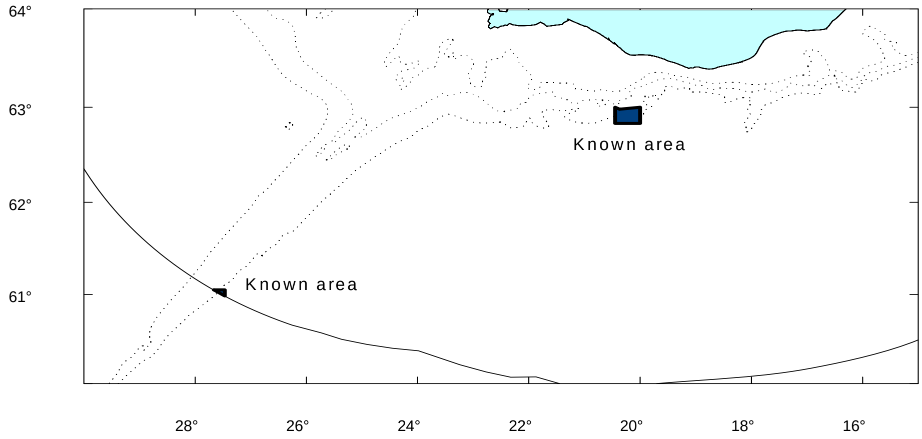


Figure 5.3.2. Known spawning grounds for blue ling in Icelandic waters

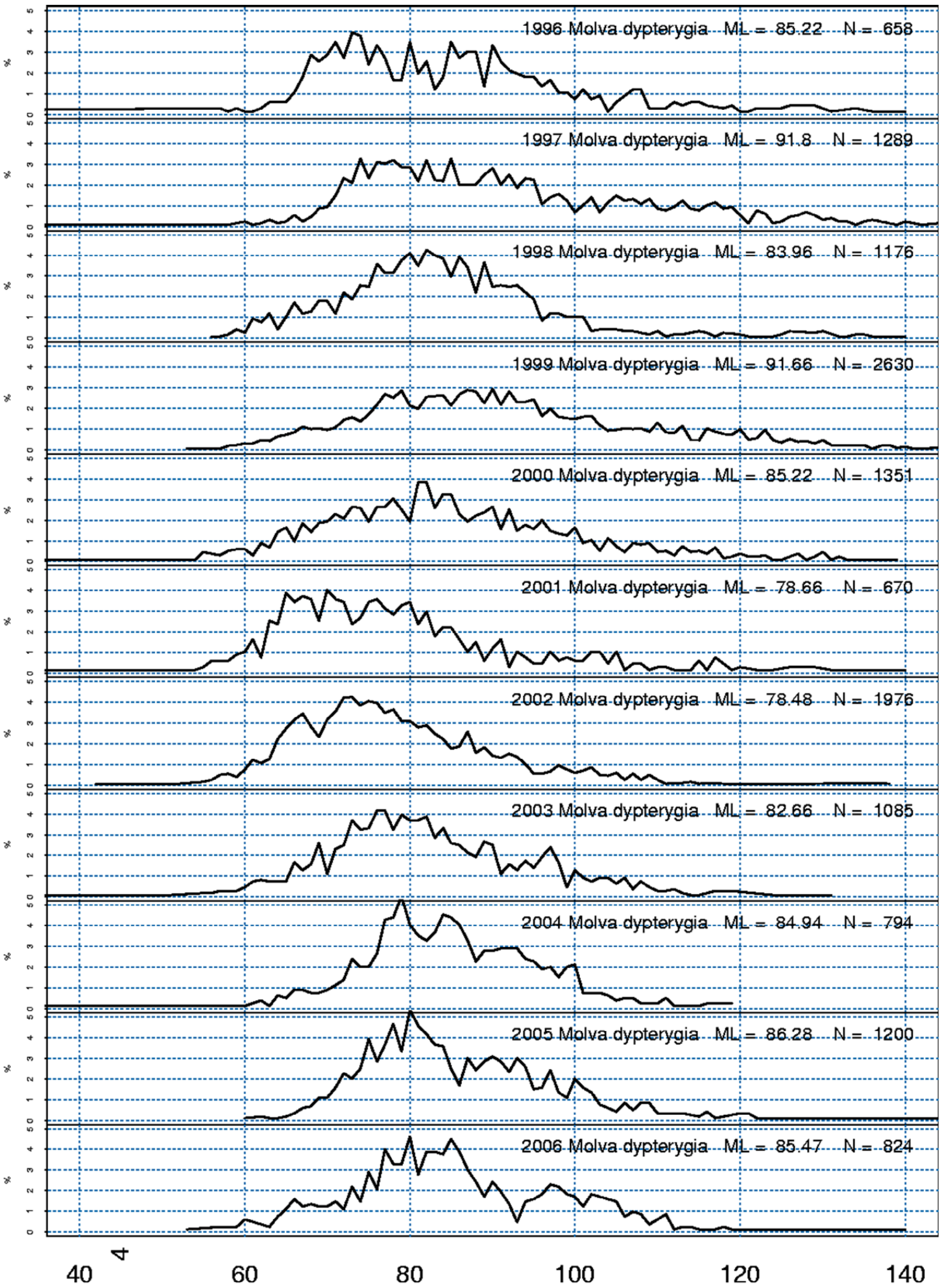


Figure 5.3.3. Length distributions of Icelandic landings of blue ling from Division Va. The number of measured fish and mean length is also given.

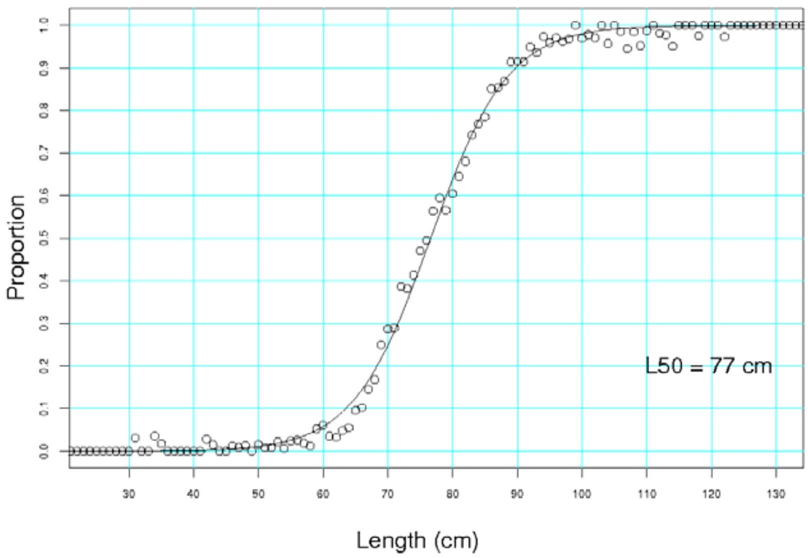


Figure 5.3.4. The proportion of mature of ling as a function of length in the Icelandic catches. The data points show the observed proportion mature and the lines the fitted maturity. Also given is L_{50}.

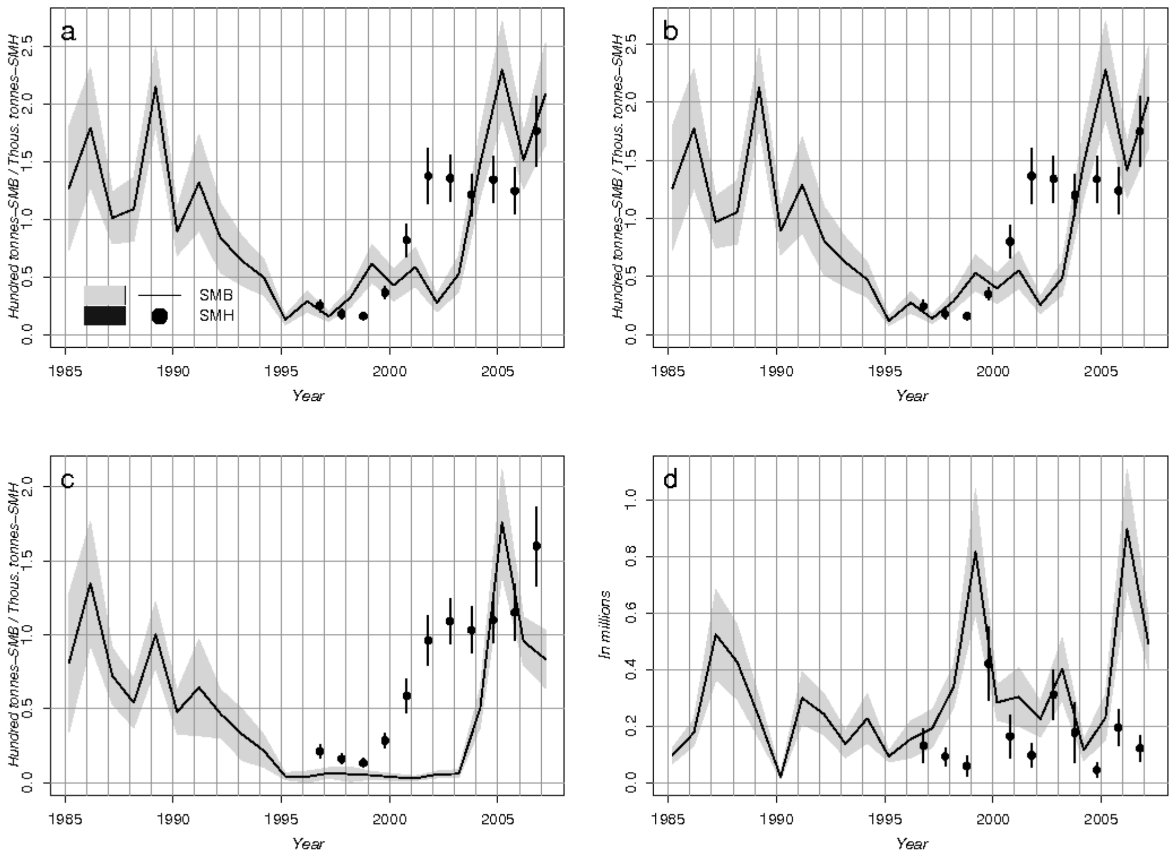


Figure 5.3.5. Blue ling. Indices form the groundfish survey in March (SMB, line, shaded area) and October (SMH, points, vertical lines). a) Total biomass index, b) Biomass of 40 cm and larger, c) Biomass 70 cm and larger, d) Abundance of < 40 cm. The shaded area and the vertical bar show ±1 standard error of the estimate.

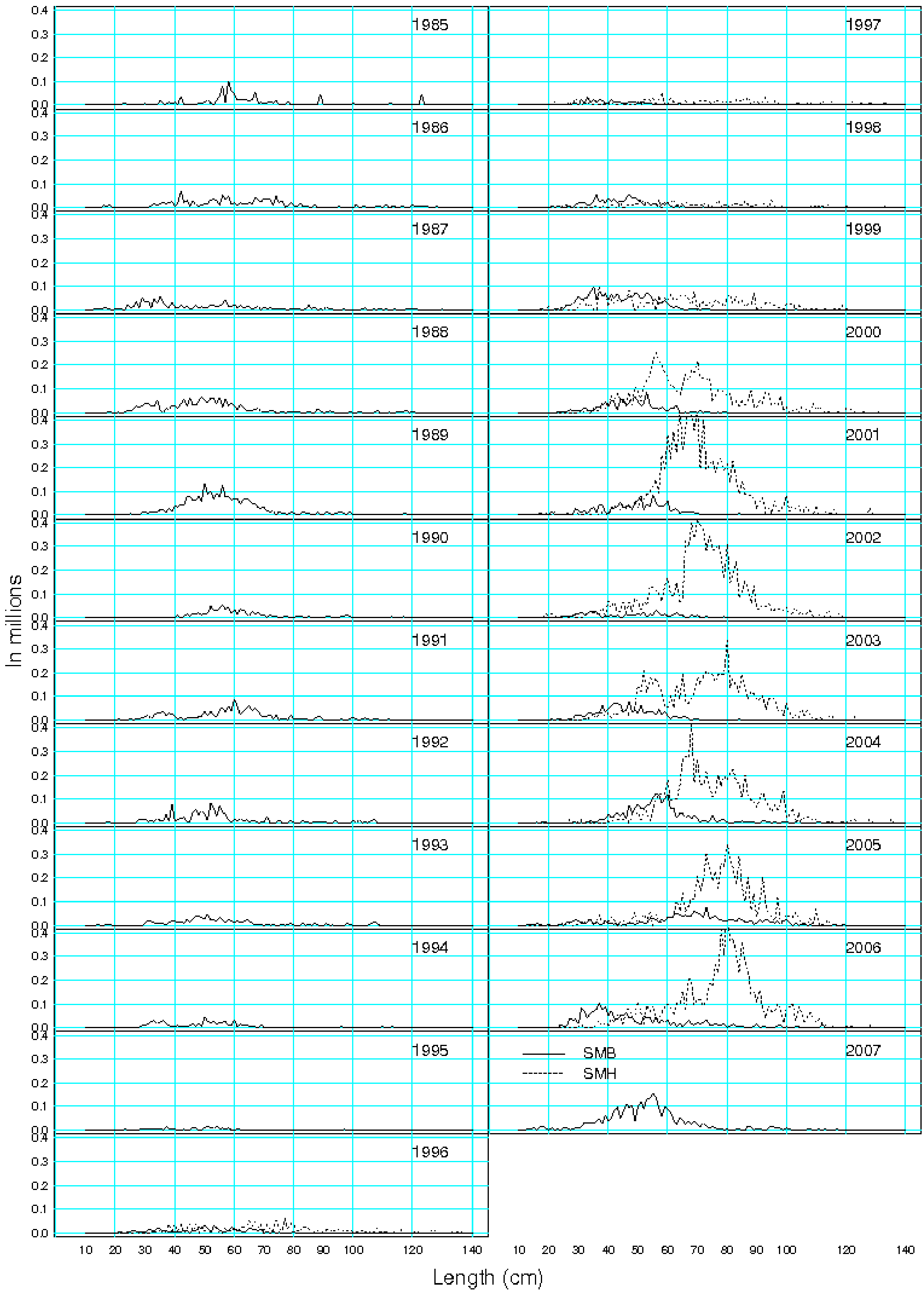


Figure 5.3.6. Blue ling length distributions in the Icelandic groundfish survey in March 1985-2007 (SMB, solid line) and in October 1996-2006 (SMH, dotted line).

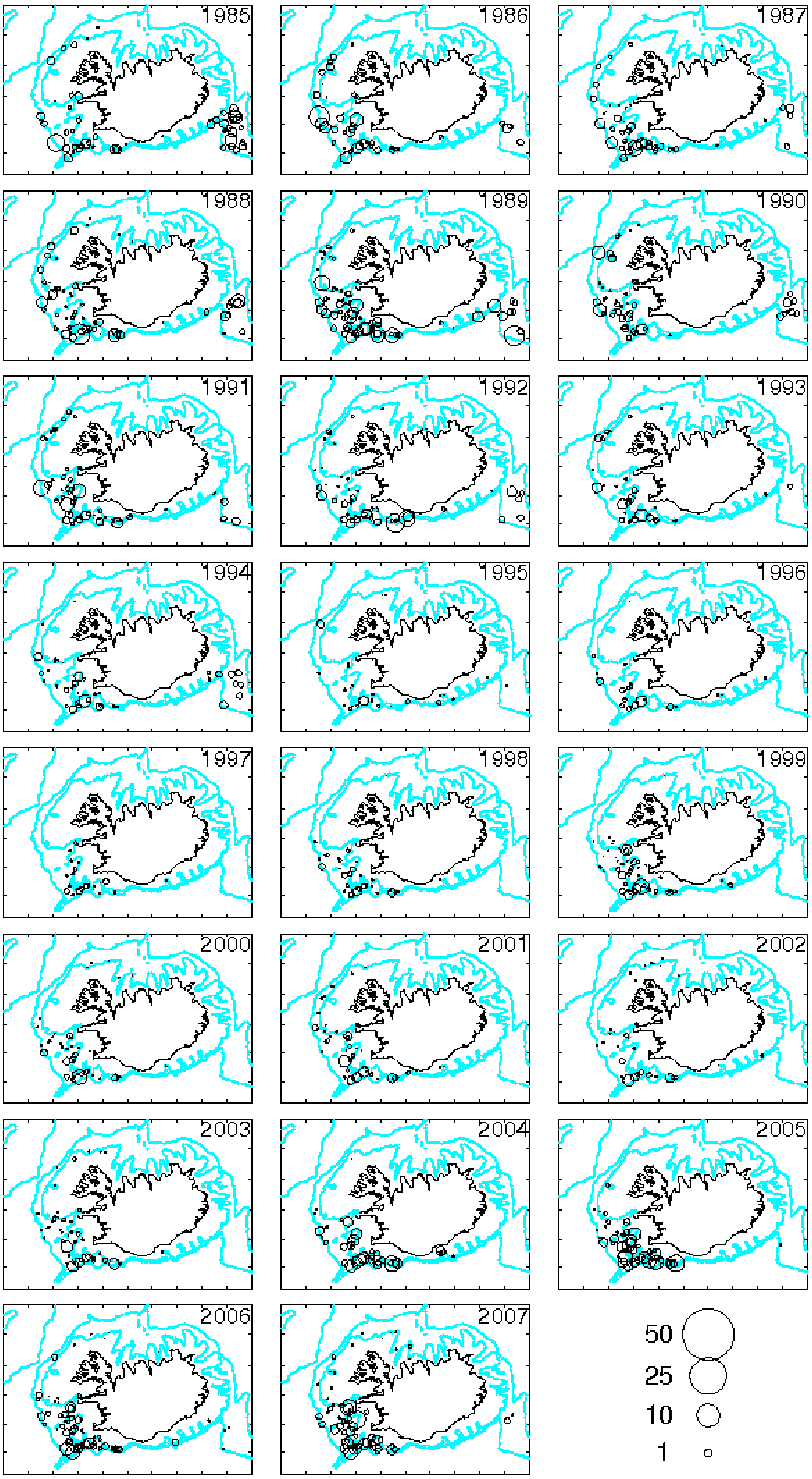


Figure 5.3.7. Blue ling. Distribution of CPUE in the groundfish survey in March 1985-2007. The size of the circles indicate kg/station.

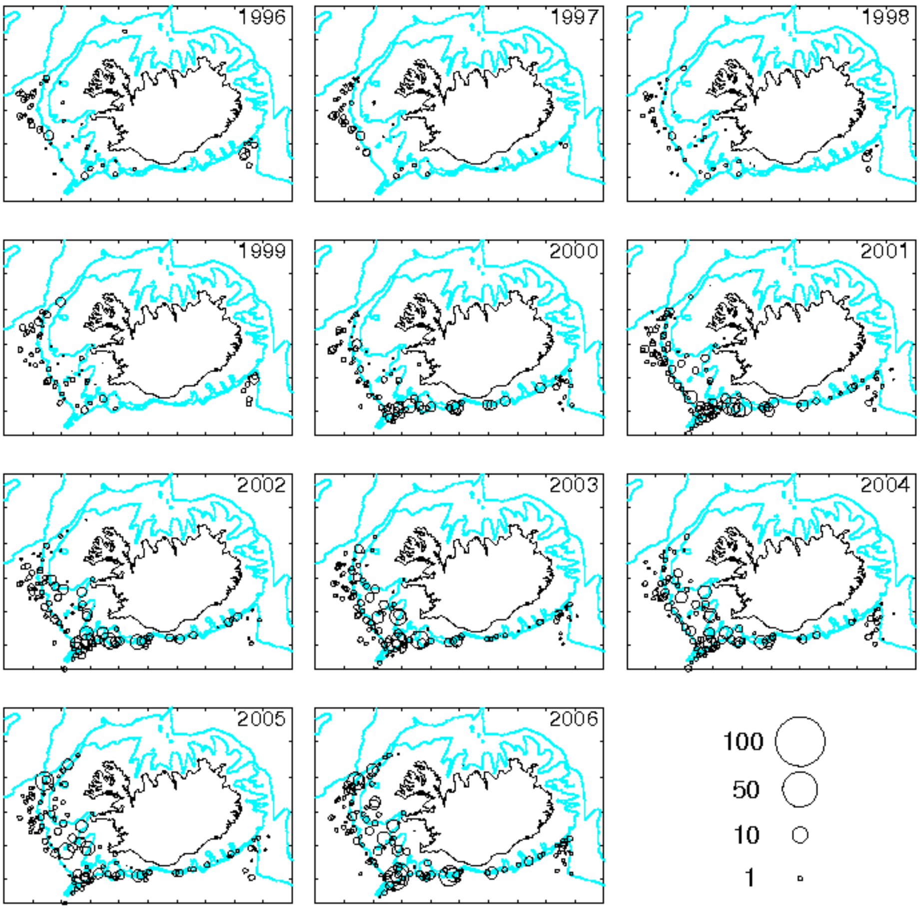


Figure 5.3.8. Blue ling. Distribution of CPUE in the groundfish survey in October 1996-2006. The size of the circles indicate kg/station.

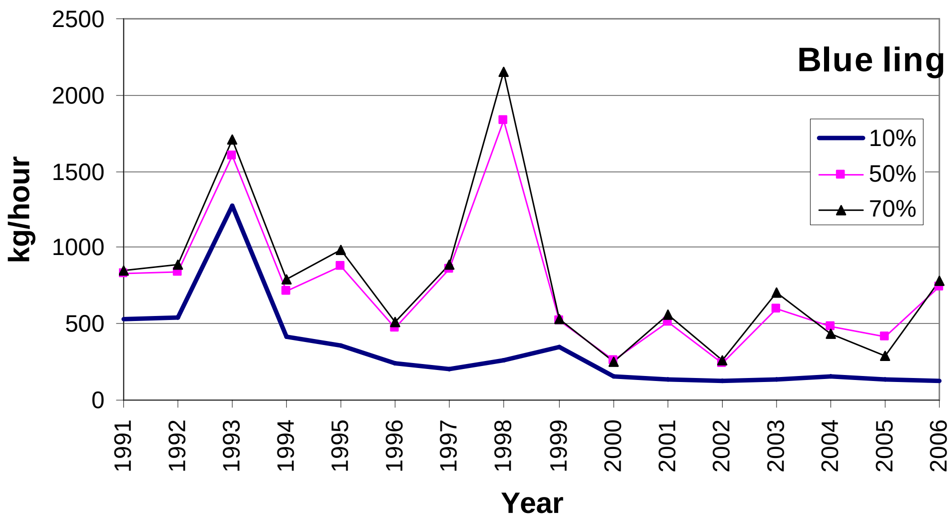


Figure 5.3.8. Blue ling. Catch per unit off effort calculated from the Icelandic trawl fishery where more than 10%, 50% and 90% of the catch was blue ling.

5.4 TUSK (*BROSME BROSME*) IN DIVISION Va

5.4.1 The fishery

The fishery for tusk in Va has not changed substantially in recent years. Tusk is mainly taken as a by-catch where the main target species are cod, haddock and other demersal species, but in some years there are direct fishery for tusk along the south and southwest coast of Iceland. In recent years, over 550-590 vessels have been reporting catches of tusk, from less than 0.1 t to over 330 t. Most of the landings from Va (over 95%) come from longlines, but only partly from aimed fisheries. Norwegian landings (290 t in 2006) are from fisheries primarily targeting ling.

In recent years, Icelandic vessels have, on average caught 75% of the tusk in Va. The fishing grounds in 2000, 2003 and 2006, as recorded in logbooks, are shown in Figure 5.4.1.

5.4.1.1 Landings trends

In late 1980's directed effort towards tusk started and the landings increased t**o** 8 700 and 8 000 tonnes in 1991 and 1992, respectively. Since then, the landings varied between 4 500 and 7 300 tonnes, highest in 1999 and lowest in 2001. Total landings in 2006 was about 6 300 tonnes. The total landings since 2001 have stabilized around 5000 tonnes, due to TAC restrictions and closure of juvenile areas. Landings by country are given in Table 5.4.0. Total landings since 1963 are given in Table 5.4.1.

5.4.1.2 ICES advice

The latest advice is from ICES ACFM in October 2005.

ICES advised reduction of 30% compared to the 1998 effort level.

5.4.1.3 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 2006 – 31. August 2007 was set to 5 000 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 1 350 tonnes since 2000.

In addition to above mentioned management measures there are area closed fore fishing where juvenile tusk has been observed in recent years along the south and southeast coast of Iceland. In addition, if measurements of observes results in a number of tusk smaller than 55 cm in catches exceeding 25%, and tusk is more than 30% of the catches in given set, then a immediate closure of that area will take place for 2 weeks**.**

5.4.2 Stock identity

No new information on stock structure was presented. In the 1998 report it was noted that ripening adult tusk and tusk eggs have been found in all parts of the distribution area, but the banks to the west and north of Scotland, around the Faroes and off Iceland, as well as the shelf edge along mid and north Norway seem to be the most important spawning areas (Magnússon *et al.* 1997). Nothing is known about migrations within the area of distribution. Studies of enzyme and haemoglobin frequencies showed no geographical structure, hence it was concluded that tusk in all areas, at least of the Northeast Atlantic, belong to the same gene pool (Bergstad and Hareide, 1996). Widely separated fishing grounds may support separate management units, i.e., stocks. It is suggested that Iceland (Va) and the Norwegian coast (I and II) have self-contained units, while the separation among possibly several stocks to the north and west of the British Isles remains unclear.

5.4.3 Data available

5.4.3.1 Landings and discards

Landings by EU and Icelandic vessels are given by the Icelandic Directorate of Fisheries. Catches are only landed in authorised ports where all catches are weighted 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 on possible discard of tusk.

5.4.3.2 Length compositions

Table 5.4.2 gives the overview of measured fishes in Va by gear type and surveys. The length distributions from the catches are shown in Figure 5.4.2.

5.4.3.3 Age compositions

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

5.4.3.4 Weight at age

No data available.

5.4.3.5 Maturity and natural mortality

No new data available. Earlier observations indicates that tusk becomes mature at age of about 8-10 years and at that time it is around 55 cm lengths (Figure.4.4.3). At 56 cm length, 50% of the tusk in Icelandic waters is mature the same length as is close to the mean length in the catches. This means that large proportion of the tusk is caught as juveniles.

5.4.3.6 Catch, effort and research vessel data

Icelandic survey data

The Icelandic Groundfish survey (see Pálsson *et. al*, 1989) which has been conduced 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 tusk. Figure 5.4.4 show both recruitment index and the trend in the fishable biomass (> 40 cm) of tusk. Survey length distributions are shown on Figures 4.4.5.

The indices of total biomass and of fishable biomass (40 cm and bigger) of tusk has gradually increased from 2001, when it was below 50% of the 1985 value (Figure 5.4.4 a, b). In 2007, the biomass indices were around 85% of the mean in 1985-1989. As can be seen, both from the recruitment index (Figure 5.4.4 d) and from the length distribution in the survey (Figure 5.4.5), there seems to be some sign of recruitment into the fishable stock (> 40 cm) in nearest future. The recruitment index (tusk less than 40 cm) was in 2007 the highest observed in the time series.

Survey indices form Icelandic autumn survey are also shown in Figure 5.4.4. The autumn survey has been conducted since 1996 aiming at deep sea species such as redfish and Greenland halibut, covering the Icelandic shelf and slope down to 1200 m with 381 stations. The results of the autumn survey show similar trend in recent year (Figure 5.4.4), except for the recruitment index which is much lower than from the spring survey.

The geographical distribution of tusk in the spring and autumns surveys are shown in Figures 4.4.6 and 4.4.7 respectively.

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

Figures 4.4.8 and 4.4.9 shows catch per unit of effort and effort of tusk in the Icelandic long-line fishery. The CPUE is calculated using all long-line 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 conflicting. The CPUE calculated using all sets where tusk was registered shows declining trend since late 1990s, but when selecting only sets where tusk was more than 30% of registered catch there is no trend in the whole series since 1990.

5.4.4 Data analyses

No age-based assessments were possible due to lack of age-structured data.

Mean length of tusk in the catches has decreased from 1999-2002 but has increased slightly again since then. This decrease in mean length in 1999-2002 can partly be explained by the increased recruitment (see chapter 4.4.3.6).

The sources of information on abundance trends were the CPUE series from the Icelandic longliners and survey indices from the Icelandic groundfish survey. There is a conflicting trends in the series, where the fishery independent series show much more optimistic status of the stock than the CPUE series does. Figure 5.4.9 shows the effort (in number of hooks) behind the CPUE calculations, based on different criteria for the calculations. As can be seen the effort is increasing while selecting all longline sets where tusk is reported, but decreasing trend while selecting only sets where tusk is 10 and 30% of the catch in each set, respectively. This indicates that higher proportion of the tusk is taken in small quantities as by-catch but less in directed fishery.

There is a consistency between the two survey indices except for the recruitment index where the autumn survey show much lower recruitment than the spring survey (Figure 5.4.4). This discrepancy is due to the survey design as the autumn survey covers badly the areas of south and southwest Iceland where most of the juveniles in the spring survey is coming from. Due to the above mentioned problems with the CPUE series and the consistency in the survey indices, the working group suggest using the fishery independent data as an indicator of stock trend.

5.4.5 Comments on the assessment

It is not possible to make age-based assessments for tusk due to lack of good time-series of age-structured data. The group noticed that material to run such analysis in Va have been collected, but otoliths have not been age read yet. The group encouraged efforts to work up the material needed to make such analyses.

As mentioned in chapter 4.4.4, the group suggest using survey indices as indicators of stock trends. There is a consistency between the two survey series except for the recruitment indices where the autumn survey show much lower recruitment than the spring survey. This discrepancy is due to the survey design as the autumn survey covers badly the areas of south and southwest Iceland where most of the juveniles in the spring survey are caught.

5.4.6 Management considerations

The state of the stocks remains uncertain, but there are indications that both the adult stock (> 55 cm) and the fishable stock (> 40 cm) has started to recover from it´s record low level in 2001, and the recruitement signs are optimistic. Action have been taken to prevent the juveniles in Division Va by closing areas of the south and southeast coast of Iceland, and there is a TAC management. This has resulted in a decreased direct effort in recent years.

Reference points that were previously assigned to tusk were:

U_{lim}= 0.2* $U_{max,}$

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

On the basis of existing biomass reference points, the status of the stock appears to be above U_{pa}. However, this evaluation does not take account of earlier exploitation, in years prior to the start of the survey data in 1985, the level of which is uncertain. The working therefore however recommends that direct effort should further be kept low in order to further rebuild the adult stock.

Table 5.4.0. Tusk Va. WG estimate of landings.

Year	Faroes	Germany	Iceland	Norway	Scotland	E&W	**Total**
1988	3,757		3,078	20			**6,855**
1989	3,908		3,143	10			**7,061**
1990	2,475		4,816				**7,291**
1991	2,286		6,446				**8,732**
1992	1,567		6,442				**8,009**
1993	1,329		4,746				**6,075**
1994	1,212		4,612				**5,824**
1995	979	1	5,245				**6,225**
1996	872	1	5,226	3			**6,102**
1997	575		4,819				**5,394**
1998	1,052	1	4,118	0			**5,171**
1999	1,075	2	5,795	391	1		**7,264**
2000	1,302	+	4,714	374	+	1	**6,391**
2001	1125	1	3407	285	+	5	**4823**
2002	1269		3935	372	1	1	**5578**
2003	1163	1	4057	373	1	1	**5596**
2004	1485	1	3135	214		1	**4836**
2005	1077	3	3539	303		4	**4926**
2006*							

* Preliminary

Table 5.4.1. Tusk. Catches in Va since 1963.

Year	*Iceland*	*Other nations*	*Total*
1963	5 872	4 425	10 297
1964	3 532	4 214	7 746
1965	2.263	4 347	6 610
1966	2 107	2 468	4 575
1967	2 699	2 433	5 132
1968	4 604	2 028	6 632
1969	4 075	2 143	6 218
1970	4 357	2 630	6 987
1971	3 793	4 319	8 112
1972	2 815	3 645	6 460
1973	2 366	5 241	7 607
1974	1 857	4 679	6 536
1975	1 673	4 058	5 731
1976	2 935	4 177	7 112
1977	3 122	4 826	7 948
1978	3 352	2 980	6 332
1979	3 558	2 895	6 453
1980	3 089	3 801	6 890
1981	2 827	3 649	6 476
1982	2 804	3 076	5 880
1983	3 469	4 818	8 287
1984	3 430	2 262	5 692
1985	3 068	1 996	5 064
1986	2 548	2 832	5 380
1987	2 987	2 657	5 644
1988	3 087	3 777	6 864
1989	3 158	3 918	7 076
1990	4 816	2 475	7 291
1991	6 446	2 286	8 732
1992	6 442	1 567	8 009
1993	4 729	1 329	6 058
1994	4 615	1 212	5 827
1995	5 245	985	6 230
1996	5 226	1 014	6 240
1997	4 814	944	5 758
1998	4 118	1 027	5 145
1999	5 795	1 494	7 289
2000	4 711	1 528	6 239
2001	3 392	1 133	4 525
2002	3 906	1 342	5 248
2003	4 030	1 284	5 314
2004	3 124	1 530	4 654
2005	3 534	1 285	4 819
2006[1)]	5 060	1 221	6 281

[1)] *Provisional figures.*

Table 5.4.2. Tusk. Overview of sampling. Number of fishes and number of stations by gear type/survey type.

Year	Danish seine	Commercial Gillnet	Commercial longline	March-groundfish survey	Other surveys	Autumn-groundfish survey	Commercial trawls	Total
1986	/	192 / 2	561 / 6	1258 / 246	/	/	248 / 18	2259 / 272
1987	/	/	774 / 4	1552 / 287	/	/	5270 / 111	7596 / 402
1988	/	159 / 2	/	1405 / 272	/	/	2787 / 99	4351 / 373
1989	/	/	/	1893 / 307	/	/	12 / 2	1905 / 309
1990	/	/	/	1446 / 290	/	/	120 / 11	1566 / 301
1991	/	/	869 / 4	1303 / 294	/	/	3513 / 17	5685 / 315
1992	/	/	720 / 4	1413 / 284	1457 / 42	/	218 / 54	3808 / 384
1993	/	/	1650 / 8	1037 / 265	37 / 9	/	2179 / 69	4903 / 351
1994	/	/	2792 / 15	1102 / 261	/	/	377 / 109	4271 / 385
1995	/	4 / 1	3563 / 24	818 / 216	/	/	61 / 13	4502 / 282
1996	/	/	4136 / 14	627 / 207	68 / 4	76 / 44	5 / 3	6398 / 308
1997	/	/	2923 / 14	847 / 227	/	55 / 37	3653 / 61	8998 / 375
1998	/	/	3277 / 13	757 / 208	/	41 / 30	342 / 22	6173 / 313
1999	/	/	3805 / 24	768 / 201	/	53 / 34	103 / 36	6217 / 334
2000	/	/	2995 / 19	959 / 233	/	75 / 42	83 / 28	6014 / 381
2001	/	/	3097 / 19	919 / 270	4 / 4	140 / 75	244 / 29	5665 / 465
2002	/	/	2843 / 21	949 / 252	/	103 / 65	34 / 16	6204 / 420
2003	/	/	8444 / 47	1167 / 269	/	117 / 69	76 / 28	11547 / 477
2004	/	/	3844 / 29	1692 / 281	/	136 / 74	111 / 25	7495 / 474
2005	/	/	6007 / 54	1921 / 297	/	135 / 72	164 / 33	9696 / 526
2006	/	/	4870 / 37	1946 / 307	/	227 / 99	149 / 30	7663 / 530
2007	/	/	1644 / 11	1977 / 328	/	/		3788 / 341

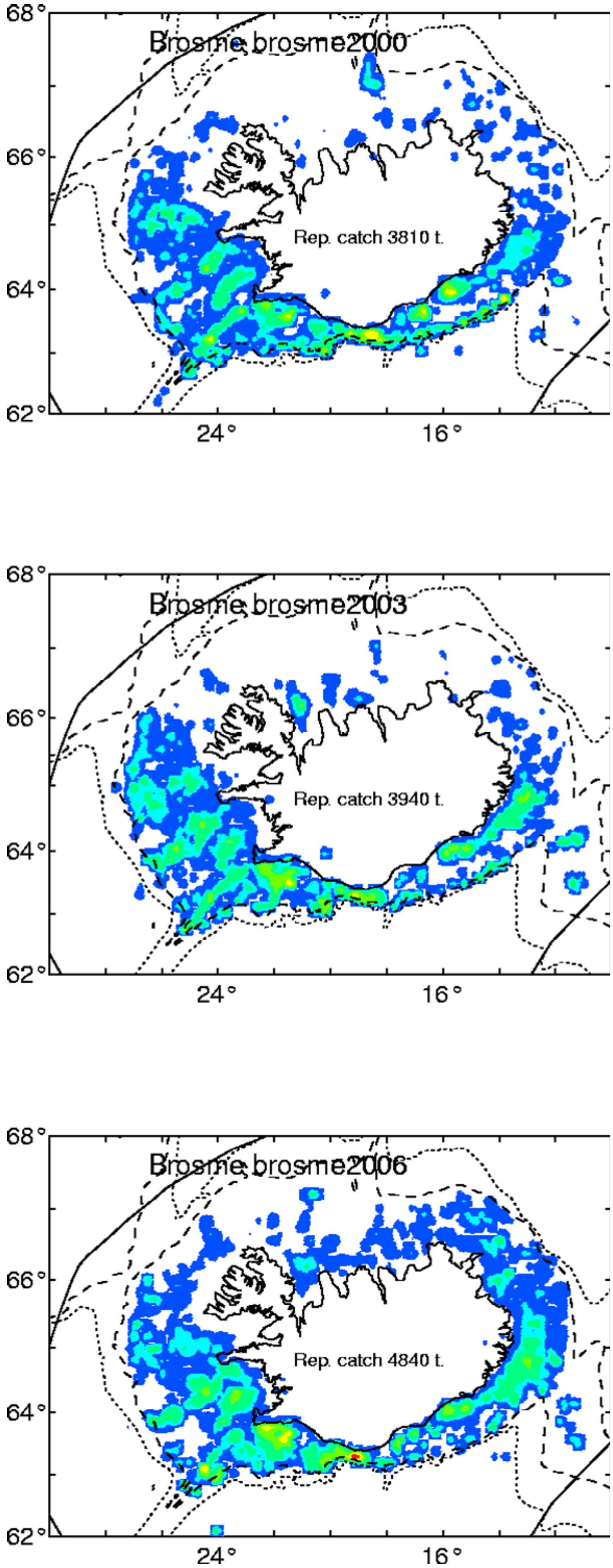


Figure 5.4.1. Tusk. Icelandic fishery in 2000, 2003 and 2006 as reported in the logbooks. All gear types combined.

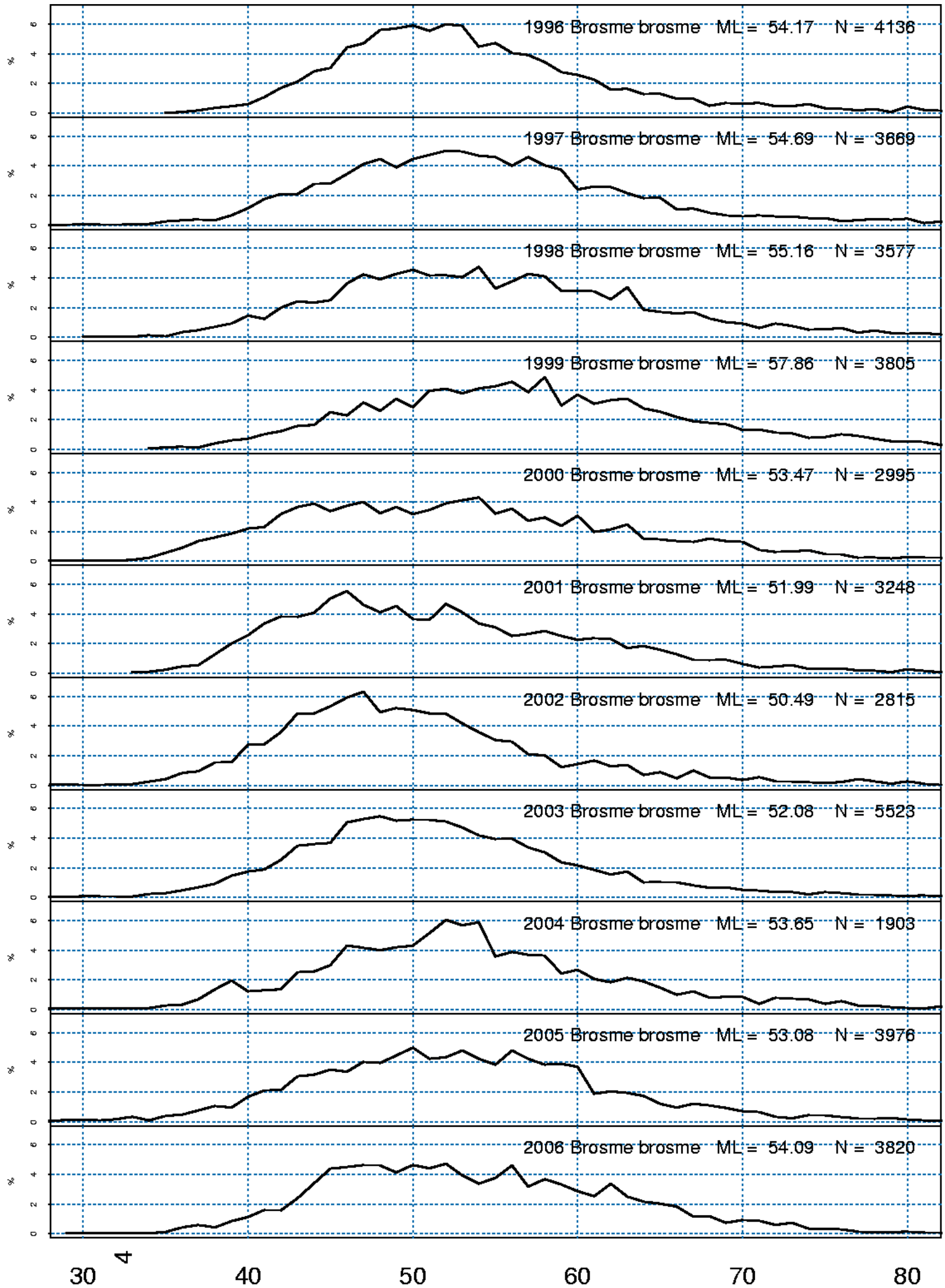


Figure 5.4.2. Length distribution of tusk in the Icelandic catches since 1996. The number of measured fishes and mean length is also given.

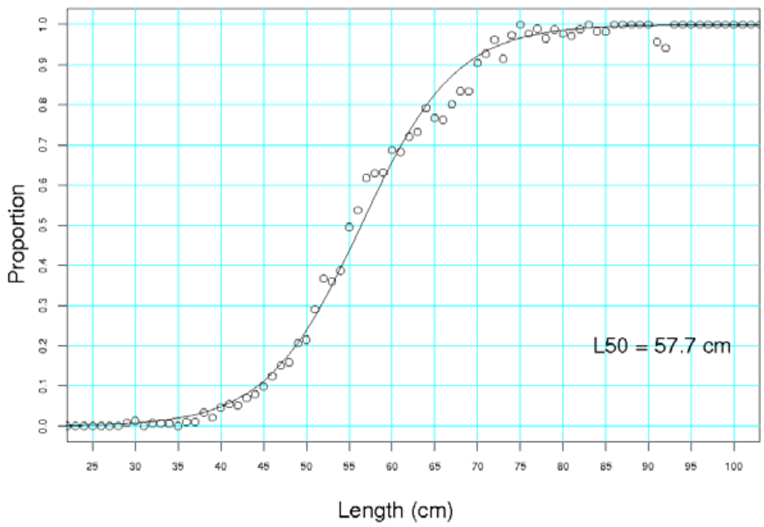


Figure 5.4.3. Tusk maturity. The figure shows average maturity at given length in the Icelandic catches. The fitted curve is also shown and the constants in the equation.

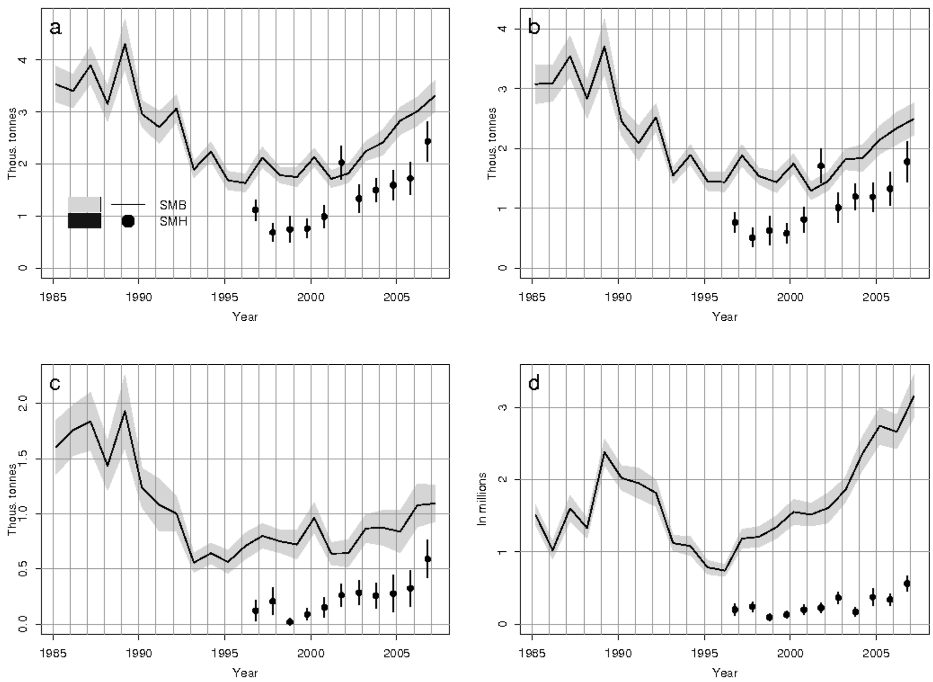


Figure 5.4.4. Tusk. Indices form the groundfish survey in March (SMB, line, shaded area) and October (SMH, points, vertical lines). a) Total biomass index, b) Biomass of 40 cm and larger, c) Biomass 55 cm and larger, d) Abundance of < 40 cm. The shaded area and the vertical bar show ±1 standard error of the estimate.

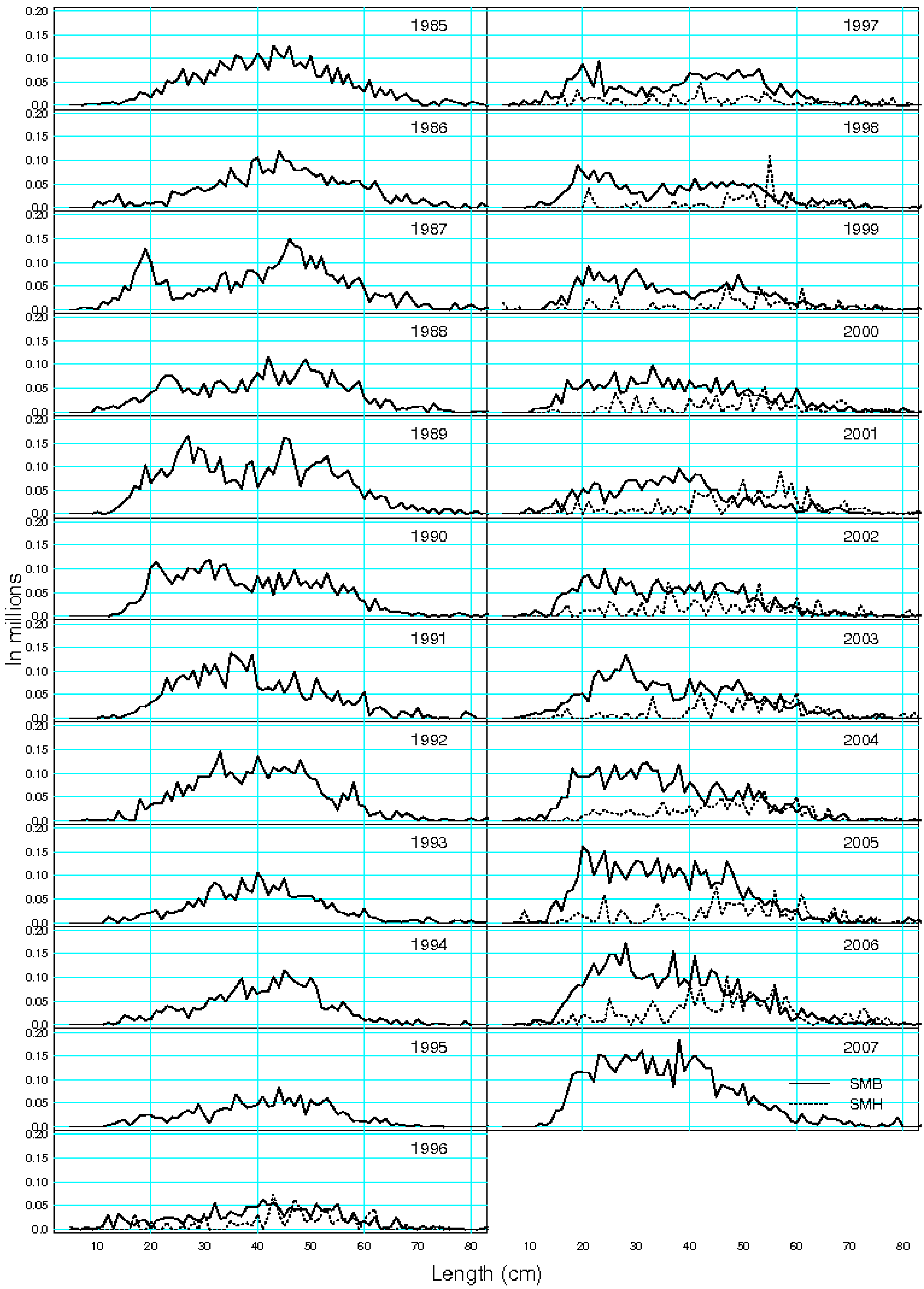


Figure 5.4.5. Tusk length distributions in the Icelandic groundfish survey in March 1985-2007.

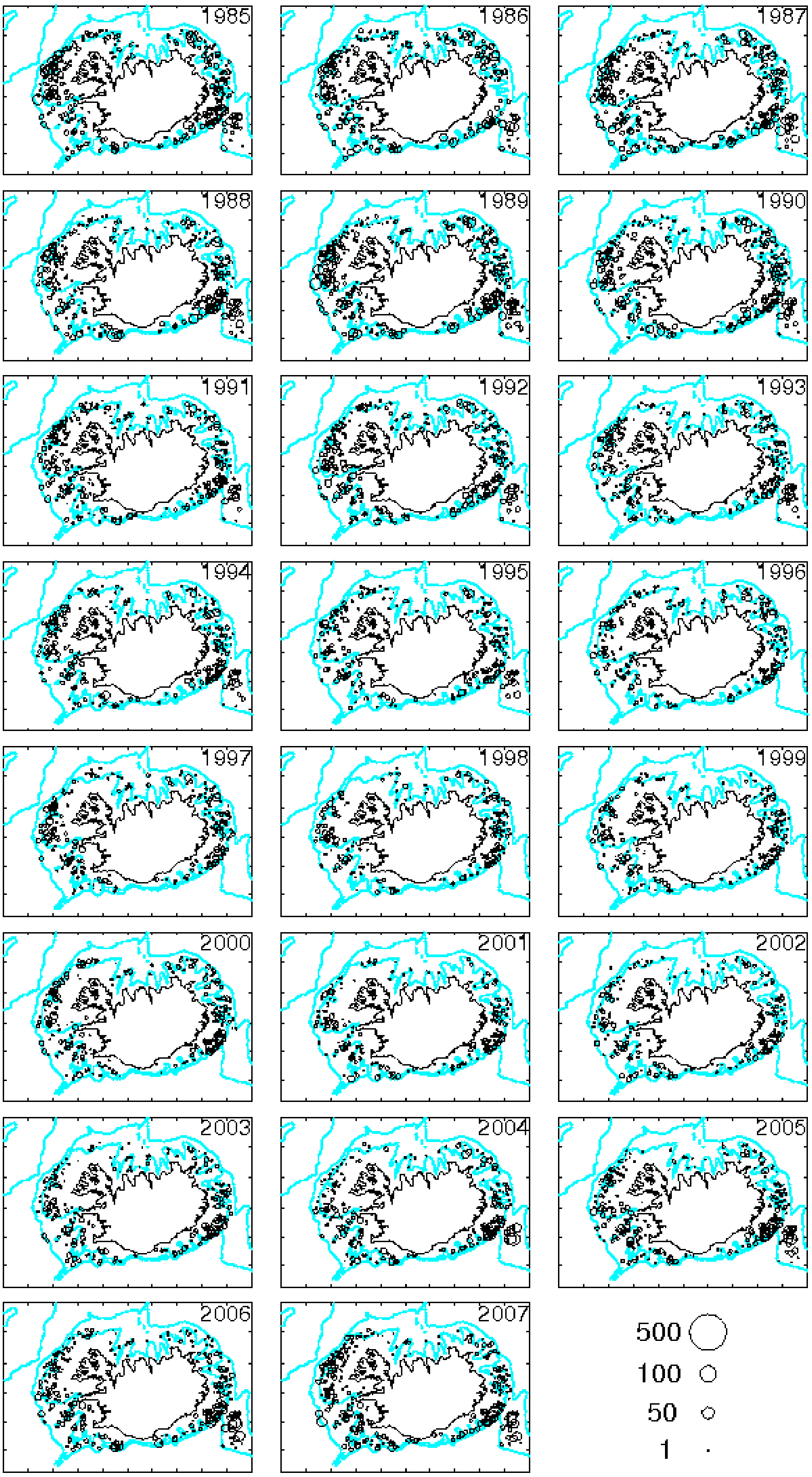


Figure 5.4.6. Tusk. Distribution of CPUE in the groundfish survey in March 1985-2007. The size of the circles indicate kg/station.

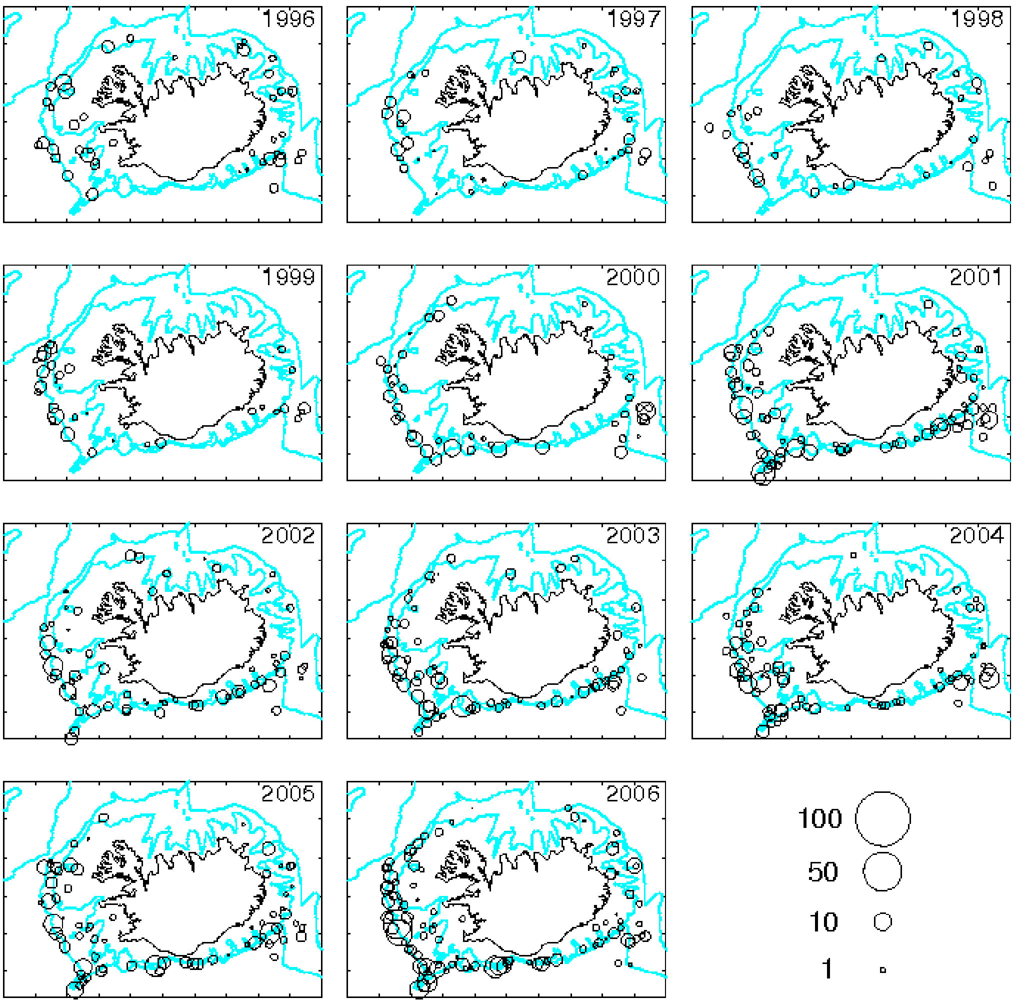


Figure 5.4.7. Tusk. Distribution of CPUE in the groundfish survey in October 1996-2006. The size of the circles indicate kg/station.

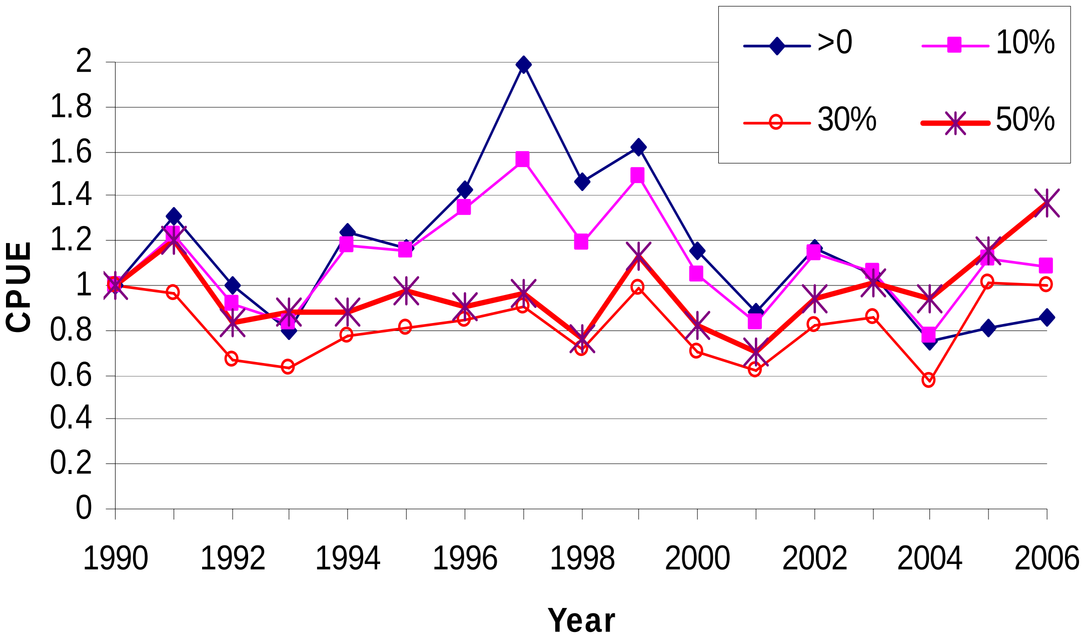


Figure 5.4.8. Tusk catch per unit of effort calculated from the Icelandic long-line fishery using different criteria for the calculations. >0 = all sets where tusk was reported in the log-books; 10% = sets where 10% or more of the catch in given set was tusk; 30% = sets were 30% or more of the catch in given set was tusk; 50% = sets were 50% or more of the catch in given set was tusk. All values standardized to 1 in 1990.

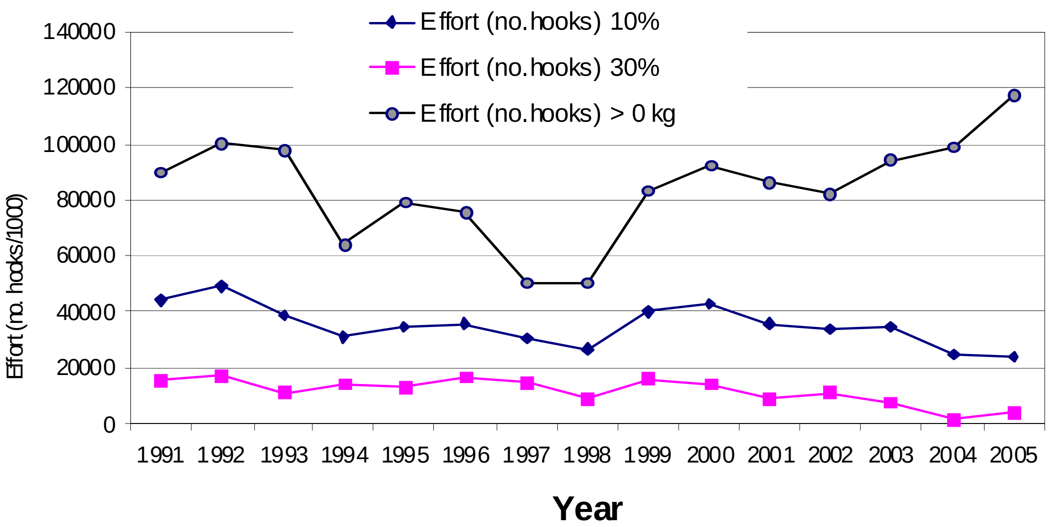


Figure 5.4.9. Tusk. Effort of the Icelandic long-line fishery using different criteria for the calculations. >0 = all sets where tusk was reported in the log-books; 10% = sets where 10% or more of the catch in given set was tusk; 30% = sets were 30% or more of the catch in given set was tusk.

5.5 Greater Silver Smelt (*Argentina Silus*) in Division Va

5.5.1 The fishery

Greater silver smelt have been caught in bottom trawls for years as by-catch in the redfish fishery. Only small amounts were reported prior to 1996 as most of the fish was discarded. Since 1997, direct fishery for greater silver smelt has been ongoing and the landings increased significantly. The greater silver smelt is taken both in directed fishery with a small mesh size belly and codends (80 mm), but also as bycatch in the redfish fishery.

Total of 43 vessels landed the species in 2006 and the range of the landed catch by vessel were from only few kilos to 1143 tonnes. Greater silvers smelt is mostly fished along the south and southwest coast of Iceland, at depths between 500 and 800 m. The fishing grounds in 2000, 2003 and 2006, as recorded in logbooks, are shown in Figure 5.5.1.

5.5.1.1 Landings trends

Landings are shown in Tables 4.5.0 and 4.5.1. Since directed fishery started in 1996, the landings increased from 800 tonnes in 1996 to 13 000 tonnes in 1998. In 1999 and 2000, the landings were close to 6000 tonnes, but decreased to only 3000 tonnes in 2001. The landings in 2002 increased again to almost 5000 tonnes where the dominant gear was bottom trawl and further down to 2700 tonnes in 2003. Total landings in 2006 were about 4800 t which was similar as in 2005. The variations in the catches are largely due to market situations.

5.5.1.2 ICES advice

Current ICES advice: Greater silver smelt can only sustain low rates of exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data on both target and bycatch fish.

5.5.1.3 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.

5.5.2 Stock identity

The limited and hypothetical information on possible stocks was reported in the 1998 Study Group report (CM1998/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 the winter but in the summer the species is widely distributed (Bergstad, 1993).”. No new information was presented to the Working Group.

5.5.3 Data available

5.5.3.1 Landings and discards

Landings by Icelandic vessels are given by the Icelandic Directorate of Fisheries. Discard is banned in the Icelandic demersal fishery and there are no informations on possible discard of ling. It is however likely that greater silver smelt has been discarded in the past, prior to 1996, but the quantity is unknown.

5.5.3.2 Length compositions

Table 5.5.2 gives the overview of measured fishes in Va by gear type and surveys. The length distributions from the catches are shown in Figure 5.5.2.

5.5.3.3 Age compositions

No data available. Otoliths have been collected randomly from the catch since 1980's, but no age readings have been done since 1998. The group encouraged efforts to work up the material in order to facilitate age-based ssessment for this stock.

5.5.3.4 Weight at age

No data available

5.5.3.5 Maturity and natural mortality

No data available

5.5.3.6 Catch, effort and research vessel data

Icelandic survey data

In the Icelandic groundfish survey which has been conduced 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. Survey length distributions of ling are shown on Figure 5.5.3.

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

Figure 5.5.4 shows catch per unit of 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.

5.5.4 Data analyses

The only sources of information on abundance trends were the CPUE series from the Icelandic trawler fleet. The CPUE indices does not show any clear trend since the fishery started in 1996. Further, as greater silver smelt is a benthopelagic species it is unknown if the indices reflects abundance.

The mean length in the catches has decreased by more than 5 cm since 1996. There could be a several explanations to this decrease:

- Direct fishery has only been for few years on the species. Therefore these changes could indicate an overfishing of large fish.

- The allowed mesh size in direct fishery has changed from being 120 mm in mesh size in the codend in the first years of the fishery to being 80 mm. It is not known the actual mesh size used by each vessel and therefore the effect of such changes could not be evaluated.
- The mean depth of the hauls where the species is has been caught has decreased since the fishery started from being 652 m on average in 1997-1998 to being 585 m on average in 2004-2005. It is well known that the size of greater silver smelt decreases as the depth becomes shallower and this might therefore affect the decrease of the size in the landings. The log-book data also confirm that higher proportion of greater silver smelt is now taken at shallower water than was in the beginning of the fishery (Table 5.5.3).

Overall, the observed changes in the length distribution could both be due to changes in the fishery and overexplotation.

5.5.5 Comments on the assessment

No analytical assessment that could be conducted and the available data does not allow any assessment on the stock status.

5.5.6 Management considerations

The status of the greater silver smelt stock is highly uncertain and the data presented could not be used to assess the stock status. The decrease in length in the commercial catches may have resulted from exploitation.

Greater silver smelt can only sustain low rates of exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data on both target and bycatch fish.

Table 5.5.0. 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	2683		**2683**
2004	3645		**3645**
2005	4401		**4481**
2006*	4769		**4769**

*Preliminary

Table 5.5.1. Greater silver smelt. Landings in ICES division Va since 1986.

Year	*Total landings*
1986	53
1987	42
1988	206
1989	8
1990	112
1991	246
1992	657
1993	1 255
1994	613
1995	492
1996	808
1997	3 367
1998	13 387
1999	5 495
2000	4 593
2001	2 478
2002	4 357
2003	2 686
2004	3 645
2005	4 481
2006[1)]	4 769

[1)] *Provisional figures.*

Table 5.5.2. Greater silver smelt. Overview of sampling. Number of fishes and number of stations/samples by gear type/survey type

Year	March trawl survey	Other surveys	Oct. trawl survey	Commercial Trawls	Total
1986	3328 / 65	/	/	6279 / 74	9607 / 139
1987	3328 / 65	/	/	6279 / 74	9607 / 139
1988	2618 / 62	/	/	14989 / 114	17607 / 176
1989	3282 / 71	/	/	/	3288 / 73
1990	2511 / 54	/	/	3316 / 21	6795 / 84
1991	2286 / 56	/	/	335 / 2	3514 / 73
1992	2322 / 65	87 / 11	/	2586 / 39	5488 / 135
1993	1421 / 52	234 / 10	/	649 / 17	2758 / 92
1994	1849 / 63	/	/	1081 / 14	2932 / 79
1995	1085 / 47	/	1419 / 35	1015 / 13	3549 / 96
1996	1566 / 46	63 / 2	925 / 37	24 / 2	2578 / 87
1997	1117 / 38	/	1149 / 41	2196 / 41	7295 / 136
1998	1804 / 50	/	2100 / 54	13675 / 136	19207 / 263
1999	1609 / 57	/	1604 / 52	4738 / 97	8533 / 209
2000	1300 / 56	/	1459 / 50	3283 / 75	7359 / 193
2001	1229 / 77	/	1454 / 57	2007 / 61	4785 / 200
2002	1767 / 77	/	1861 / 49	1975 / 81	7347 / 233
2003	1560 / 73	/	1797 / 47	5309 / 123	10442 / 260
2004	1709 / 88	/	1997 / 49	2987 / 111	7248 / 265
2005	1500 / 63	/	1893 / 45	1456 / 73	8239 / 220
2006	1355 / 65	/	1714 / 49	1227 / 47	7885 / 186
2007	1808 / 66	/	/	4 / 2	2097 / 70

Table 5.5.3. Greater silver smelt. Cumulative catches by depth intervals from 1998-2005. The data are extracted from log-books of the Icelandic trawler fleet. As an example, 46% of the catches in 1998 where taken at shallower water than 700m as 75% of the catches in 2005 were taken shallower than that.

	1998	**1999**	**2000**	**2002**	**2003**	**2004**	**2005**
100-200 m	0%	0%	0%	0%	1%	0%	1%
200-300m	1%	2%	3%	2%	4%	3%	3%
300-400m	1%	3%	7%	4%	5%	6%	6%
400-500m	6%	9%	9%	21%	12%	28%	12%
500-600m	15%	33%	21%	41%	34%	51%	29%
600-700m	46%	62%	49%	86%	78%	93%	75%
700-800m	75%	79%	70%	92%	87%	95%	86%
800-900m	98%	97%	97%	100%	100%	98%	99%
900-1000m	100%	99%	100%	100%	100%	98%	100%
> 1000m	100%	100%	100%	100%	100%	100%	100%

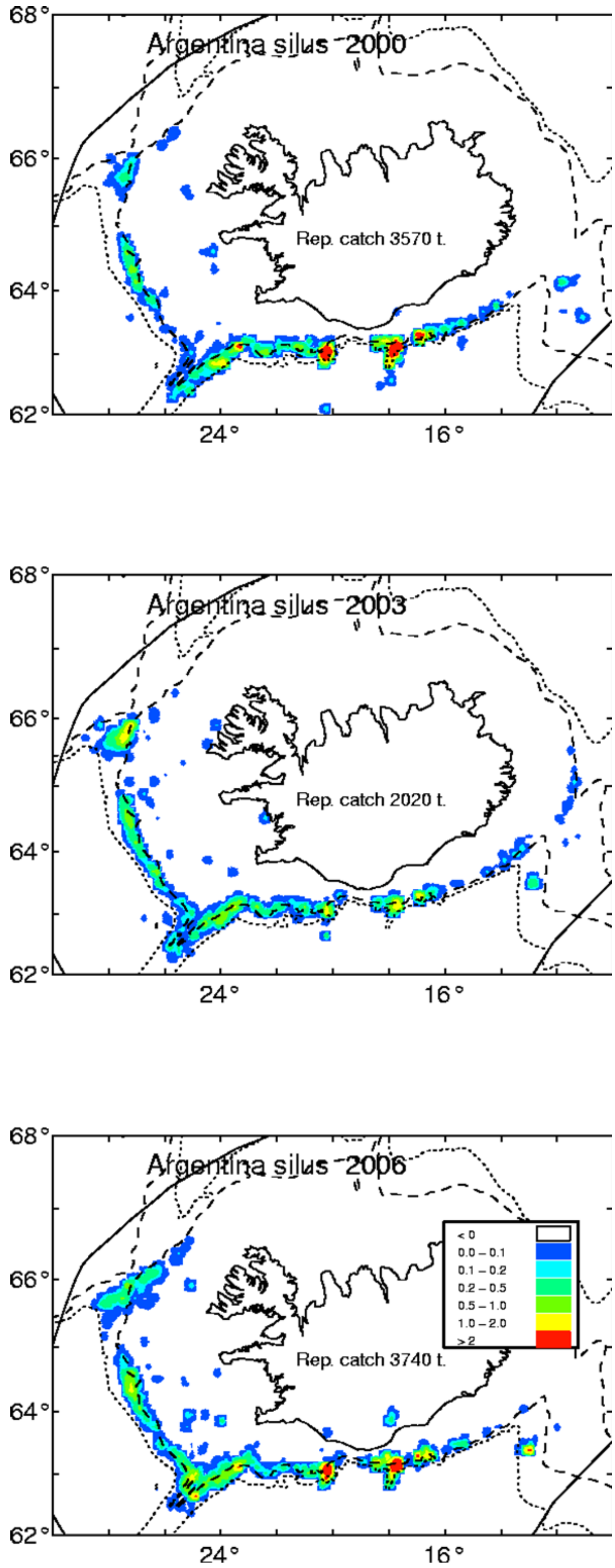


Figure 5.5.1. Greater silver smelt. Icelandic fishery in 2000, 2003 and 2006 as reported in the trawlers logbooks.

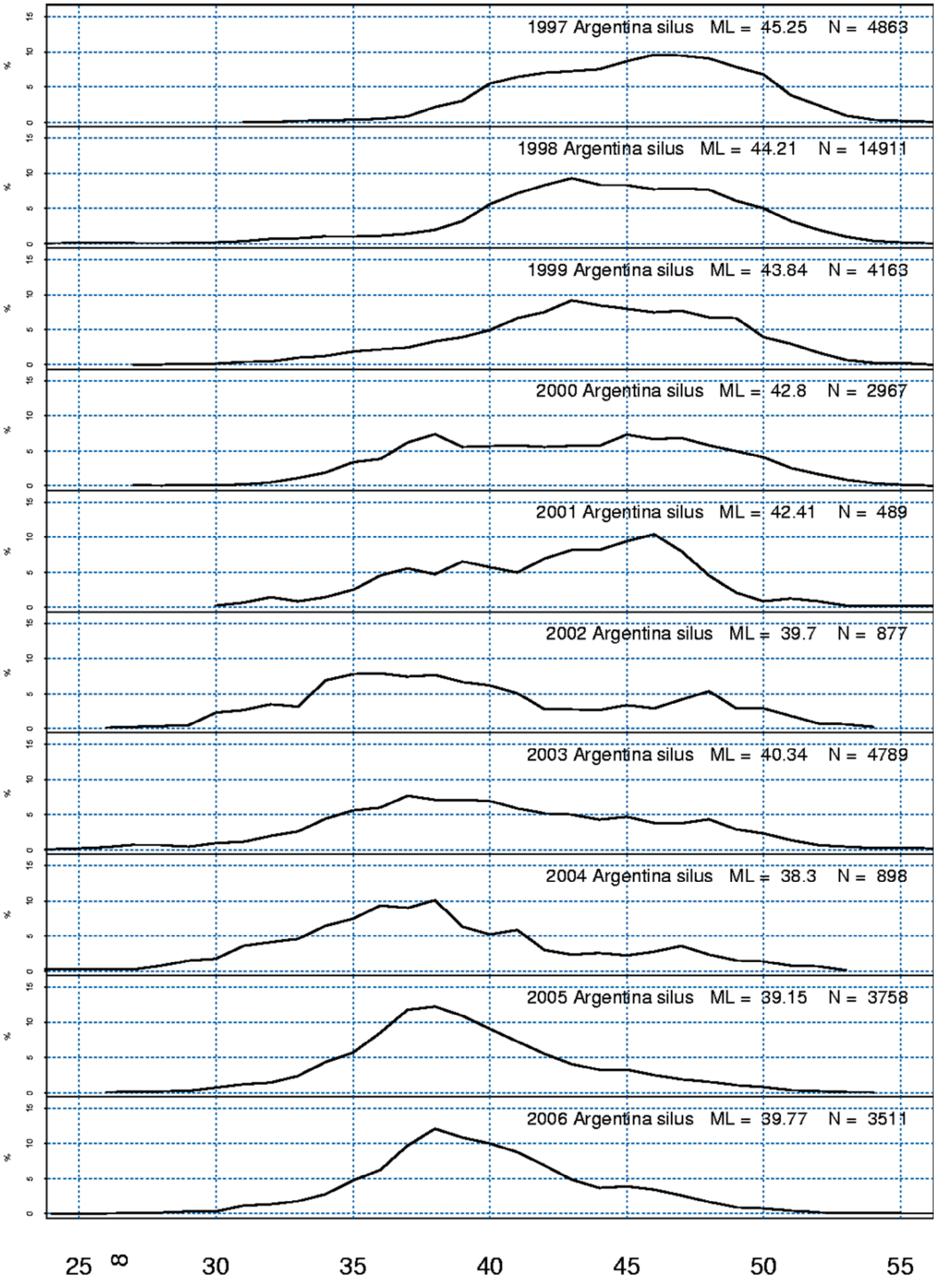


Figure 5.5.2. Length distribution of greater silver smelt in the Icelandic catches since 1996. The number of measured fishes and mean length is also given.

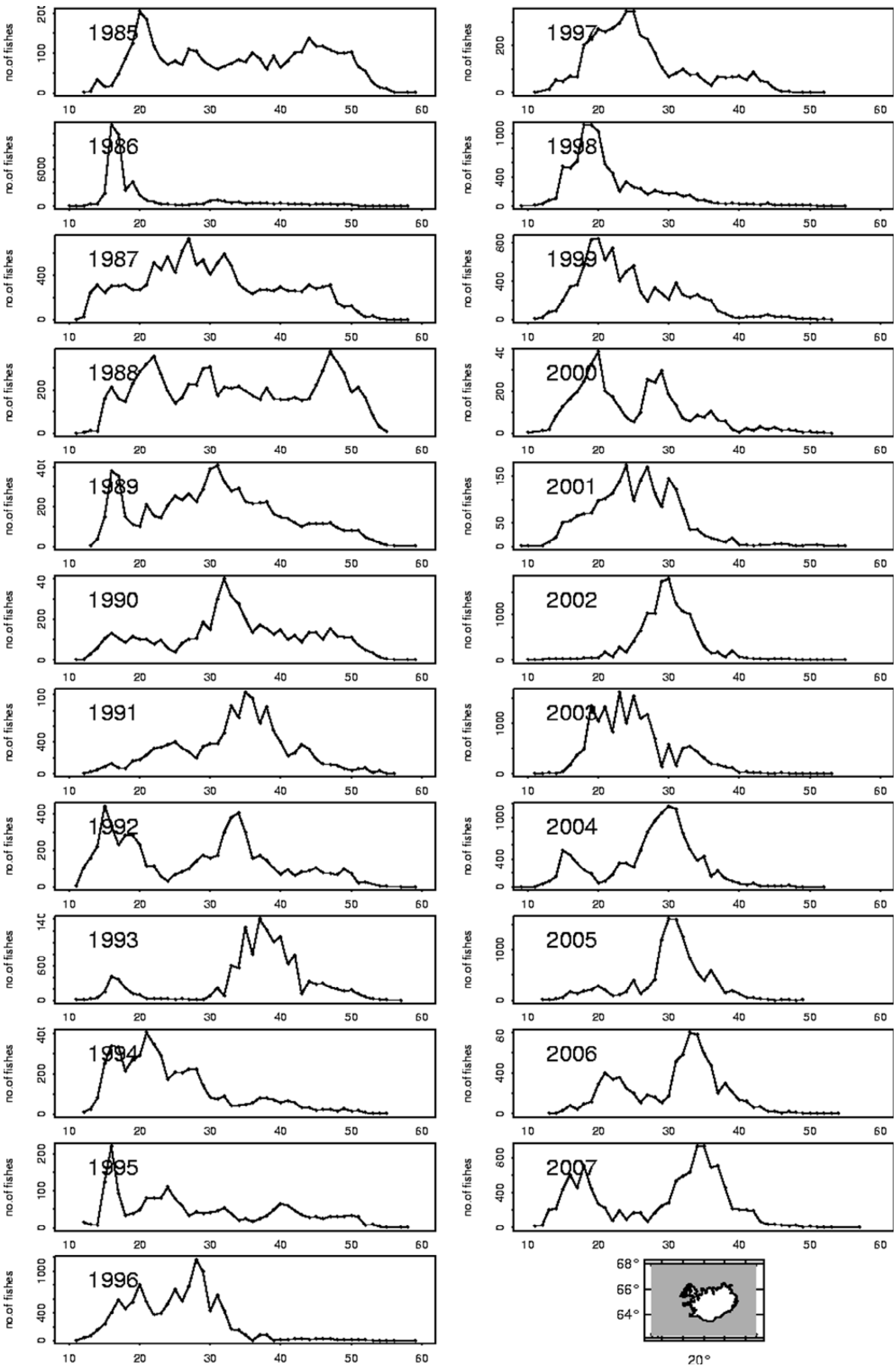
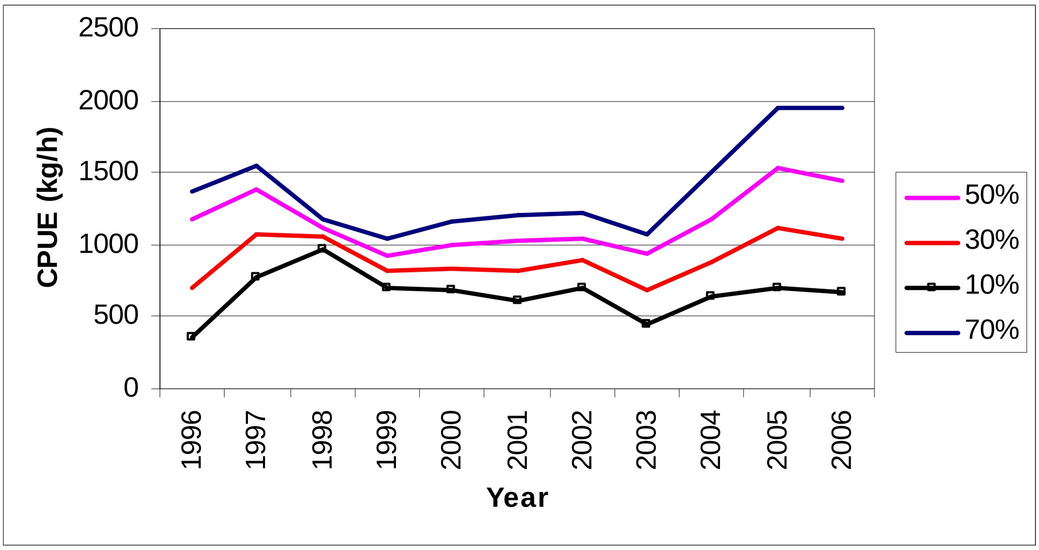


Figure 5.5.3. Greater silver smelt length distributions in the Icelandic groundfish survey in March 1985-2007.



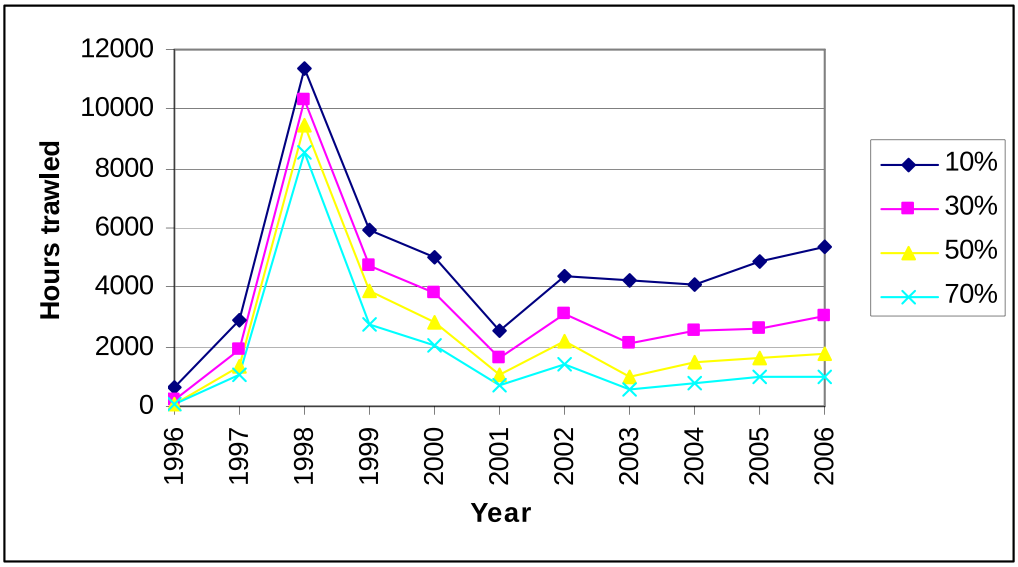


Figure 5.5.4. Greater silver smelt catch per unit of effort (a) and effort (b) calculated from the Icelandic trawler fishery. The lines corresponds to cpue calculated where total catch of greater silver smelt in each haul is 10, 30, 50 or 70% of the total catch in each haul.

6 Stocks and fisheries of the Barents Sea and Norwegian waters

6.1 Fisheries Overview

In subareas I and II three species, ling (*Molva molva*), tusk (*Brosme brosme*) and Greater silver smelt (*Argentina silus*) make up almost 99 percent of the landed catches (Figure 6.1.1). Ling and tusk are mainly caught by long liners and a small proportion is caught in gillnets. Greater silver smelt is caught by bottom and mid-water trawls in almost equal amounts. Minor catches of other species that are mainly taken as by-catches include roughhead grenadier (*Macrourus berglax*), greater forkbeard (*Phycis blennoides*), roundnose grenadier (*Coryphaenoides rupestris*), rabbitfish (Chimaerids) and blue ling (*Molva dypterigia*). Norway is landing by far the largest amount of the three species. Small by-catch landings of ling, blue ling and tusk are reported by the Faroes, France, Germany, Russia, Scotland, Ireland and England and Wales. Occasional landings of direct fishery for greater silver smelt is reported by the Netherlands and by-catches by Germany, Russia, Scotland and the Faroes.

Longline fisheries

The longline fishery for ling (*Molva molva*) and tusk (*Brosme brosme*) has until recently 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 35 in 2006 (Table 6.1.2). The number of vessels declined during this period mainly due to 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 and recently there has been a large increase.

Intermittently there are minor trawl fisheries in mid-Norway (IIa) targeting roundnosed grenadier *Coryphaenoides rupestris* and *Argentina silus*. Six 120-140 foot trawlers have licenses. Details on this fishery were given in the report of the EC FAIR project (Gordon, 1999).

Gillnet fisheries

There is an aimed 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 through the following decade to the extent that the fishery has since the 1990s become almost entirely focused on ling.

6.1.1 Trends in fisheries

Landing statistics for sub-areas I and II for the period 1988-2006 are given in Table 6.1.1.

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 7 000 tons in 2005. In 2006 the catches increased to over 10 000 tons. 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. Blue ling had a large decline of landed catches from 1988 through 1993, and the catches were small and still declining from 1994 until 2006 (Figure 6.1.2).

Greater silver smelt

During the period 1988-2000 there was a slight downwards trend in the landed catches. In 2000, 2004 through 2006 this trend shifted and there was a doubling in the landed catches to about 22 000 tons (Figure 6.1.2).

6.1.2 Technical interactions

Table 6.1.3 shows landings by gear and by species for 2005. The table has not been updated for 2006.

The main target species for the Norwegian long liner fleet is Arcto-Norwegian cod (*Gadus morhua*) and the time used fishing for other species depends on the size of the cod stock and hence the quotas given to the fleet. The mid-water trawl fishery for greater silver smelt is allowed during the period March 1 to May 31.

6.1.3 Ecosystem considerations

Along the coast of northern Norway and in the Norwegian Sea a large number of coral reefs have been discovered recently. These are Lophelia reefs that represent an important natural resource with a high associated biodiversity and great abundance of fish. To protect the corral 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. Long liners can fish in these areas.

Cold-water corals are particularly abundant along the Norwegian Continental shelf, between 200-400m depth. Fosså et al (2000) estimated that between 1500-2000km^2 of the Norwegian EEZ is covered in 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 abundance of fish. However, it has been estimated that between 30-50% of the Norwegian reef areas have been impacted by trawling activities (Fosså et al., 2000). A number of areas have now been closed to towed fishing ears although long lining is still permitted. Whilst such static gear has a lower 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 daytime depth of deep-scattering layer, but at depths shallower than 2000m. Little is known about the fauna in these locations 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.

6.1.4 Management measures

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

The trawl fishery for argentines is limited by licences but no TAC is set.

Table 6.1.1. Overview of landings in Sub-Areas I & II.

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
ALFONSINOS (Beryx spp.)																			
ARGENTINES (Argentina silus)	11351	8390	9120	7741	8234	7913	6807	6775	6604	4463	8261	7163	6293	14369	7407	8917	16162	17093	21685
BLUE LING (Molva dypterigia)	3537	2058	1412	1479	1039	1020	422	364	267	292	279	292	252	209	150	148	175	198	200
BLACK SCABBARDFISH (Aphanopus carbo)																			
BLUEMOUTH (Helicolenus dactylopterus)																			
GREATER FORKBEARD (Phycis blennoides)			23	39	33	1								8	318	155	75	51	49
LING (Molva molva)	6126	7368	7628	7793	6521	7093	6322	5954	6346	5409	9200	7651	5964	4957	7132	6157	6560	6313	8845
MORIDAE																			
ORANGE ROUGHY (Hoplostethus atlanticus)																			
RABBITFISHES (Chimaerids)												1	6	5	15	57	21	66	28
ROUGHHEAD GRENADIER (Macrourus berglax)			589	829	424	136				17	55		48	94	29	77	79	77	78
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)		22	49	72	52	15	15	7	2	106	100	46		2	12	4	27	13	12
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)																			
SHARKS, VARIOUS	37	15											1						
SILVER SCABBARDFISH (Lepidopus caudatus)																			
SMOOTHHEADS (Alepocephalidae)																			
TUSK (Brosme brosme)	14403	19350	18628	18306	15974	17585	12566	11617	12795	9426	15353	17183	14008	12061	12191	7940	7426	7050	10038
WRECKFISH (Polyprion americanus)																			

Table 6.1.2. Number of vessels exceeding 21 m in the Norwegian long liner fleet during the period 1995-2006.

Year	Number of long liners
1995	65
1996	66
1997	65
1998	67
1999	71
2000	72
2001	65
2002	58
2003	52
2004	43
2005	39
2006	35

Table 6.1.3. Technical interactions in Sub-Areas I & II, 2005. The table has not been updated for 2006.

year	2005

Sum of Kg		species										
main gear	ICES area	ALF	ARU	BLI	BSF	FOR	LIN	ORY	RNG	SBR	USK	ZZZ
bottom trav	I		7214	1000			13657				2902	
	IIa		8062492	20210		341	335858		1150		71846	3223
	IIb		641	35			21044				3088	205
gill nets	I			11			13				11885	
	IIa		265605	127200		11446	21879		2365		755232	6595
	IIb						1870					
lines	I			1061		2555	92199		502		546920	4979
	IIa		60	2701		48776	3155588		6658		5451418	112731
	IIb					1820	79201		412		161382	2367
pel trawls	IIa		8313588	407			852		67		151	
seines	I		50				152				366	
	IIa		240004	46			26620		767		6383	767

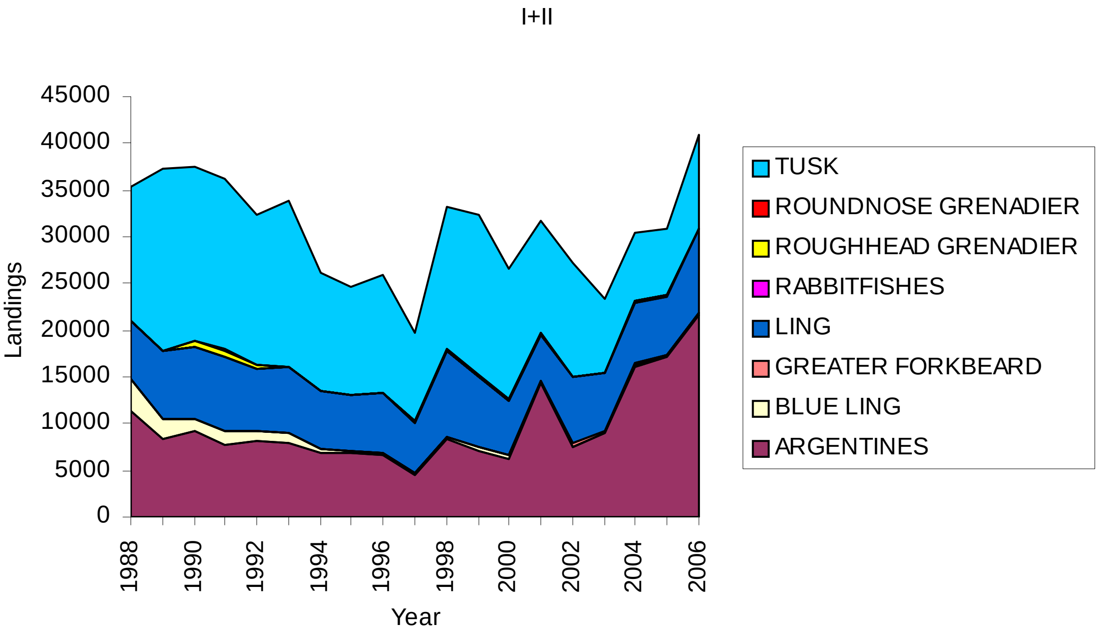


Figure 6.1.1. Trends in the landings in subareas I and II during the period 1988 through 2006.

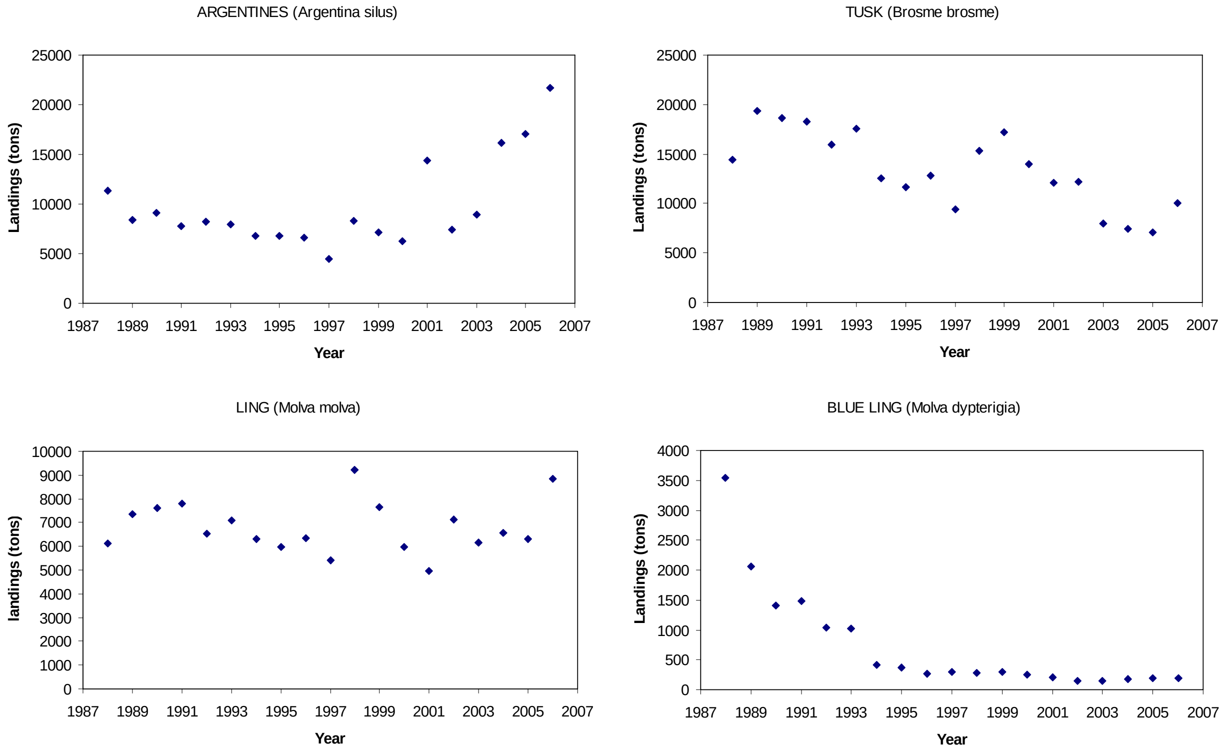


Figure 6.1.2. Trends in the total landings of argentines, tusk, ling and blue ling in areas I and II during the period 1988 through 2006.

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

6.2.1 The fishery

Ling has been fished in this area for centuries, and the historical development was described by e.g. Bergstad and Hareide (1996), including the post-world war II increase due to 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 by-catches by other gears, i.e., trawls and handline. Of the Norwegian landings, around 50% are taken by longline and 45% by gillnet, partly in directed ling fisheries and partly as by-catch in fisheries for other groundfish. Other nations catch ling as a by-catch in trawl fisheries.

6.2.1.1 Landings trends

Landing statistics by nation in the period 1988-2006 are given in Table 6.2.0a-d. During the period 2000-2005 the landings varied between 6,000 and 7,000 tonnes, at about the same level as in the preceding decade. The preliminary data shows that the landing increased to 8846 tonnes in 2006.

6.2.1.2 ICES advice

The advice statement from 2004 was: *The overall fishing effort in Subarea II should be reduced by 30% compared with the 1998 level.*

6.2.1.3 Management

There is no species-specific management of the ling fishery in Subarea I and II, but the exploitation is influenced by regulations aimed at other groundfish species, e.g. cod and haddock.

6.2.2 Stock identity

No new information on stock separation was available. Relevant data were presented and discussed in reports of previous Norwegian and Nordic projects and summarised in the 1998 report of the study group (ICES C.M. 1998/ACFM:12). 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 previously that Subarea I and II has a stock separate from other Subareas.

In an ongoing project microsatellite DNA primer development is soon to be completed, Further, samples from several parts of ling’s distribution range are obtained. DNA analysis will be initiated autumn 2007.

6.2.3 Data available

6.2.3.1 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.

6.2.3.2 Length compositions

Length compositions/mean lengths from 1976 to present based on data from the Norwegian longliners were presented in Bergstad and Hareide (1996) and Helle and Pennington (WD6, 2007). In this period, when the ling has been fully or heavily exploited, the mean length has varied without any clear trend.

6.2.3.3 Age compositions

No new age compositions were available.

6.2.3.4 Weight at age

No new data were presented.

6.2.3.5 Maturity and natural mortality

No new data were presented.

6.2.3.6 Catch, effort and research vessel data

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

The extensive Norwegian longliner CPUE data based on private skipper’s 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:

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 2000-2006. 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.
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 and Pennington, WD6 2007). 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).

6.2.4 Data analyses

No analytical assessments were possible due to lack of age-structured data and/ or tuning series.

The only source of information on abundance trends was the CPUE series from the Norwegian longliners presented by Helle and Pennington (WD6, 2007). The number of longliners has declined in recent years (Table 6.2.1), from 72 to 35 in the period 2000-2006. In 2006 the number of fishing days with ling catch declined compared to 2005 (Table 6.2.2). The number of hooks set per day remained rather stable in Subareas I and II (Table 6.2.3) while the total number of hooks set per year has declined considerably (Table 6.2.4).

Table 6.2.5 gives estimates of CPUE based on the Norwegian official logbooks and the reference vessels. In Figure 6.2.1 the data for 2000-2006 are shown together with the data for the period 1971-1994 (considered earlier by WGDEEP and presented in Bergstad and Hareide, 1996). There is a gap in the time series between 1995 and 2000, and due to data limitations it was not possible to estimate CPUE for all years in the early period.

The CPUE varied strongly, but generally declined in the 1970s and 1980s, and the level appears to have remained comparatively low from the early 1990s into the 2000-2006 period. There is an apparent increase in period 2002-2005 with a sharp decrease in 2006, but estimates from 2006 must be interpreted with caution since they are based on few logbooks.

Table 6.2.0a. 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

*Preliminary

Table 6.2.0b. Ling IIa. WG estimates of landings.

Year	Faroes	France	Germany	Norway	E & W	Scotland	Russia	**Total**
1988	3	29	10	6,070	4	3		**6,119**
1989	2	19	11	7,326	10	-		**7,368**
1990	14	20	17	7,549	25	3		**7,628**
1991	17	12	5	7,755	4	+		**7,793**
1992	3	9	6	6,495	8	+		**6,521**
1993	-	9	13	7,032	39	-		**7,093**
1994	101	n/a	9	6,169	30	-		**6,309**
1995	14	6	8	5,921	3	2		**5,954**
1996	0	2	17	6,059	2	3		**6,083**
1997	0	15	7	5,343	6	2		**5,373**
1998		13	6	9,049	3	1		**9,072**
1999		11	7	7,557	2	4		**7,581**
2000		9	39	5,836	5	2		**5,891**
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		3	6114		1	5	**6138**
2005	6	5	6	6085	2		2	**6106**
2006*	9	8	6	8680	6	1	11	**8721**

*Preliminary

Table 6.2.0c. Ling IIb. WG estimates of landings.

Year	Norway	E & W	**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		**100**
2006*	67		67

*Preliminary

Table 6.2.0d. Ling I & II. Total landings by sub-areas 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	100	6313
2006*	58	8720	67	8845

*Preliminary

Table 6.2.1 Summary statistics for the Norwegian long liner fleet during the period 1995-2006 (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 long liners
1995	65
1996	66
1997	65
1998	67
1999	71
2000	72
2001	65
2002	58
2003	52
2004	43
2005	39
2006	35

Table 6.2.2 Estimated number of days that the Norwegian long liner fleet (selected using criteria described in the text) operated in Subareas I and II in the period 2000-2006.

All species	2000	2001	2002	2003	2004	2005	2006
I	6	5	10	13	22	22	3
IIa	42	68	70	63	68	76	68
IIb	2	8	2	2	10	13	4

Table 6.2.3. Estimated number of hooks that the Norwegian long liners 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	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
I	32953	193	31974	153	35340	293	35172	383	32440	433	32732	354	33345	29
IIa	31512	1438	30719	2234	33459	2023	34712	1815	33404	1358	32997	1211	34556	608
IIb	36354	65	34779	280	34756	45	34776	67	31299	199	35101	209	39083	36

Table 6.2. 4. Estimated total number of hooks (in thousands) the Norwegian long liner fleet used in Subareas I and II for the years 2000-2005 in the fishery for tusk, ling and blue ling.

All	2000	2001	2002	2003	2004	2005	2006
I	13468	9636	20709	24155	30200	28244	3761
IIa	95960	135173	135375	112970	97530	97401	81706
IIb	5004	19181	3128	4178	13391	17882	5472

Table 6.2.5. Estimated mean CPUE ([kg/hook]x1000) in IIa based on log book data. standard error (se) and number of catches sampled (n) is also given.

All vessels submitting logbooks

	2000			2001			2002			2003			2004			2005			2006		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
IIA	26,2	727	1	22	1308	0,6	24,2	1346	0,5	29,0	924	0,7	37,3	630	1,4	50,1	770	1,5	35,73	406	1,94

Reference vessels:

Ling	2001			2002			2003			2004			2005			2006		
Area	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	47,12	183	2,46	54,4	275	2,4	54,94	366	2,33

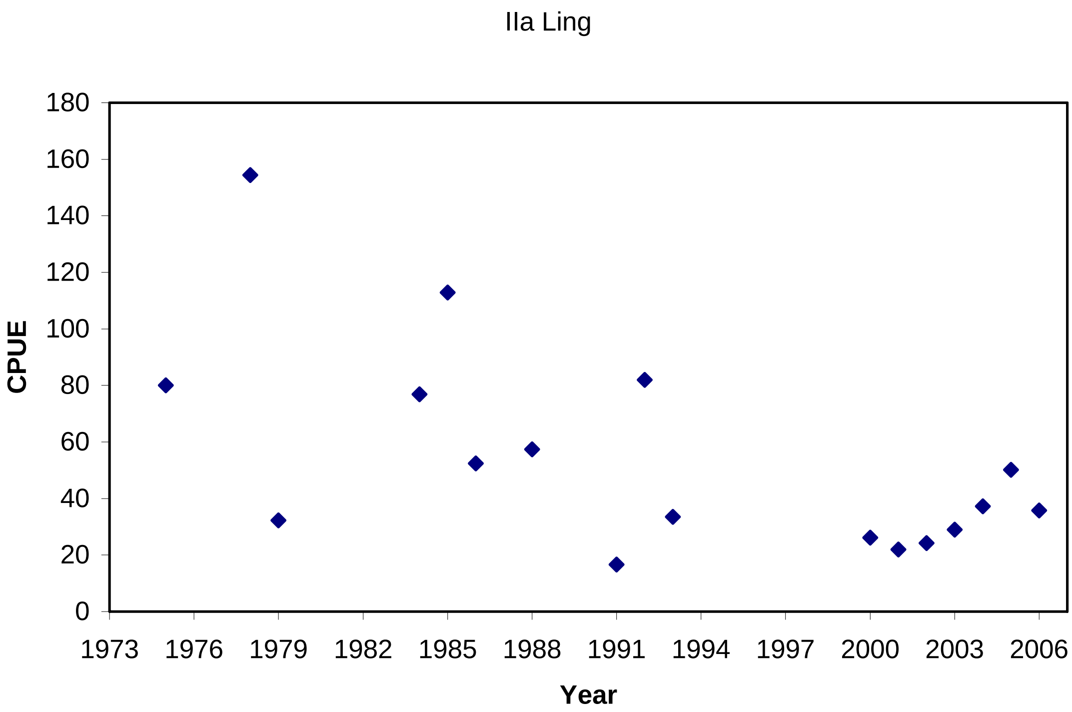


Figure 6.2.1 Ling in IIa. Estimates of CPUE (kg/1000 hooks) based on skipper's logbooks (pre-2000) and official logbooks (post 2000). Combination of data from Bergstad and Hareide (1996) and WD6 by Helle and Pennington (2007).

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

6.3.1 The fishery

Tusk has been fished, primarily as a by-catch in ling and cod fisheries, in this area for centuries, and the historical development was described by e.g. Bergstad and Hareide (1996), including the post-world war II increase due to 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 by-catches by other gears, i.e., trawls and handline. 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 by-catch in trawl and long line fisheries.

Russian landings (74 tonnes) from Sub-Divisions IIa and IIb in 2006 were mainly taken as by-catch in long-line fisheries. In Subarea I, 4 t was taken.

6.3.1.1 Landings trends

Landing statistics by nation in the period 1988-2006 are given in Table 6.3.0a-d. Compared with the pre-2000 landings level, recent landings were about halved. The preliminary landings for 2006 are 10 038 tonnes which is an increase compared to previous years.

6.3.1.2 ICES advice

The advice statement from 2004 was: *Effort should be reduced by 30% compared to the 1998 effort.*

6.3.1.3 Management

There is no species-specific management of the tusk fishery in Subarea I and II, but the exploitation is influenced by regulations aimed at other groundfish species, e.g. cod and haddock (Ref. Ch 4). There is no minimum landing size in the Norwegian EEZ.

EU TACs (Valid after 2003 for community vessels fishing in community waters and waters not under the sovereignty or jurisdiction of third countries): 35 t (Includes also XIV)

6.3.2 Stock identity

In the 1998 report it was noted that ripening adult tusk and tusk eggs have been found in all parts of the distribution area, but the banks to the west and north of Scotland, around the Faroes and off Iceland, as well as the shelf edge along mid and north Norway seem to be the most important spawning areas (Magnússon *et al.* 1997). Nothing is known about migrations within the area of distribution. Studies of enzyme and haemoglobin frequencies showed no geographical structure, hence it was concluded that tusk in all areas, at least of the North-east Atlantic, belong to the same gene pool (Bergstad and Hareide, 1996).

In 2004 the Group concluded that widely separated fishing grounds may support separate management units, i.e., stocks. It was suggested that Iceland (Va) and the Norwegian coast (I and II) have self-contained units, while the separation among possibly several stocks to the north and west of the British Isles remained unclear.

Tusk is one of the species included in a Norwegian population structure study using molecular genetics (microsatellite DNA). New data presented at the meeting (Section 4) appeared to document geographical heterogeneity within the ICES area. However, samples from within Subareas I and II (Storegga and Tromsøflaket) were very similar; strengthening the perception that tusk from different parts of these subareas may be regarded as belonging to the same stock.

6.3.3 Data available

6.3.3.1 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.

6.3.3.2 Length compositions

Length compositions/mean lengths from 1988 to present based on data from the Norwegian longliners were presented in Bergstad and Hareide (1996) and Helle and Pennington (WD6, 2007). In this period, when the tusk has been fully or heavily exploited, the mean length has varied around 50cm without any clear trend.

6.3.3.3 Age compositions

No new age compositions were available.

6.3.3.4 Weight at age

No new data were presented.

6.3.3.5 Maturity and natural mortality

No new data were presented.

6.3.3.6 Catch, effort and research vessel data

Catch and effort data for Norwegian longliners were presented. No research vessel data were available.

The extensive Norwegian longliner CPUE data based on private skipper's 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:

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 2000-2006. 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.

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 and Pennington, WD 2004). 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).

6.3.4 Data analyses

No analytical assessments were possible due to lack of age-structured data and/or tuning series.

The only source of information on abundance trends was the CPUE series from the Norwegian longliners presented by Helle and Pennington (WD6, 2007). The number of longliners has declined in recent years (Table 6.3.1.), from 72 to 35 in the period 2000-2006. Compared with the previous years the number of fishing days decreased in 2006 (Table 6.3.2). The number of hooks set per day and the total set per year has remained rather stable in Subareas I and II (Table 6.3.3 and6.3.4).

Table 6.3.5 gives estimates of CPUE based on the Norwegian official logbooks and the reference vessels. In Figure 6.3.1. the data for 2000-2006 are shown together with the data for the period 1971-1994 (considered earlier by WGDEEP and presented in Bergstad and Hareide, 1996). There is a gap in the time series between 1995 and 2000, and due to data limitations it was not possible to estimate CPUE for all years in the early period.

The CPUE varied strongly, but generally declined in the 1970s and 1980s, and the level appears to have remained at a low level from the early 1990s into the 2000-2006 period. There was an increase in 2005 with a following decrease in 2006, but the 2006 data must be interpreted with caution since it is based on few logbooks.

Table 6.3.0a. 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**

*Preliminary

Table 6.3.0b. Tusk IIa. WG estimates of landings

Year	Faroes	France	Germany	Greenland	Norway	E & W	Scotland	Russia	Ireland	**Total**
1988	115	32	13	-	14,241	2	-			**14,403**
1989	75	55	10	-	19,206	4	-			**19,350**
1990	153	63	13	-	18,387	12	+			**18,628**
1991	38	32	6	-	18,227	3	+			**18,306**
1992	33	21	2	-	15,908	10	-			**15,974**
1993	-	23	2	11	17,545	3	+			**17,584**
1994	281	14	2	-	12,266	3	-			**12,566**
1995	77	16	3	20	11,271	1				**11,388**
1996	0	12	5		12,029	1				**12,047**
1997	1	21	1		8,642	2	+			**8,667**
1998		9	1		14,463	1	1	-		**14,475**
1999		7	+		16,213		2	28		**16,250**
2000		8	1		13,120	3	2	58		**13,192**
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			9296	1		51	11	**9401**

*Preliminary

Table 6.3.0c. Tusk IIb. WG estimates of landings

Year	Norway	E & W	Russia	**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**

Table 6.3.0d. Tusk I & II. WG estimates of total landings by Sub-areas 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	9401	191	**10038**

*Preliminary

Table 6.3.1. Summary statistics for the Norwegian long liner fleet during the period 1995-2006 (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 long liners
1995	65
1996	66
1997	65
1998	67
1999	71
2000	72
2001	65
2002	58
2003	52
2004	43
2005	39
2006	35

Table 6.3.2. Estimated number of days that the Norwegian long liner fleet (selected using criteria described in the text) operated in Subareas I and II and caught tusk in the period 2000-2006.

Tusk	2000	2001	2002	2003	2004	2005	2006
I	3	1	4	5	6	5	2
IIa	34	58	62	50	53	65	59
IIb	1				0	1	

Table 6.3.3. Estimated number of hooks that the Norwegian long liners 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	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
I	32953	193	31974	153	35340	293	35172	383	32440	433	32732	354	33345	29
IIa	31512	1438	30719	2234	33459	2023	34712	1815	33404	1358	32997	1211	34556	608
IIb	36354	65	34779	280	34756	45	34776	67	31299	199	35101	209	39083	36

Table 6.3.4. Estimated total number of hooks (in thousands) the Norwegian long liner fleet used in Subareas I and II for the years 2000-2006 in the fishery for tusk, ling and blue ling.

All	2000	2001	2002	2003	2004	2005	2006
I	13468	9636	20709	24155	30200	28244	3761
IIa	95960	135173	135375	112970	97530	97401	81706
IIb	5004	19181	3128	4178	13391	17882	5472

Table 6.3.5. Estimated mean CPUE ([kg/hook]x1000) of tusk in Subarea I and II based on log book data. Standard error (se) and number of catches sampled (n) is also given.

All vessels submitting logbooks:

	2000			2001			2002			2003			2004			2005			2006		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
I	8,7	101	3,2	22,6	43	4,5	4,2	116	1,9	11,9	141	1,6	3,8	120	3,4	3,5	73	5,1	8,55	15	15,8
IIA	62	1172	0,9	53,2	1903	0,6	47,14	1806	0,5	40,3	1453	0,5	36,7	1065	1,1	50	1046	1,4	46,6	528	2,66
IIB	48,7	17	8	2,5	1	29,4				5,3	5	8,6	2,2	20	8,4	2,7	12	12,7	22,29	4	30,5

Reference vessels:

Tusk	2001			2002			2003			2004			2005			2006		
Area	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
IIA	22,1	46	3,6	41,4	208	2,89	35,13	296	1,66	32,57	431	1,58	63,38	349	2,09	61,79	498	2,43
IIB										8,74	2	23,26	0,55	4	19,42	4,69	45	8,08

Figure 6.3.1. 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 WD6 by Helle and Pennington (2007). Note interruption in time series in the period 1993-2000.

7 Stocks and fisheries of the Faroes

7.1 Fisheries overview

See last years report

7.1.1 Trends in fisheries

Updated landings in Division Vb are given in Table 7.1.1 and Figure 7.1.1. See last years report for more details.

7.1.2 Technical interaction

See last years report.

7.1.3 Ecosystem considerations

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 in primary production in the ecosystem (Gaard *et al*. 2001). Since 2002, the primary production has been at or below average. Preliminary information indicates that the 2007 primary production may be above average. For more details, see last years report.

7.1.4 Management measures

See last years report.

Table 7.1.1. Estimated landings (tonnes) of deep-water species in ICES Division Vb.

Vb	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	ALFONSINOS (Beryx spp.)			5		4			1											
	ARGENTINES (Argentina silus)	287	227	2888	60	1443	1063	960	12286	9498	8433	17570	8214	5204	10081	7471	6552	6451	7009	12559
	BLUE LING (Molva dypterigia)	9526	5264	4799	2962	4702	2836	1644	2440	1602	2798	2584	2932	2524	2119	2020	3815	2699	2454	2834
	BLACK SCABBARDFISH (Aphanopus carbo)		166	419	152	33	287	160	424	186	68	180	172	311	795	1751	1633	862	502	784
	BLUEMOUTH (Helicolenus dactylopterus)												58	16				3		
	DEEP WATER CARDINAL FISH (Epigonus telescopus)												8	2	7			1		
	GREATER FORKBEARD (Phycis blennoides)	2	1	38	53	49	27	4	9	7	7	8	34	32	100	148	73	48	45	
	LING (Molva molva)	4488	4652	3857	4512	3614	2856	3622	4070	4896	5657	5359	5238	3785	4588	4138	4893	5967	5744	5046
	MORIDAE				5								1		100	19	8	1	1	5
	ORANGE ROUGHY (Hoplostethus atlanticus)			22	48	13	37	170	420	79	18	3	5	155	5	1	5	7	13	
	RABBITFISHES (Chimaerids)								1				3	54	84	64	61	96	57	62
	ROUGHHEAD GRENADIER (Macrourus berglax)											9	58	1	4	3	15	9	6	8
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	1	258	1549	2311	3817	1681	668	1223	1078	1112	1667	1996	1791	2016	1025	1532	1579	2336	2215
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)																			
	SHARKS, VARIOUS			140	78	164	478	192	262	380	308	433	470	409	543					
	SILVER SCABBARDFISH (Lepidopus caudatus)																			
	SMOOTHHEADS (Alepocephalidae)																	6	1	
	TUSK (Brosme brosme)	5665	5122	6181	6266	5391	3439	4316	3978	3310	3319	2710	3964	2700	3993	3003	3292	3643	3544	3776
	WRECKFISH (Polyprion americanus)																			

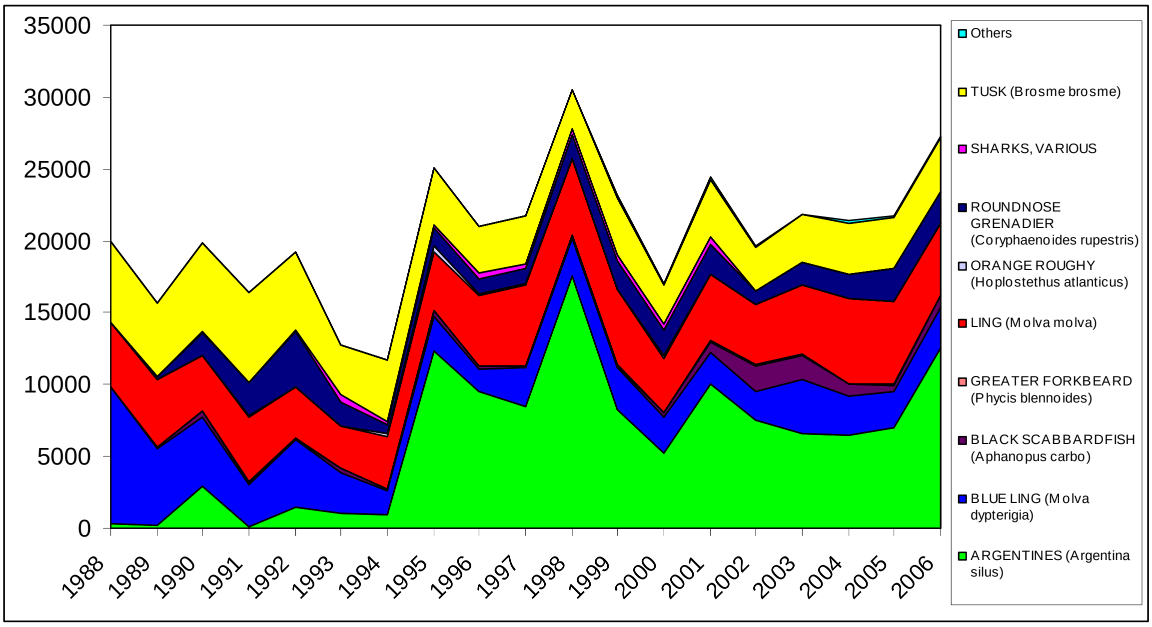


Figure 7.1.1. Deep-sea landings in Division Vb.

7.2 Ling (*Molva Molva*) in Division Vb

7.2.1 The fishery

7.2.1.1 Landings trends

Landing statistics for ling by nation in the period 1988-2006 are given in Tables 7.2.1a-7.2.1c. Landings in Division Vb have varied between about 4 000 and 6 000 tonnes since 1980, except for low landings in 1993 (about 3000 tonnes) (Figure 7.2.1). The preliminary landings of ling in 2006 are 5 000 tonnes, of which Norwegian longliners took about 1 000 tonnes and the Faroese fleets 4 000t. Other nations account for 154 tonnes.

The 2006 Faroese landings by fleet were:

Longliners <110GRT	Longliners >110GRT	OB trawlers <1000HP	OB trawlers >1000HP	Pairtrawlers <1000HP	Pairtrawlers >1000HP	Others
7%	63%	1%	10%	4%	14%	1%

7.2.1.2 ICES advice

ACFM spring 2006: For Division Vb, effort should not be allowed to increase compared with the present level.

7.2.1.3 Management

For the Faroese fleets, there is no species-specific management of ling in Vb, only minimum landing size (60 cm); other nations are regulated by TAC’s. Details on management measures in Faroese waters were given in last years report and in the 2006 ACFM overview.

7.2.2 Stock identity

No new information on stock separation was available. Relevant data were presented and discussed in reports of previous Norwegian and Nordic projects and summarised in the 1998 report of the study group (ICES C.M. 1998/ACFM:12). 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 previously that ling in Division Vb could be considered as one unit, but this remains uncertain. Ling from Faroese waters is included in an ongoing Norwegian population structure study using molecular genetics, and new data may thus be expected in the future.

7.2.3 Data available

There are data on length, weights and age available for ling from the Faroese landings; Table 7.2.2 gives an overview of the levels of sampling. There are also catch and effort data from logbooks for the Faroese longliners and pair trawlers, and from the two annual Faroese groundfish surveys are biological data (length, weight, sex) as well as catch and effort data available(WD1 by Ofstad, 2007). There are also data available on catch, effort and mean length from Norwegian longliners fishing in Faroese waters (WD6 by Helle & Pennington, 2007) and length distributions 2003-2005 for the reference fleet (see last years report).

7.2.3.1 Landings and discards

Landings were available for all relevant fleets. No estimates of discards of ling are available. However, since no quotas are used in the management of the Faroese fishery the incentive to discard in order to high grade the catches should be low. Moreover there is a ban on discarding in Vb. The landings statistics are therefore regarded as being adequate for assessment purposes. It should be kept in mind that there are a minimum landing size for this stock, and this may create an incentive to discard or underreport. Also it should be noted that since other fleets, especially the Norwegian longliners are regulated by TAC's, discarding may be occurring. This may however not be a major problem since TAC's have not been taken in recent years.

7.2.3.2 Length compositions

Length distributions are available for Faroese commercial landings (Figures 7.2.2 – 7.2.3) and two Faroese groundfish surveys in Division Vb. There are also length distributions from the Norwegian longliners "reference fleet" for the period 2003-2005 (see last years report). 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. The trawlers have a slightly greater length distribution. In a WD to this meeting by Helle and Pennington estimates of mean lengths were presented for 2003-2006 and compared to older longline data. The mean lengths varied slightly from year to year but with no obvious trends.

7.2.3.3 Age compositions

As stated above, age samples are available for selected Faroese fleets. No catch at age data are however provided here since the procedure of ageing and working up of relevant data at present are being made every second year; see last years report for data prior to 2007.

7.2.3.4 Weight at age

No such data are presented here (see above). For data prior to 2006, please consult last years report.

7.2.3.5 Maturity and natural mortality

No such data are presented here (see above). For data prior to 2006, please consult last years report.

7.2.3.6 Catch, effort and research vessel data

Commercial CPUE series. There are catch per unit effort (CPUE) data available for three different commercial series, for Faroese longliners, Faroese pair trawlers and Norwegian longliners , and these have been updated this year (see details in last years report). The Norwegian CPUE series show a small increasing trend in the last years whereas the two Faroese CPUE series have stabilised after an increase for some years (Figure 7.2.4-7.2.5).

Fisheries independent CPUE series. CPUE estimates (kg/hour) for ling are available from the two annual groundfish surveys in Faroese waters (see details in last years report). Both surveys show a decreasing trend in recent years (Figure 7.2.6).

7.2.4 Data analyses

As for the age based data, no analytical assessment exercise was attempted this year (see above).

The available information on abundance trends can be derived from the CPUE data (see above) and are given in Figures 7.2.4-7.2.6). The Norwegian commercial longline CPUE series extends back to the 1970s and indicates that the current level remains low compared with the level in the 1970s and 80s but is slowly increasing. The two Faroese commercial CPUE series have stabilised after an increase for some years. The two surveys indicate that the abundance in recent years may be higher than for some years ago but are now slowly decreasing.

Table 7.2.1a. Ling in Vb1. Nominal landings (1988-2006) (* preliminary data).

Year	Denmark	Faroes	France	Germany	Norway	E&W	Scotland	Russia	Total
1988	42	1,383	53	4	884	1	5	-	2,372
1989	-	1,498	44	2	1,415	-	3	-	2,962
1990	-	1,575	36	1	1,441	+	9	-	3,062
1991	-	1,828	37	2	1,594	-	4	-	3,465
1992	-	1,218	3	+	1,153	15	11	-	2,400
1993	-	1,242	5	1	921	62	11	-	2,242
1994	-	1,541	6	13	1,047	30	20	-	2,657
1995	-	2,789	4	13	446	2	32	-	3,286
1996	-	2672	-	-	1,284	12	28	-	3,996
1997	-	3224	7	-	1,428	34	40	-	4,733
1998	-	2,422	6	-	1,452	4	145	-	4,029
1999	-	2,446	22	3	2,034	0	71	-	4,576
2000	-	2,103	9	1	1,305	2	61	-	3,481
2001	-	2,069	17	3	1,496	5	99	-	3,689
2002	-	1,638	9	2	1,640	3	239	-	3,531
2003	-	2,139	17	2	1,526	3	215	-	3,902
2004	-	2,733	10	1	1,799	3	178	2	4,726
2005	-	2,886	10	-	1,553	3	70	-	4,522
2006*	3[2]	3,563	4	+	830	-	147[1]	-	4,397

Table 7.2.1b. Ling in Vb2. Nominal landings (1988-2006) (* preliminary data).

Year	Faroes	Norway	Total
1988	832	1,284	2,116
1989	362	1,328	1,690
1990	162	633	795
1991	492	555	1,047
1992	577	637	1,214
1993	282	332	614
1994	479	486	965
1995	281	503	784
1996	102	798	900
1997	526	398	924
1998	511	819	1,330
1999	164	498	662
2000	229	399	628
2001	420	497	917
2002	150	457	607
2003	624	927	1,551
2004	1,058	247	1,305
2005	575	647	1,222
2006	472	177	649

(1) Includes Vb_2.

(2) Greenland

Table 7.2.1c. Ling in Vb. Nominal landings (1988-2006) (* preliminary data).

Year	Vb1	Vb2	Vb
1988	2,372	2,116	4,488
1989	2,962	1,690	4,652
1990	3,062	795	3,857
1991	3,465	1,047	4,512
1992	2,400	1,214	3,614
1993	2,242	614	2,856
1994	2,657	965	3,622
1995	3,286	784	4,070
1996	3,996	900	4,896
1997	4,733	924	5,657
1998	4,029	1,330	5,359
1999	4,576	662	5,238
2000	3,386	628	4,109
2001	4,091	917	4,606
2002	3,681	607	4,138
2003	3,966	1,551	5,453
2004	5,720	1,305	6,031
2005	5,097	1,222	5,744
2006*	4,397	649	5,046

Table 7.2.2. Ling in Vb. Overview of the sampling of the commercial landings.

Year:	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Lengths	6399	7900	5912	4536	3512	3805	4299	6585	6827	7167	5807
Weights	410	541	538	360	360	420	180	360	1169	3217	4477
Ages	1081	1526	1081	480	360	420	300	661	659	540	276

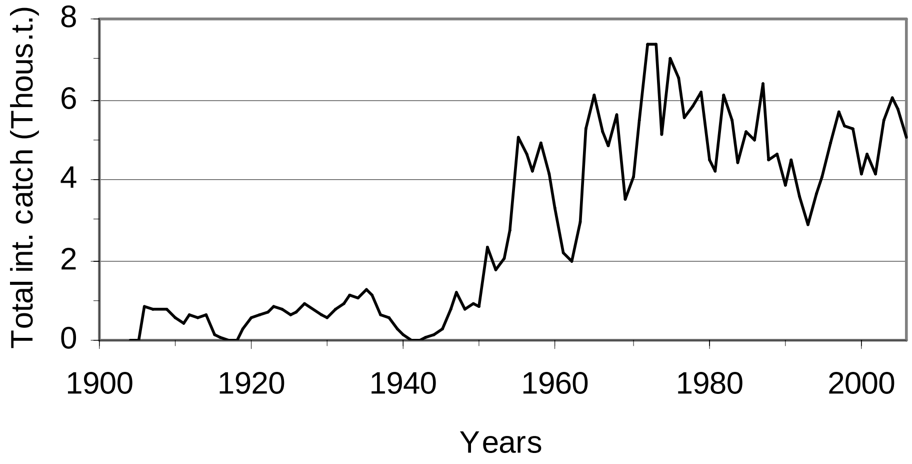


Figure 7.2.1. Ling in Vb. Nominal landings (thousand tonnes) 1904-2007.

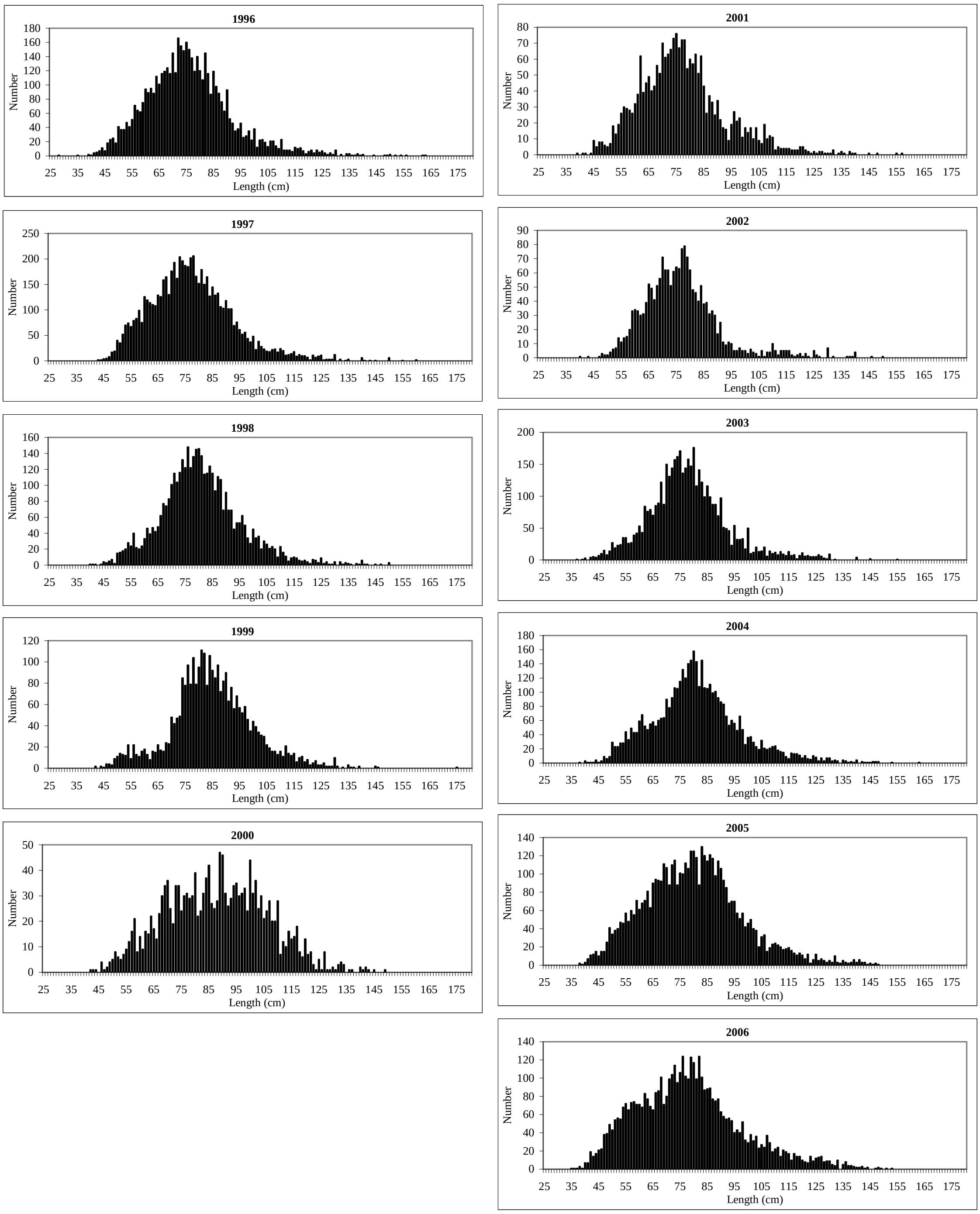


Figure 7.2.2. Ling in Vb. Length distribution in the landings from Faroese longliners >110GRT.

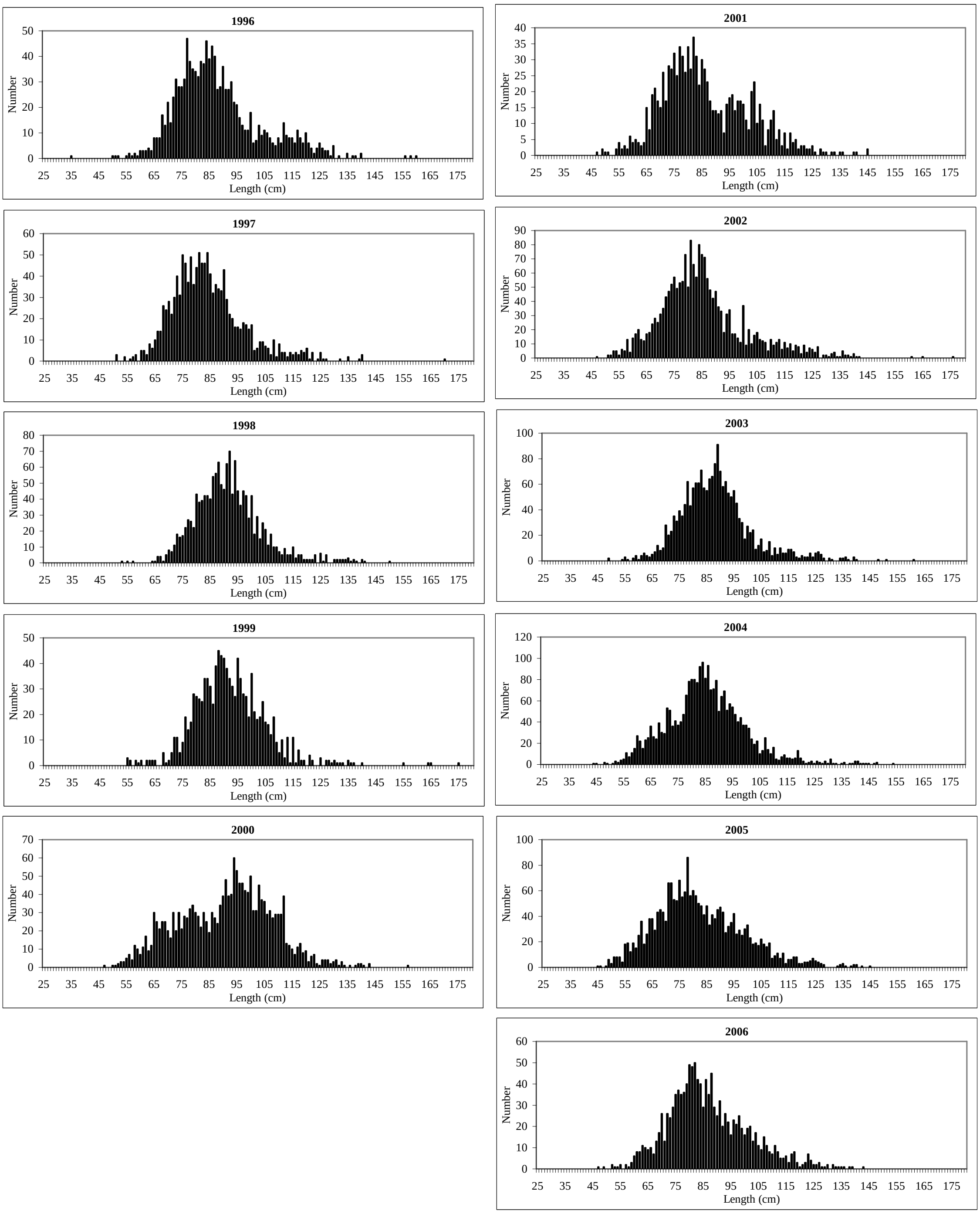


Figure 7.2.3. Ling in Vb. Length distribution in the landings from Faroese pair trawlers > 700 HK.

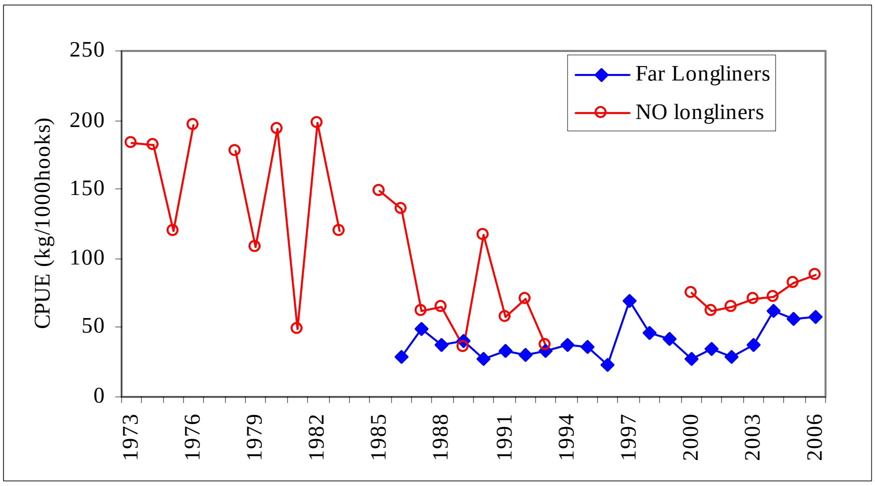


Figure 7.2.4. Ling in Vb. CPUE (kg/1000 hooks) from Faroese longliners >110 GRT and Norwegian longliners (NO).

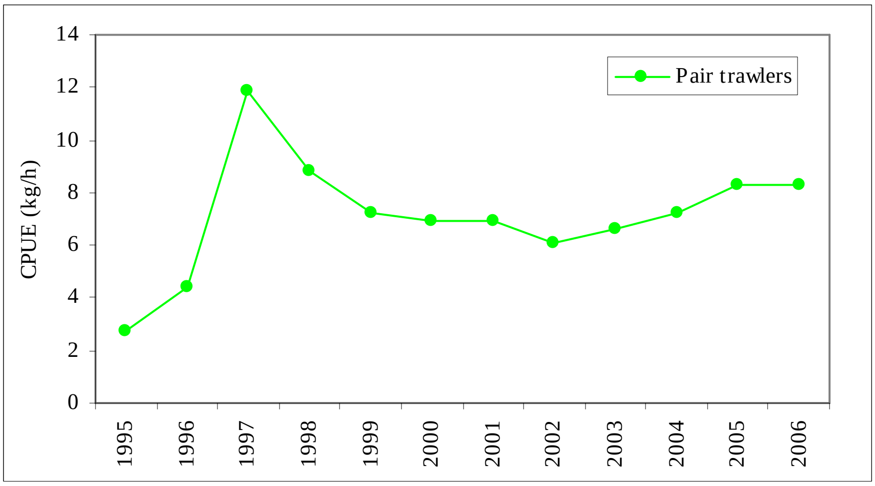


Figure 7.2.5. Ling in Vb. CPUE (kg/h) from commercial Faroese pair trawlers >700 HP.

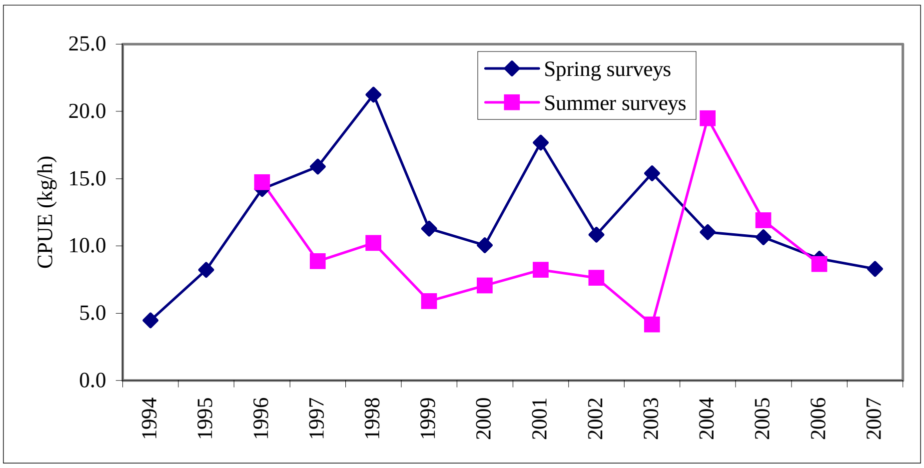


Figure 7.2.6. Ling in Vb. CPUE (kg/h) in the two annual Faroese groundfish surveys.

8 Stocks and fisheries of the Celtic Seas

8.1 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 deepwater fishery mainly targeting roundnose grenadier, black scabbardfish and siki sharks on the continental slope and offshore banks of sub-area VI and VII. The Irish deepwater 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 sub-area VIa and on the Rockall Bank. This fishery 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 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 area (ICES XIIb & 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 800-1600m, mainly at depths >1000m or deeper. Roundnose grenadier and Baird’s smoothhead are the most important species in the catches.

A fleet UK registered gill-netters have, until recently, operated in areas VI and VII targeting hake, monkfish and deep-water sharks. In 2006, the EC introduced a temporary ban on deep-water gillnetting at depths greater than 200m as an emergency measure under the CFP. NEAFC has also banned deep-water gill-netting in international waters until management measures can be put in place.

UK registered longliners target hake with a bycatch of ling and blue ling. These vessels have also, on occasions, targeted siki sharks in deeper water.

8.1.1 Trends in fisheries

No update available (see WGDEEP06).

8.1.2 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. Vessels can move rapidly between fisheries and often target both deepwater and shelf species in the course of a single trip. None of the Scottish vessels fishing deepwater stock is dedicated to deepwater 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. Due to quota restrictions, only two vessels now fish in the targeted deep-water fishery, however, the Scottish bottom trawl fishery targeting monkfish and Megrim extends to depths of 800m or more and has a bycatch deepwater species.

Although considered as deep-water species by this WG, the depth range of ling and tusk in sub-areas VI and VII extends into relatively shallow water 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. His particularly applies to bluemouth which is discarded in very large quantities by vessels fishing on the continental shelf in are VIa and on the Rockall Bank.

UK registered gill-netters prosecute three distinct fisheries characterized by different gear configuration, mesh size and depth range. These fisheries respectively target hake, monkfish and deep-water sharks and vessels specialize in a particular fishery rather than moving between them.

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.

8.1.3 Ecosystem considerations

No update available (see WGDEEP06).

8.1.4 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 seabream (*Pagellus bogaraveo*), Roundnose grenadier (*Coryphaenoides rupestris*) and Tusk (*Brosme brosme*) have been subject to 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 gill nets by Community vessels at depths greater than 200m in ICES Divisions VIa, b and VII b, c, j, k. This was intended as an emergency measure with a duration of one year and the regulation will be reviewed within 2006.

8.2 Blue Ling (*MOLVA DYPTERYGIA*) in Division Vb, Subareas VI a VII

8.2.1 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 Sub-area VII are very small and are by-catches 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 by-catch in French trawl fisheries for roundnose grenadier, black scabbardfish and deep-water sharks.

8.2.1.1 Landings trends

The total landings from Division Vb fluctuated between 5,000 and 10,000 t during the 1980s, but since 1992 have been stable at around 2-3000 t .

The landings from Sub-area VI peaked at about 13,000 t in 1985, then declined to 4,000 t in 1994 before increasing to 9,000 t in 1999 and then declining to around 3000 t in recent years. French trawlers have consistently accounted for a large proportion of total international landings (77% in 2005).

8.2.1.2 ICES advice

The latest advice is from ICES ACFM in October 2006 is:

"Trends in abundance from all areas indicate declines of varying gravity. In Iceland the decline appears to have halted, west of the British Isles it is stable but at a very depleted level, while it appears seriously depleted in Subdivisions I and II. In all areas the species is at a low level of abundance relative to when the fisheries commenced.

In most cases advice is given to stop directed fishing. Where blue ling is taken as a bycatch, seasonal closed areas can be an effective means of reducing exploitation."

8.2.1.3 Management

In 2006 there was an EC TAC for EU vessels fishing for blue ling in EU and international waters in VI and VII of 3137 t and in II, IV and V of 119 t per annum

The TAC in VI and VII in 2006 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) (see below).

EU TAC area	EU TAC in 2006 (t)	EU landings in 2006 (t)
VI and VII	3137	2284
II, IV and V	119	840 (Vb only)

EU TACs for these stocks are set on a bi-annual basis. TAC for sub-areas II, IV and V has been set at 95t in 2007 and 78t in 2008 and in VI and VII, 2510t for 2007 and 2009t for 2008. In sub-areas VI and VII, EU vessels that landed more than 30t in 2005 must give prior notification of landing and may not land more than 25 tonnes of Blue ling at the end of any fishing trip. Quotas for other countries are for bycatch only.

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

8.2.2 Stock identity

WGDEEP 2007 reviewed existing knowledge and assessed new information on stock identity in blue ling. The results are presented in section 4.3.4 of this report.

The WG considered that available information is inadequate to evaluate the stock structure of blue ling in the NE Atlantic. It is suggested that the current practise of separating blue ling into a northern stock (Va and XIV) and a southern stock (Vb,VI,VII) is continued until information from microsatellite studies is available. The stock structure should then be reviewed.

8.2.3 Data availability

8.2.3.1 Landings and discards

Landings data are given in Tables 8.2.1 to 8.2.5. There is no information available on discards. Landings data were provided by France, Scotland 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 figures 8.2.1 and 8.2.2.

8.2.3.2 Length compositions

New data were supplied to the working group on mean lengths of blue ling from the Norwegian reference fleet in divisions Vb, Via, VIb and sub-area 12 (table 8.2.1). Details of sampling can be found in WGDEEP06 WD3.

Length composition of blue ling in Faroese trawlers in division Vb are presented in figure 8.2.5. Further details can be found in WGDEEP07 WD1

Length distribution of Blue ling in spanish observer samples in Hatton Bank trawl fishery are presented in Figure 8.2.6.

8.2.3.3 Age compositions

No new data were available but existing data are available for many ICES Sub-areas. These are not presented due to the difficulties in the ageing of this species.

8.2.3.4 Weight at age

No new weight at age were available. Existing data are not presented because of difficulty with ageing.

8.2.3.5 Maturity and natural mortality

no new data on maturity were available.

8.2.3.6 Catch, effort and RV data

Catch, effort and CPUE data from Faroese trawl surveys are shown in Table 8.2.8 and Figure 8.2.3. There appears to have been an increase in CPUE of blue ling in the summer survey in 2004 and 2005 however this trend was not continued in 2006. The CPUE trend from both surveys should be treated with caution because blue ling is usually taken in low numbers because the surveys are targeted at cod, haddock and saithe.

CPUE data are also available from Faroese trawlers in Sub-area Vb (Figure 8.2.4), but these data must also be treated with caution because there has been shifts in species-directivity during the time period. For example, there was a shift away from saithe and redfish towards deep-water species between 1995 and 1999 and this is reflected by a large increase in CPUE for blue ling across these years.

In 2003 the Institute of Marine Research (IMR), in cooperation with the Norwegian Directorate of Fisheries (NDF), began recording in an electronic database the logbooks of long liners larger than 21 m. 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. To obtain more detailed and targeted information, the IMR initiated in 2000 a program to collect data and biological samples directly from selected commercial long-liners, the so-called **"**reference fleet**.**" The fishers measure a subsample of fish at selected locations. Upon request they may also collect otoliths, stomachs, tissue for genetics, and other biological samples. Presently four long-liners are members of the reference fleet. Tables 8.2.6 contains estimates of the catch-per-unit of effort (CPUE) based on the logbook data and data from the reference fleet. The measure of CPUE is the average weight (kg) of fish caught per 1000 hooks per day.

8.2.4 Data analyses

No New data analysis was undertaken by WGDEEP in 2007

Table 8.2.1 Working group estimates of landings of Blue ling from Division Vb1.

Blue ling Vb1

Year	Faroes	France(3)	Germany(2)	Norway	E & W(2)	Scotland (1)	Ireland	Russia	Total
1988	3487	3036	49	94					6666
1989	2468	1800	51	228					4547
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	1068	4	38	4				2844
2000	1677	575	1	163	33			1	2450
2001	1407	433	4	130	11		2		1987
2002	1003	574		274	8				1859
2003	2465	1133		12	1				3611
2004	751	1131		20				13	1915
2005	1028	781		15	1				1825
2006*	1276	839		21	1			16	2153

*Preliminary. (1) Included in Vb2. (2) Includes Vb2 (3) Reported as Vb.

Table 8.2.2 Working group estimates of landings of Blue ling from Division Vb2.

Blue ling Vb2

Year	Faroes	Norway	Scotland (1)	E & W	Total
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	6		629
2006*	647	34			681

*Preliminary. (1) Includes Vb1.

Table 8.2.3 Working group estimates of landings of Blue ling from Division VIa.

Blue ling VIa

Year	Faroes	France	Germany	Ireland	Norway	Spain (1)	E & W	Scotland	Lithuania(1)	Total
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	3730		10	55	119	5	1105		5024
2000		4443	94	9	102	108	24	1300		6080
2001		2693	6	52	117	797	116	2136		5917
2002		2005		62	61	285	16	2027		4456
2003	7	2000		2	106	195	3	428		2741
2004	10	2259		1	24	24	1	482		2801
2005	17	2031		2	33	210		390	29	2683
2006*	8	1804		2	49	27	3			1893

*Preliminary. (1) Includes Vib

Table 8.2.4 Working group estimates of landings of Blue ling from Division VIb

Blue ling VIb

Year	Poland	Russia	Faroes	France	Germany	Norway	E & W	UK (Sco)	Iceland	Ireland	Estonia	Total
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	690		9	168	2411	610	4		4096
2000				508		184	500	966		7		2165
2001			238	202	1	256	337	1803		4	85	2926
2002		3	79	319		273	141	497		1		1313
2003	4	2		510		102	14	113			5	750
2004	1	5	4	486		2	10	96			3	607
2005		15	1	234		1	9	73				333
2006*			3	313		2	4					322

Table 8.2.5 Working group estimates of landings of Blue ling from Division VII

Blue ling VII

Year	France	Germany	Spain (1)	E & W	Scotland	Ireland	Norway	Totals
1988	21	1						22
1989	291						2	293
1990	223							223
1991	211				1			212
1992	397				6		3	406
1993	273			16	30		2	321
1994	298		4	9	26	1	1	339
1995	155		13	43	16	3		230
1996	189		21	57	97		1	365
1997	179	8	0	170	15	9	2	383
1998	252		22	283	30	10	1	598
1999	86	2	59	168	18	27	1	361
2000	85	2	65	31	17	75	5	280
2001	80	2	64	29	17	494	5	691
2002	38		42	76	55	272		483
2003	19	1	42	8	16	28		114
2004	20	1	15	4	1	17		58
2005	23		25	1	0	10		59
2006*	30		31	1	0	4		66

*Preliminary.

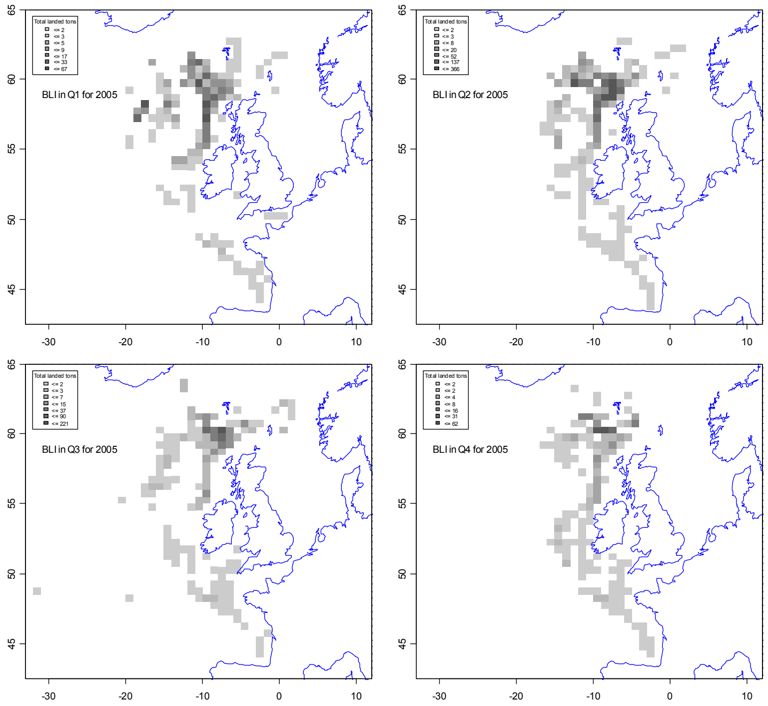


Figure 8.2.1. Combined French, Scottish and Irish landings of Blue Ling by statistical rectangle and quarter in 2005.

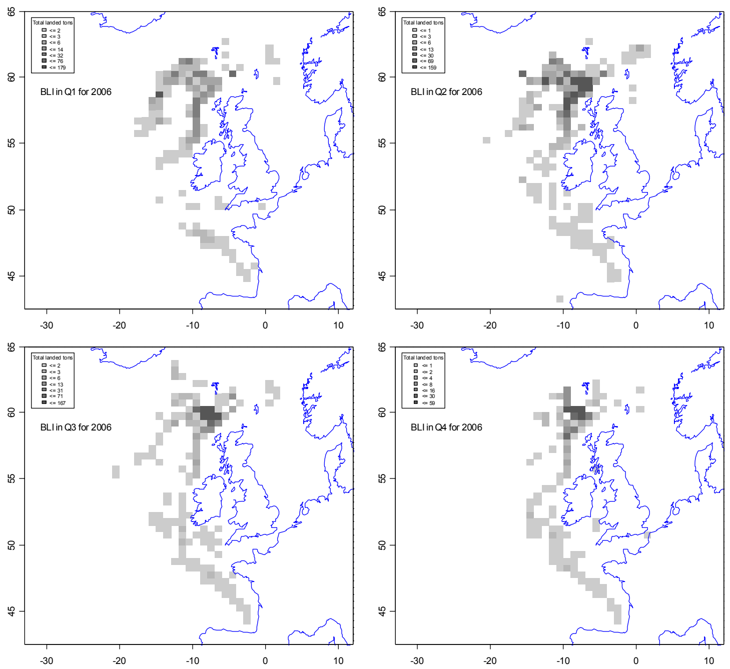


Figure 8.2.2 Combined French Scottish and Irish landings of Blue Ling by statistical rectangle and quarter in, 2006

Table 8.2.6. Estimated mean CPUE ([kg/hook]x1000) based on log book data along with its standard error (*se*) and number of catches sampled for blue ling.

Blue ling

	2000			2001			2002			2003			2004			2005			2006		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
VB	8,1	44	2,4	12,7	71	4,4	6,4	65	0,6	27,2	63	2,3	8,6	70	1,7	10,4	20	2,3	21,98	52	2,36
VIA	8,3	103	1,6	4,6	130	3,2	8,9	46	0,7	7,5	123	1,7	7,2	110	1,3	7,6	162	0,8	13,01	91	1,78
VIB	61,3	8	5,7	16	10	11,7	2,6	13	1,3	113,1	12	5,4							1,93	6	6,95
XII	212,9	17	3,9	183,4	77	4,3				25,1	36	3,1									
XIVB							4,8	3	2,7				14,7	5	3,1						

Table 8.2.7 Unweighted estimates of the mean length of blue ling during 2003-2005, along with its standard error (se) and number of fish measured, . The method for estimating the average length is given in Helle et al., (2006).

Blue ling **ICES-area**		**2003**	**2004**	**2005**	**2006**
Vb	Mean		96,35	107,79	104,5
	se		1,32	3,81	5,2
	N		103	14	15
VIa	Mean	83,6			
	se	1,88			
	N	40			
VIb	Mean	91,26			
	se	0,16			
	N	5743			
XII	Mean	91,07			
	se	0,56			
	N	445			
All areas	Mean	91,18	87,434	87,48	81,33
	N	6290	576	86	184

Table. 8.2.8 Blue ling. Catch, effort and CPUE in the Faroese demersal surveys.

	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			

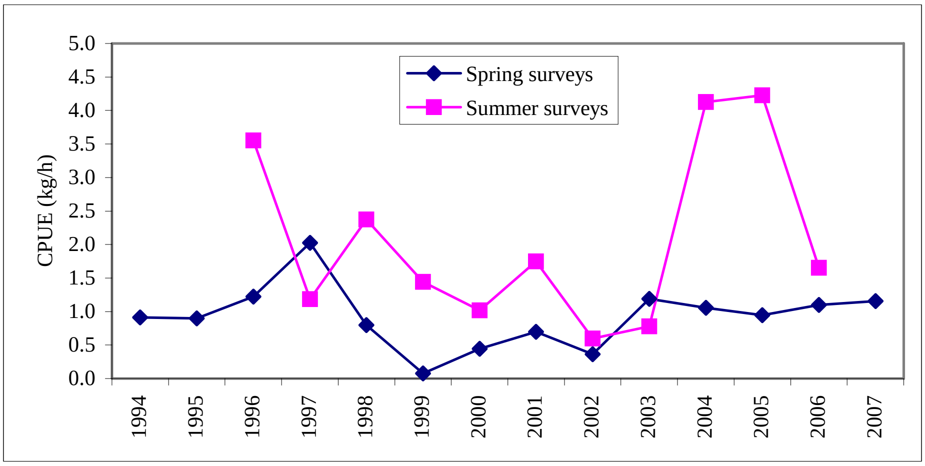


Figure.8.2.3 Blue ling. CPUE series from the spring and summer surveys.

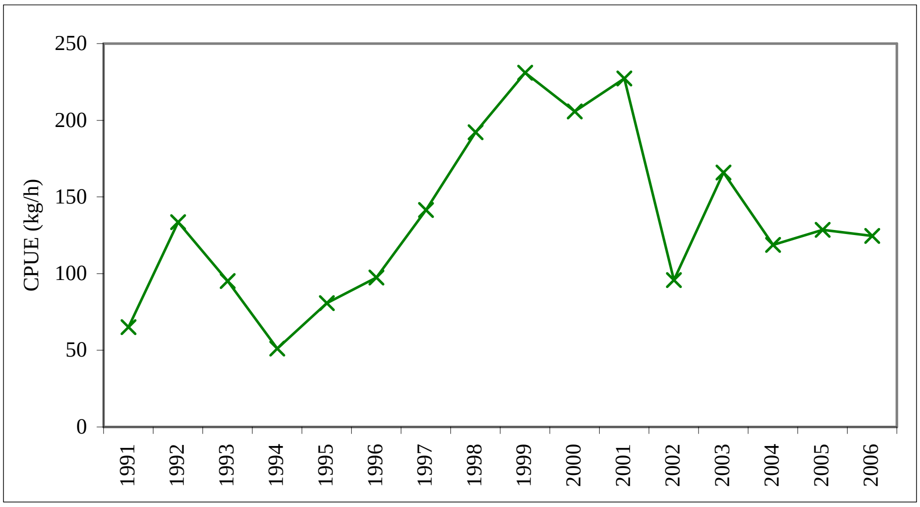


Figure 8.2.4. Blue ling in Vb (Faroes). CPUE from otterboard trawlers >1000 HP.

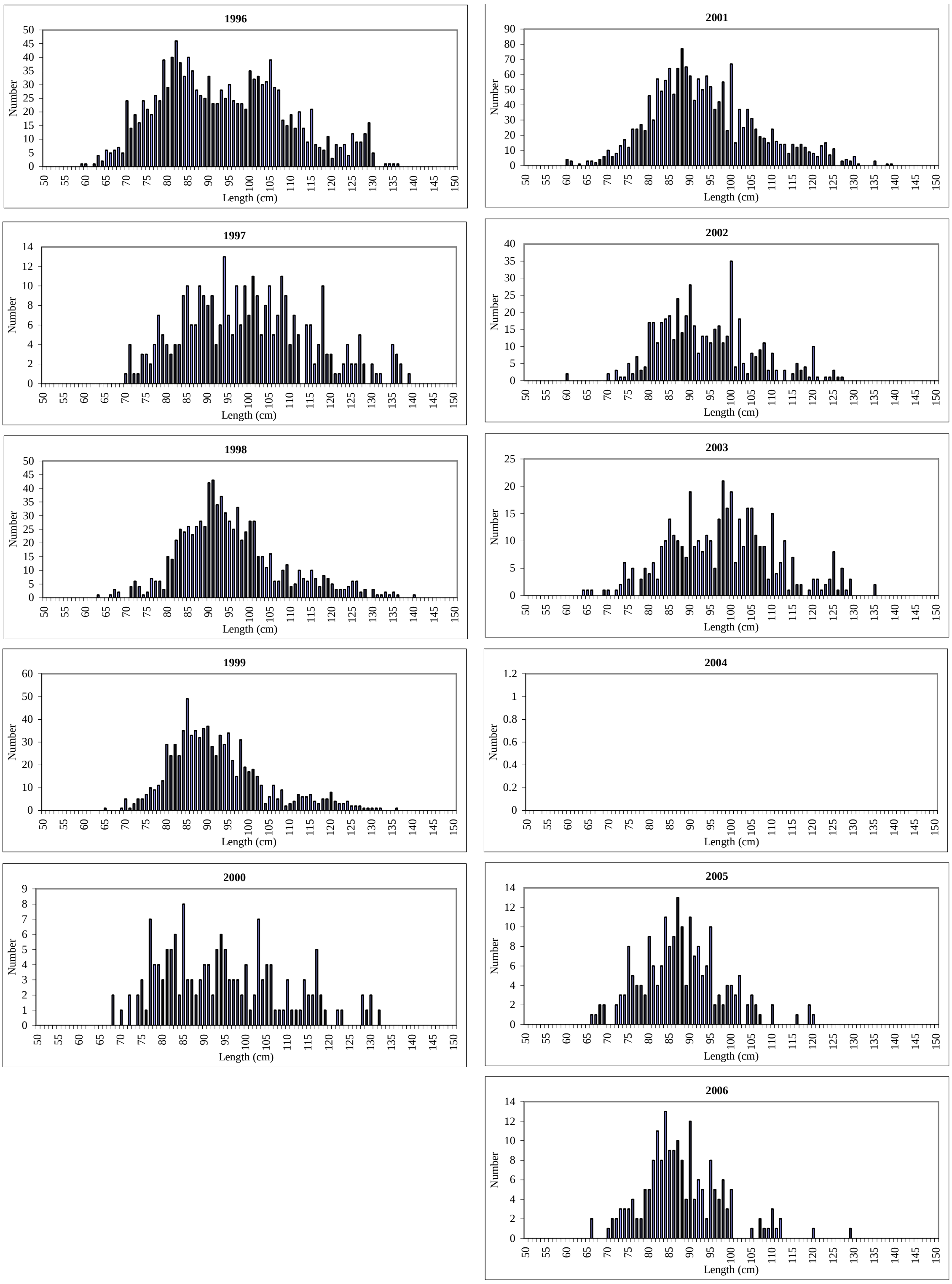


Figure.8.2.5 Blue ling in Vb (Faroes). Length distribution in the landings from otterboard trawlers >1000 HP.

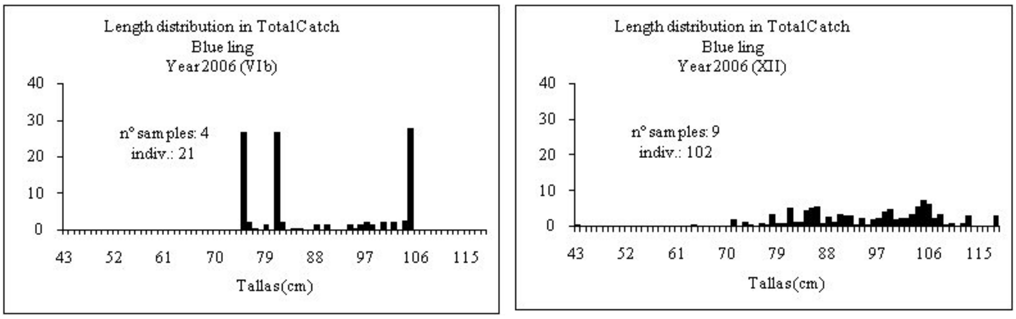


Figure 8.2.6 Length distribution of blue ling in Spanish observer samples from Hatton Bank. (P. Durán, *pers. com.*)

8.3 ORANGE ROUGHY (HOPLOSTETHUS ATLANTICUS) IN SUB-AREA VI

8.3.1 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.

8.3.1.1 Landings trends

Table 8.31 shows 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 3,500 t in 1991, and 5,300 t removed from the stock by the end of 1993. This stock is now severely depleted (Anon., 2000) and some of the landings from France and Ireland starting in 2001 have been from further south in this Sub-area 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 TAC's. Catches since 2003 are decreasing and are consistently below the TAC.

8.3.1.2 ICES advice

The advice statement from 2006 was:

"*Orange roughy can only sustain very low rates of exploitation. Currently, it is not possible to manage a sustainable fishery for this species. Hence, ICES recommends no fishery for this species. Bycatches in mixed fisheries should be limited as far as possible*".

8.3.1.3 Management

Landings in relation to TAC are shown in the table below. This table illustrates that in the last number of years the catches 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

In order to align the TAC with catches, the TAC for EC vessels in area VI has now been reduced to 51 tons for 2007 with a further reduction to 34 tons for 2008.

In addition to a TAC, a number of Orange Roughy protection areas have been introduced from which EU vessels have no permission to land or retain any catches of Orange Roughy. These areas are defined as the following sea areas:

(a) that sea area enclosed by rhumb lines sequentially joining the following positions:

57° 00′ N, 11° 00′ W,57° 00′ N, 8° 30′ W,56° 23′ N, 8° 30′ W,55° 00′ N, 9° 38′ W, 55° 00′ N, 11° 00′ W and 57° 00′ N, 11° 00′ W;

(b) that sea area enclosed by rhumb lines sequentially joining the following positions: 55° 30′ N, 15° 49′ W,

53° 30′ N, 14° 11′ W, 50° 30′ N, 14° 11′ W, 50° 30′ N, 15° 49′ W;

(c) that sea area enclosed by rhumb lines sequentially joining the following positions: 55° 00′ N, 13° 51′ W, 55° 00′ N, 10° 37′ W, 54° 15′ N, 10° 37′ W, 53° 30′ N, 11° 50′ W, 53° 30′ N, 13° 51′ W.

8.3.2 Stock identity

The fishing grounds so far discovered in the North Atlantic have appeared to support relatively small aggregations of fish, usually associated with seamounts and other topographical features. It would appear that the aggregations fished on the Hebrides Terrace Seamount constituted a separate stock. Further south, it seems likely that the separate aggregations are separate stock units too, though it is not clear. The probability of finding, in the northern Atlantic, stocks comparable in size to the stocks exploited in the south Pacific seems low. A genetics project is now underway, to study the genetic structure of orange roughy in the north Atlantic.

8.3.3 Data available

Landings were available for all fleets. A new French CPUE series is available. The distribution of landings per statistical rectangle and quarter for 2005 and 2006 are shown in section 12.5.

8.3.3.1 Landings and discards

Landings are in Table 8.3.1. Landings data were provided by France, Scotland and Ireland at the level of ICES statistical rectangles and these have been aggregated by quarter and plotted to display the geographic distribution of the fishery in figures 8.3.3 and 8.3.4.

8.3.3.2 Length compositions

No new data. See section 18 for older data that combines VI and VII data from observers.

8.3.3.3 Age compositions

No new data. See section 18 for older data that combines VI and VII data.

8.3.3.4 Weight at age

No data.

8.3.3.5 Maturity and natural mortality

No data.

8.3.3.6 Catch, effort and research vessel data

There are CPUE data are available from observed fishing trips as part of the Irish Sea Fisheries Board Deepwater Programme (BIM, WD, 2002a). These data are presented in Table 8.3.2.

The previous French CPUE series (Anon., 2000; 2002) are shown in Figure 8.3.1. These used data from all vessels combined.

A new French series up to 2005 was calculated as kg/hr for data that had more then 10% orange roughy in the catch and split into small (400-600 kw) and large (1400-1800 kw) vessels (Figure 8.3.2).

8.3.4 Data analyses

No data analysis has been performed during WGDEEP 2007, for previous exploratory analysis please refer to WGDEEP 2006.

Table 8.3.1. Orange roughy catch in Sub-area 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

* Preliminary.

Table 17.2. VI CPUE from observed trips on Irish trawlers in 2001 and 2002, from data made available by BIM. Catch in kg, effort in hours, CPUE in kg per hour and kg per haul. Hauls with zero catches are removed for ease of comparison between years, as zero haul data unavailable for 2001.

Year	Effort	Catch	CPUE kg per hour	No. hauls	Kg per haul
2001	47.2	7090	150.3	9	788
2002	3.5	10	2.9	1	10
2002	5.8	40	6.9	5	8

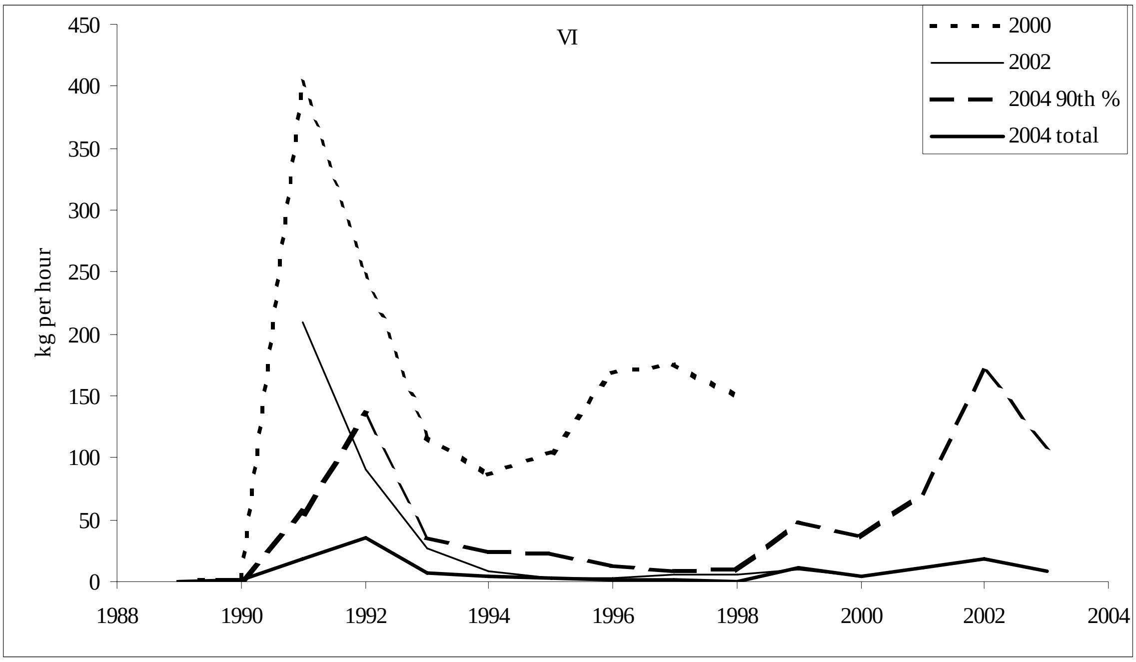


Figure 8.3.1. Comparison of four previous series of CPUE from French trawlers in Sub-areas VI.

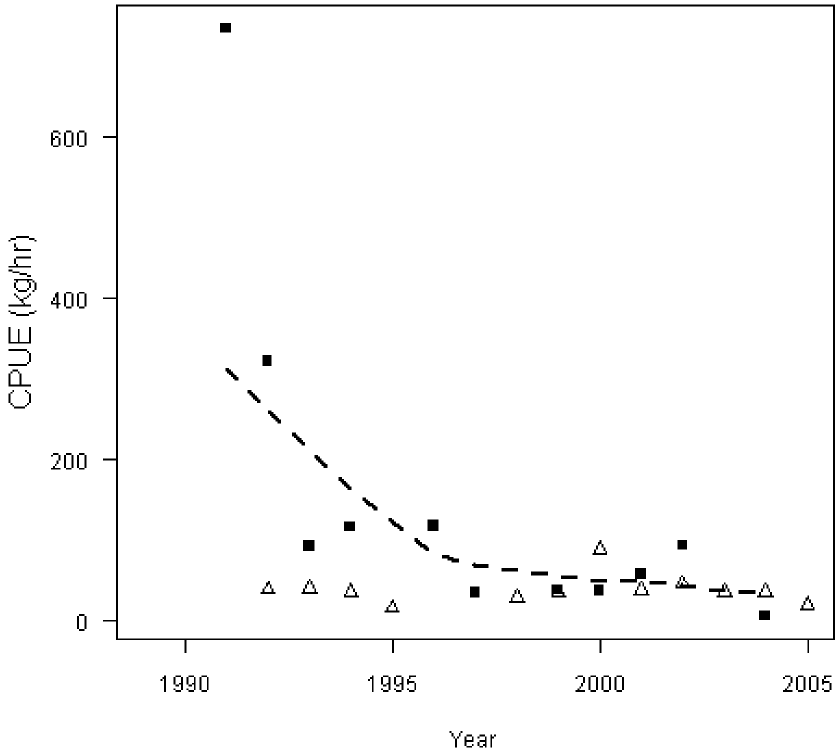


Figure 8.3.2. French 2006 CPUE series (VIa) for 400-600 kw power vessels (open triangles) and for 1400-1600 kw vessels (solid squares). The line is a smooth curve through the latter series.

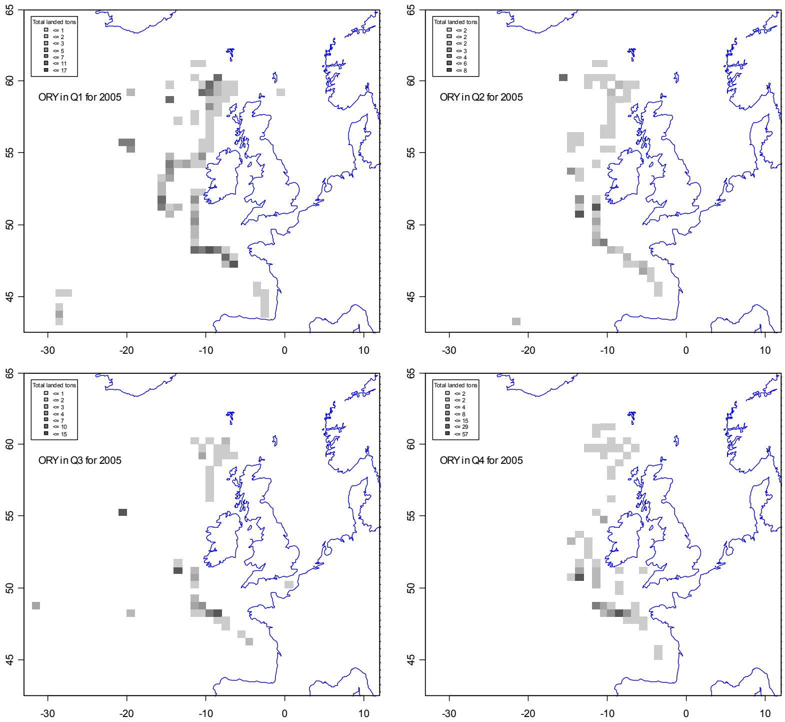


Figure 8.3.3 Combined French, Scottish and Irish landings of Orange Roughy by statistical rectangle and quarter in 2005.

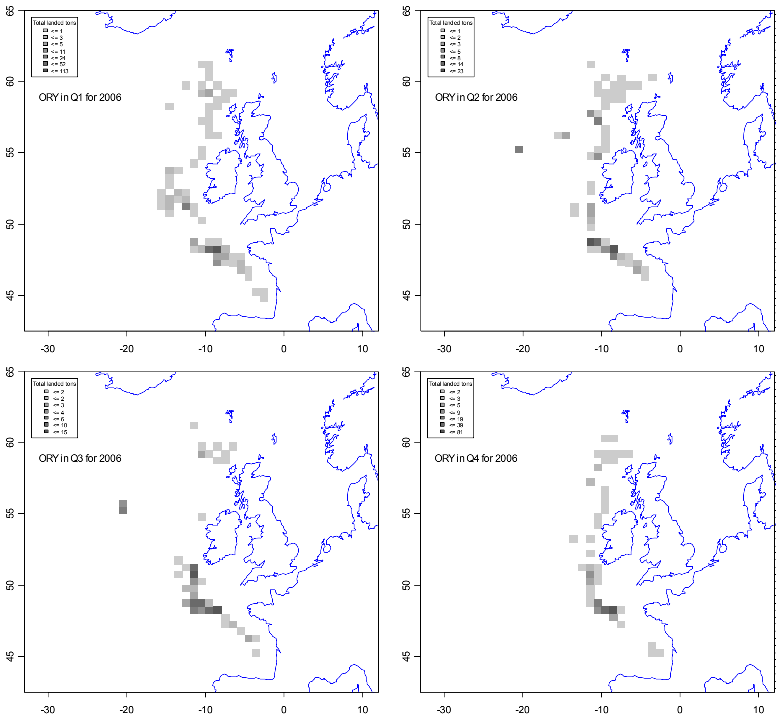


Figure 8.3.4 Combined French, Scottish and Irish landings of Orange Roughy by statistical rectangle and quarter in 2006

8.4 Orange Roughy (*HOPLOSTETHUS ATLANTICUS*) in Subarea VII

8.4.1 The fishery

Since the collapse of the VI fishery, the main fishery for orange roughy in the northern hemisphere is in this sub-area. 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. There is a small roughy bycatch from trawling on the "flats".

8.4.1.1 Landings trends

Table 8.4.1 shows the landings data for orange roughy as reported to ICES or as reported to the Working Group. The preliminary landing for 2006 is 488 t.

A French fishery developed in 1989, and landings peaked at over 3,000 t in 1992. By the end of 2000 the French fleet had removed over 13,500 t of orange roughy from this Sub-area. An Irish fishery commenced in 2001, and since then the combined Irish and French accumulated landings (preliminary data) have amounted to a further 10,600 t. The fishery takes place on several separate topographical features.

Historic landings data suggest several pulses in landings. The first occurred in 1992 when over 3,000 t were landed. Landings declined until 1995, but then increased again to the highest in the series in 2002. Misreporting is likely to have been a feature of this fishery in most recent years, with both under- and over-reporting probably taking place. The restrictive quotas that have been introduced in 2003 may have resulted in further species and area misreporting. In addition, there is a likelihood of misreporting of orange roughy as other species. Since TACs were applied in 2003, catches have not reached that level.

8.4.1.2 ICES advice

The ICES advice statement from 2006 was:

"*Orange roughy can only sustain very low rates of exploitation. Currently, it is not possible to manage a sustainable fishery for this species. Hence, ICES recommends no fishery for this species. Bycatches in mixed fisheries should be limited as far as possible*".

8.4.1.3 Management

For 2007 and 2008 the TAC for Orange Roughy in VII has been fixed to 193 t and 130 t respectively. Further to a TAC, a number of Orange Roughy protection areas have been introduced, from which EU vessels have no permission to land or retain any catches of Orange Roughy. These areas are defined as the following sea areas:

(a) that sea area enclosed by rhumb lines sequentially joining the following positions:

57° 00′ N, 11° 00′ W,57° 00′ N, 8° 30′ W,56° 23′ N, 8° 30′ W,55° 00′ N, 9° 38′ W, 55° 00′ N, 11° 00′ W and 57° 00′ N, 11° 00′ W;

(b) that sea area enclosed by rhumb lines sequentially joining the following positions: 55° 30′ N, 15° 49′ W,

53° 30′ N, 14° 11′ W, 50° 30′ N, 14° 11′ W, 50° 30′ N, 15° 49′ W;

(c) that sea area enclosed by rhumb lines sequentially joining the following positions: 55° 00′ N, 13° 51′ W, 55° 00′ N, 10° 37′ W, 54° 15′ N, 10° 37′ W, 53° 30′ N, 11° 50′ W, 53° 30′ N, 13° 51′ W.

Landings in relation to TAC are shown in the table below. This table illustrates that catches 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	488	488

8.4.2 Stock identity

The fishing grounds so far discovered in the North Atlantic have appeared to support relatively small aggregations of fish, usually associated with seamounts and other topographical features. It seems likely that the separate aggregations are separate stock units too, though it is not clear. The probability of finding, in the northern Atlantic, stocks comparable in size to the stocks exploited in the south Pacific seems low. A genetics project is now underway, to study the genetic structure of orange roughy in the north Atlantic

8.4.3 Data available

Landings were available for all fleets. French CPUE series is available. Landings data for 2005 and 2006 per quarter by statistical rectangle were available and are shown in section 12.5.

8.4.3.1 Landings and discards

Landings shown are in Table 8.4.1. Distribution maps of the landings by statistical rectangle per quarter for 2005 and 2006 are shown in section 12.5.Discard information is available from two discard trips in 2004. One discard trip was for fishing on the flats and it gave 1 t of discarded orange roughy. The other trip was for directed orange roughy fishing on seamounts and no discards were reported.

8.4.3.2 Length compositions

Updated length frequency information is available from the 2005 acoustic survey (Figure 8.4.1).

Figure 8.4.2 presents length frequencies from the Irish developmental programme (BIM, WD 2002) and this also included some data from VI. Length frequencies from the Irish Marine Institute observer programme in 2003 are presented in Figure 8.4.3, which again includes some samples from VI. Most fish were between 45 and 65 cm. Length frequencies for the French fishery during the 1990’s are presented in Figures 8.4.4 and 8.4.5 and, again, this covers all sub-areas, but mainly VII.

Standard length weight relationships for orange roughy caught in the Irish developmental fishery in 2001 are presented by the Irish Sea Fisheries Board and documented in BIM (WD, 2002a). This includes data from VI also. The relationships are as follows:

Both sexes: $y = 0.3108x^{2.3959}$ $R^2 = 0.743$ N = 320

Females: $y = 0.0136x^{3.2174}$ $R^2 = 0.9237$ N = 23

Males $y = 1.1410x^{2.0531}$ $R^2 = 0.7643$ N = 58

A relationship between total individual size (L in cm) and weight (W in g) has been derived from French landings taken off the British Islands:

$W = 0.022\ L^{2.95}$

8.4.3.3 Age compositions

Age data was available from sampling at-sea on commercial trawlers operating on the Porcupine Bank during September 2003-April 2004 and February 2005 (WD13 in WGDEEP, 2006). Most otolith samples were of juvenile fish (< 30 cm SL). Otoliths were prepared and sectioned according to Tracey and Horn (1999). Age estimates (6-169 years) were obtained from a total of 151 otoliths. The Von Bertalanffy growth model was fitted to the data (R^2=0.92) (Figure 8.4.6). Estimated growth parameters were: L_∞=47.6 cm, k=0.039 yr^{-1} and t_0=2.61 years.

Age estimates were presented by Talman et al. (2002) based on samples taken from the Irish developmental fishery in 2001, in VI and VII (BIM, WD 2002). Age estimates from sectioned otoliths ranged from 20 to 187 years (Standard Lengths 30 to 68 cm). Empirical growth curves presented by Talman et al. (2002) suggests that growth slows and reaches an asymptote at about 55cm SL and 37 years. This asymptote is far greater than estimate above and the cause of this is unknown (it possibly could be TL rather than SL).

These age estimates, though unvalidated, were obtained using the most accepted technique used for New Zealand and Australian fisheries. The orange roughy in the area west of Ireland appear to reach the greatest age of any populations so far examined. Though these data cannot be used to infer the age structure of the stocks in this area, they do indicate that the populations consist of a great many age groups.

8.4.3.4 Weight at age

No data.

8.4.3.5 Maturity and natural mortality

Maturity L_{50} was estimated to be 37 cm SL from the new data colleted under the NSH stagetic project (WD 13c). This is similar to the estimate from the west of Ireland of 36 cm SL (Minto and Nolan, 2003; in prep.). These are higher than that estimated for orange roughy in New Zealand and Australia.

Based on Tasman et al.'s (2002) age estimates, an estimate of natural mortality of 0.025 is obtained for orange roughy caught in the Irish fishery, from the following equation:

M = ln100 / maximum age (187 years). This is only a very approximate estimate, but it is consistent with the estimates obtained by using amore statistically precise method on New Zealand data (0.045, Sullivan et al., 2005).

8.4.3.6 Catch, effort and research vessel data

<u>Acoustic survey, 2005</u>

In 2005 the Marine Institute, together with University College Cork and Bord Iascaigh Mhara carried out an orange roughy acoustic survey on the slopes to the west and north of the Porcupine Bank. This used a scientific echosounder system mounted within a deep towed vehicle operated from the *RV Celtic Explorer*. Biological samples collected by the *MFV Mark*

Amay (WD 13a). In addition, the multibeam echosounder and a ROV were used on selected sea-mounds to map the orange roughy habitats.

CPUE

CPUE data are available from observed fishing trips as part of the Irish Sea Fisheries Board Deepwater Programme (BIM, WD, 2002a). These data are presented in Table 8.4.2 and by area in Table 8.4.3.

The previous French CPUE series (Anon., 2000; 2002) are shown in Figure 8.4.8. These used data from all vessels combined.

A new French series was calculated as kg/hr for data that had more then 10% orange roughy in the catch and split into small (400-600 kw) and large (1400-1800 kw) vessels (Figure 8.4.8).

8.4.4 Data analyses

No new data exploration has been carried out for Orange Roughy in VII during WGDEEP 2007. For details on previous data analysis, refer to WGDEEP 2006.

Table 8.4.1. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus,* by nation in Sub-area 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			488

*Preliminary.

Table 28.2. VII CPUE from observed trips on Irish trawlers in 2001 and 2002, from data made available by BIM. Catch in kg, effort in hours, CPUE in kg per hour and kg per haul. Hauls with zero catches are removed for ease of comparison between years, as zero haul data unavailable for 2001.

Year	Effort	Catch	CPUE kg per hour	No. hauls	Kg per haul
2001	124.2	34656	279.1	45	770
2001	102.8	4960	48.2	21	236
2001	336.9	78037	231.6	84	929
2002	81.8	11060	135.2	29	381
2002	122.5	124930	1019.8	93	1343

Table 8.4.3. CPUE from Irish observer scheme carried out by the Irish Sea Fisheries Board in 2001 and 2002.

	Area	CPUE in 2001	CPUE in 2002	Comments
2	North Porcupine	426	-	Bordering VI and VII
3	North Porcupine	317	158	Southern slopes of Rockall Trough
4	West Porcupine	1532	+	Porcupine slope
5	West Porcupine	178	121	Porcupine slope
6	West Porcupine	636	139	Southwest Porcupine

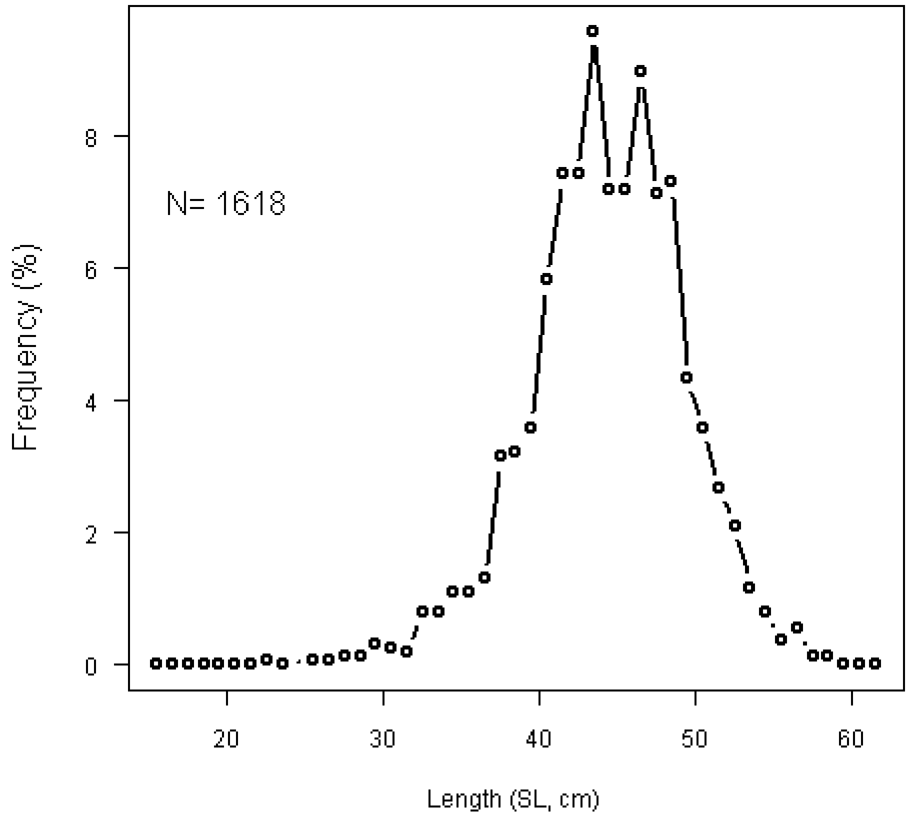


Figure 8.4.1. Length frequency from seamount trawl data sampled on the 2005 acoustic survey, VII.

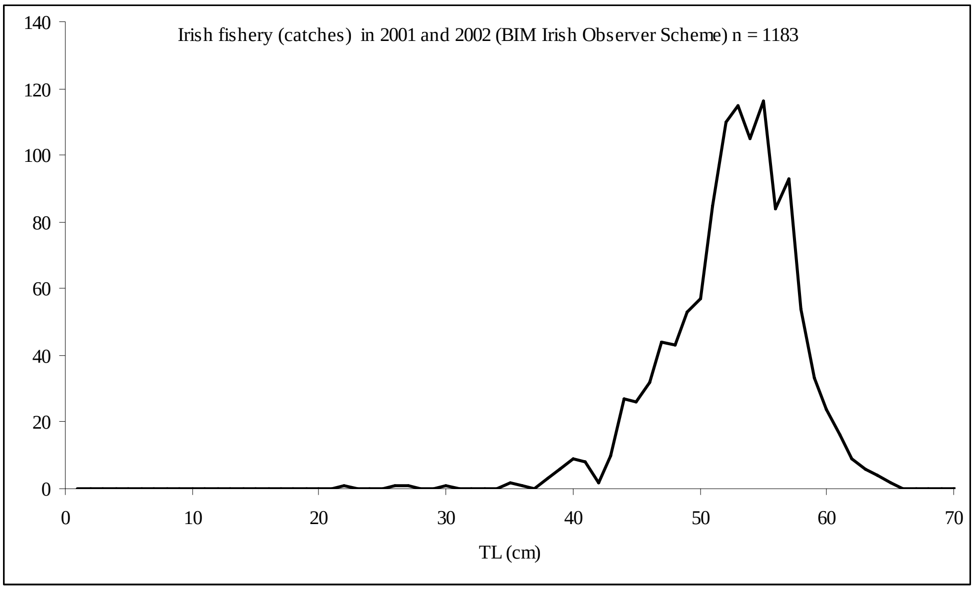


Figure 8.4.2. Length frequencies from Irish fisheries in 2001 and 2002, data from Irish Sea Fisheries Board observer scheme (BIM, WD 2002). VI and VII data.

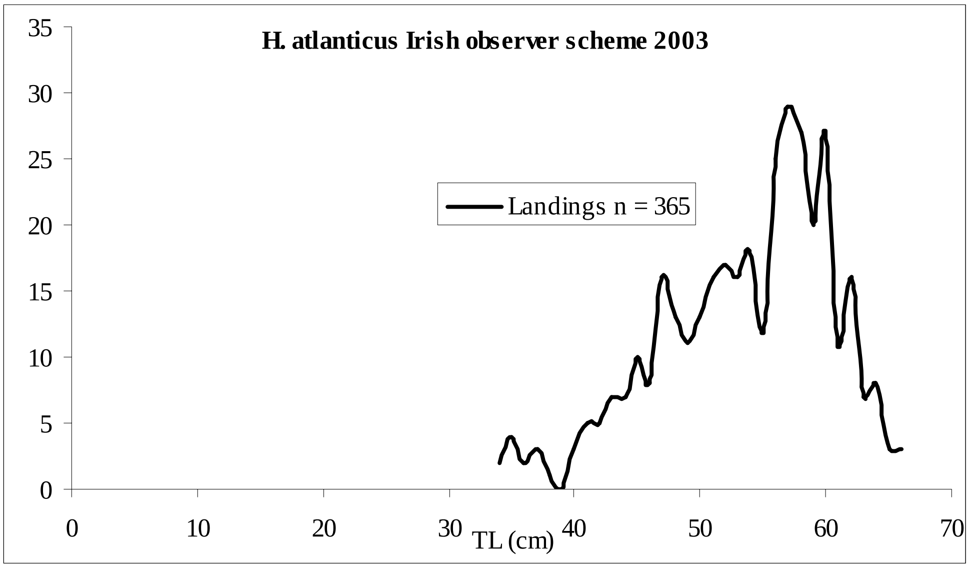
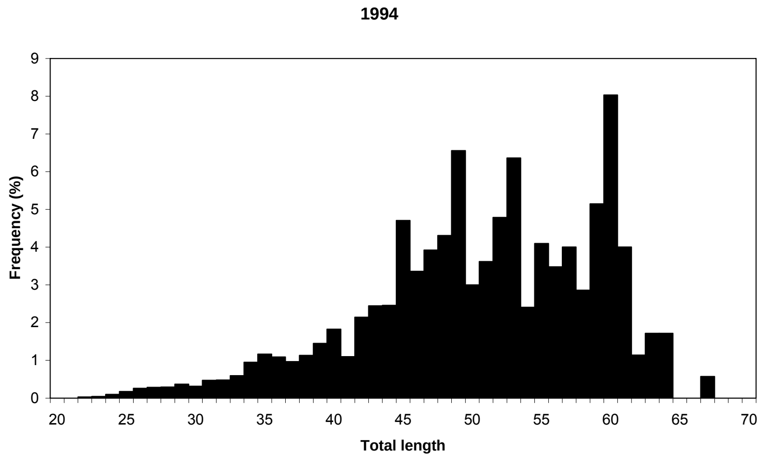
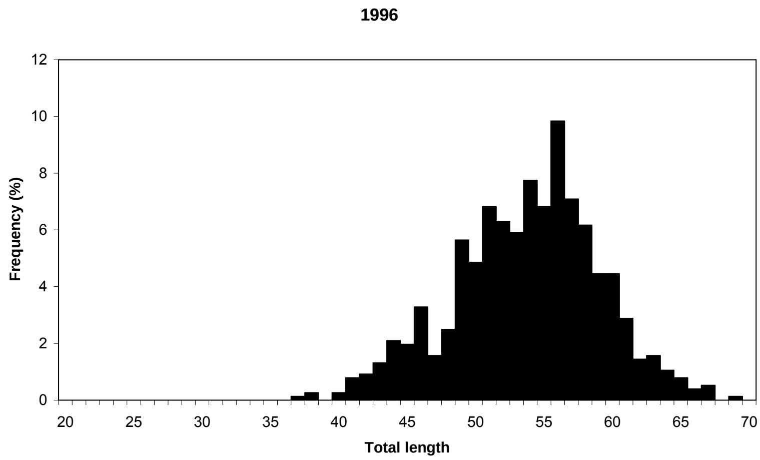


Figure 8.4.3. Length frequencies from Irish fishery in 2003 (VI and VII) from Irish Marine Institute observer scheme.





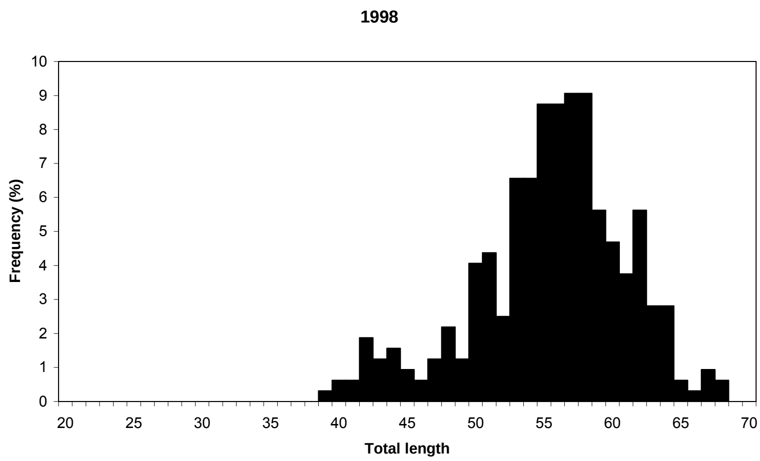


Figure 8.4.4. Length distribution of French landings of orange roughy from 1994 to 1998.

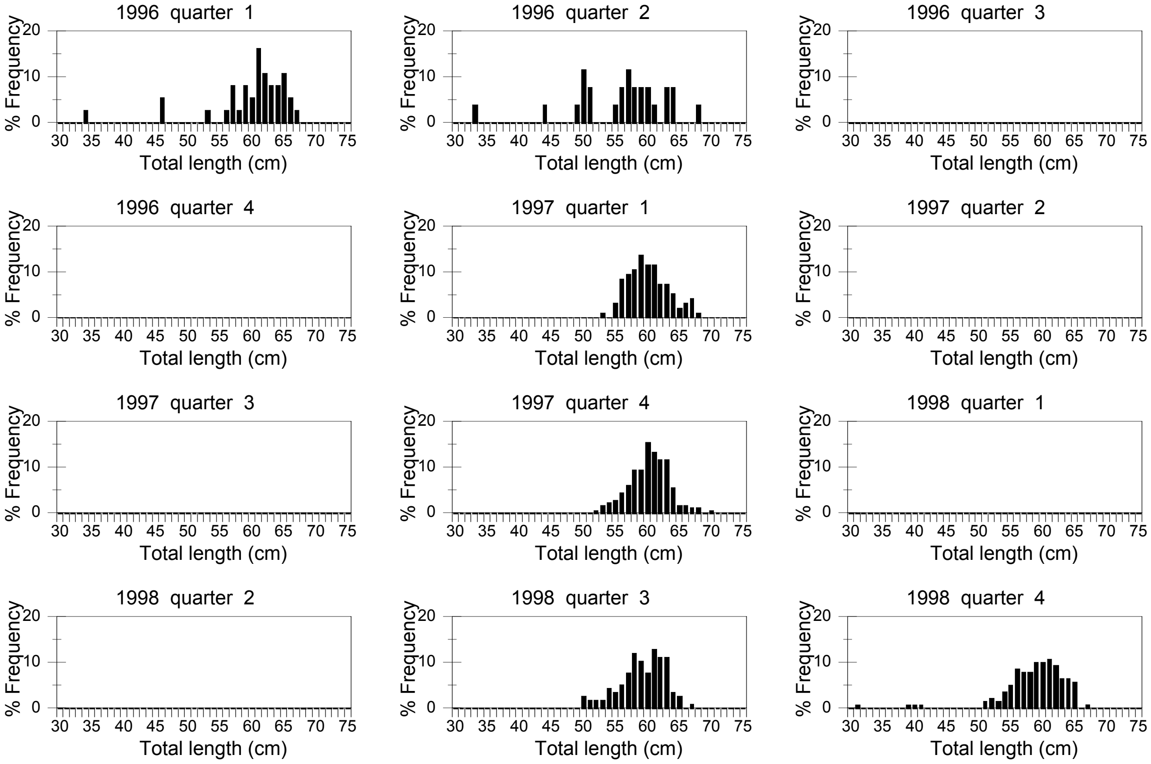


Figure 8.4.5 Orange roughy, quarterly landings from French vessels landing in Scotland (FRS data) (EC FAIR 1999)

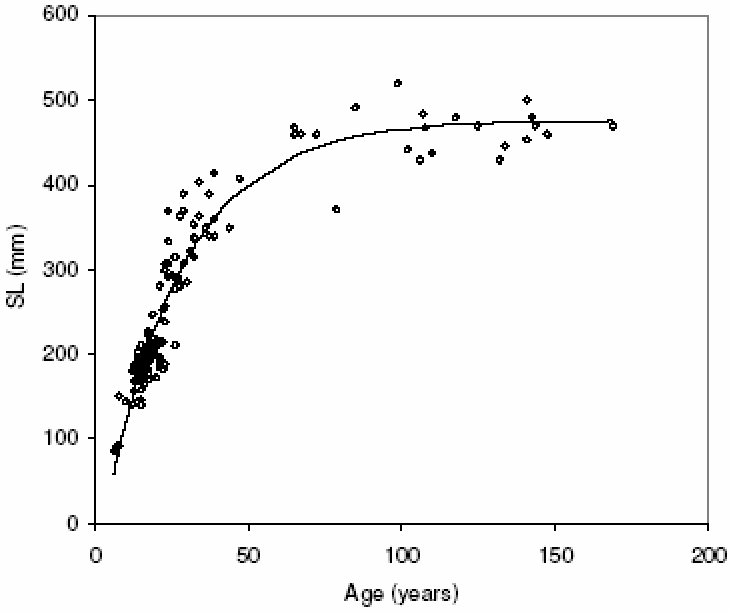


Figure 8.4.6. Age estimates and the estimated Von Bertalanffy growth curve (WGDEEP,2006).

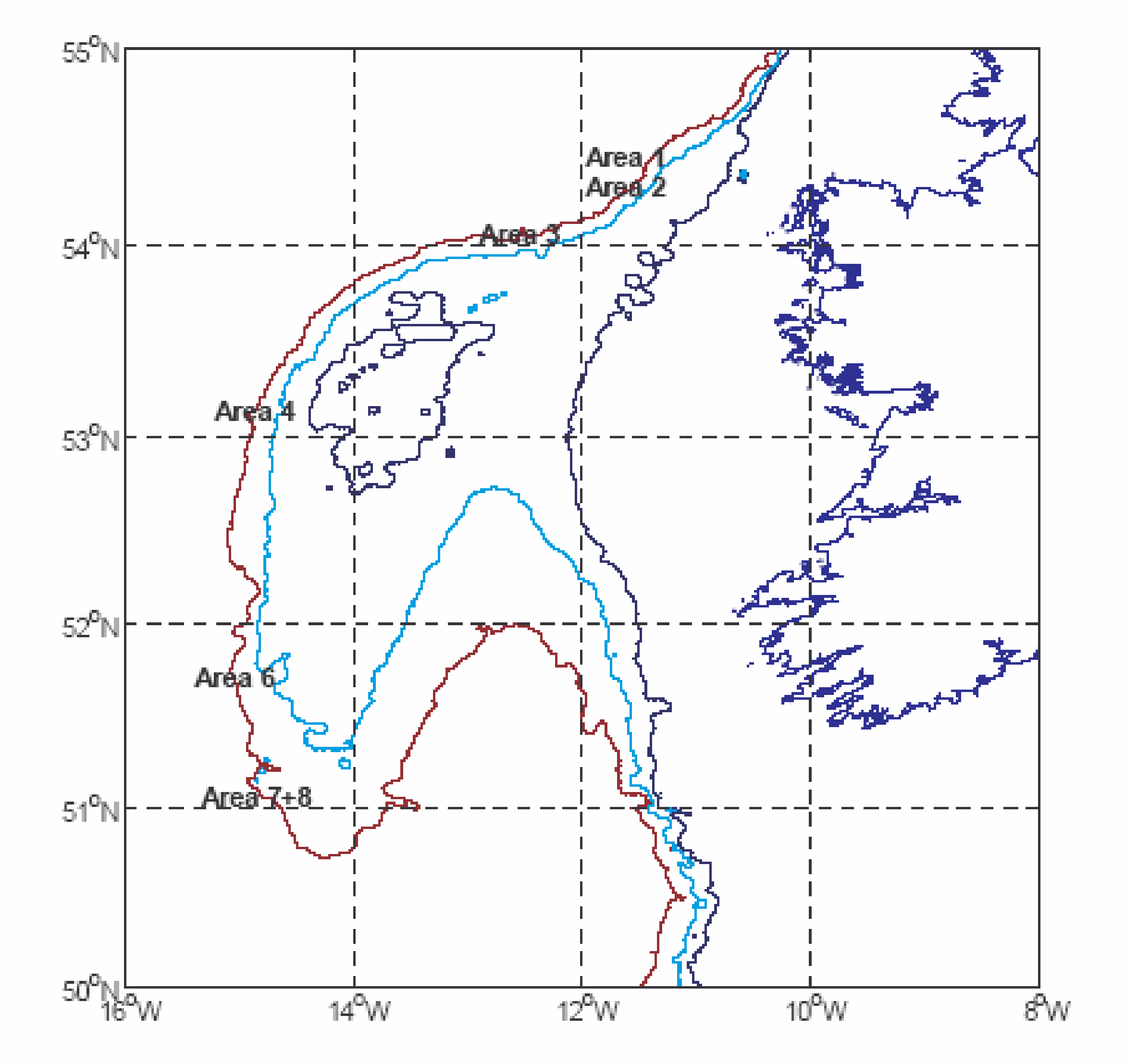
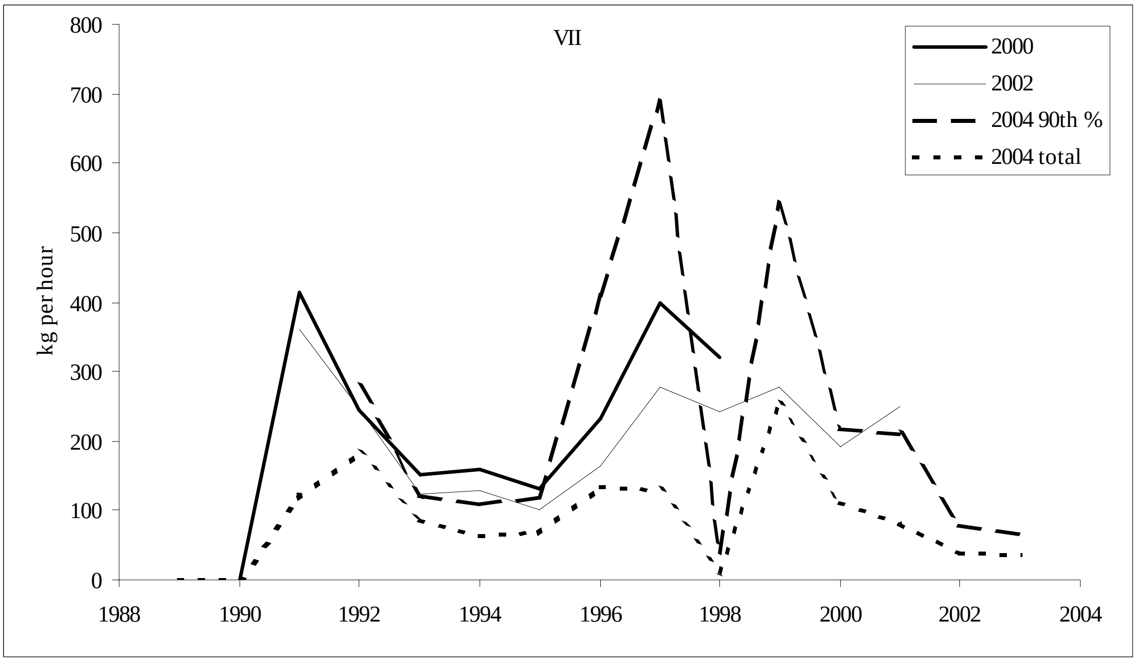


Figure 8.4.7. Acoustic survey of VII, 2005. Survey sub-areas.



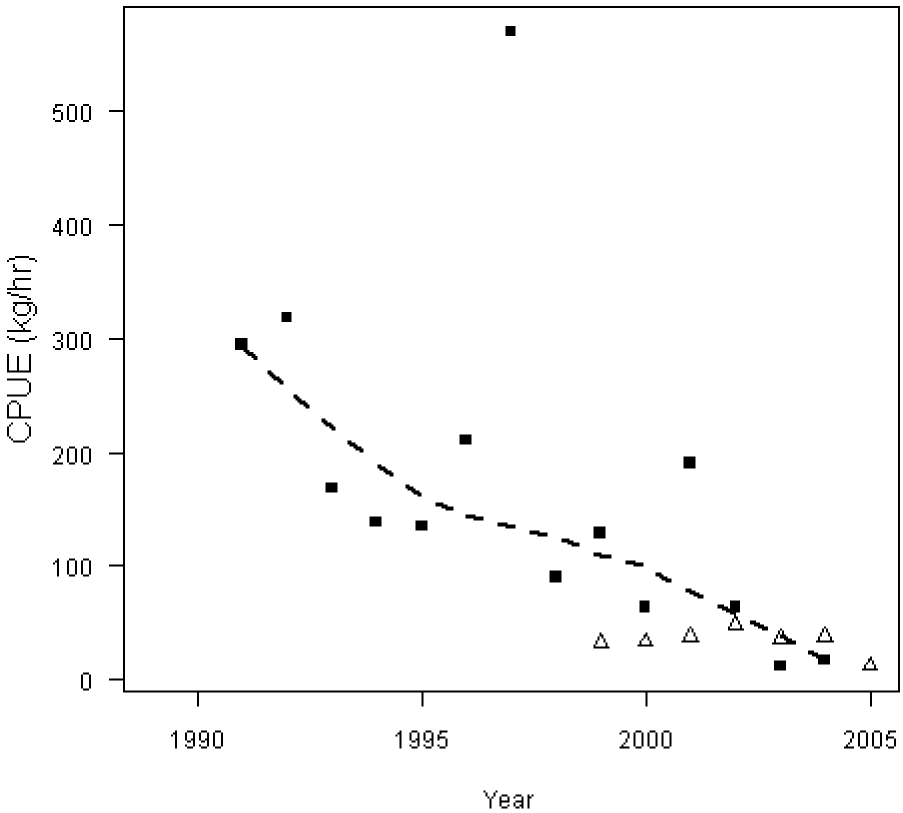


Figure 8.4.8. Top: Comparison of four old series of CPUE from French trawlers in Sub-areas VII. Note that there in no data in 1988 so that point is spurious in the plot. Bottom: 2006 CPUE series for 400-600 kw power vessels (open triangles) and for 1400-1600 kw vessels (solid squares). The line is a smooth curve through the latter series excluding the high 1997 point.

8.5 Roundnose Grenadier (*CORYPHAENOIDES RUPESTRIS*) in Division Vb and XIIb, Subareas VI and VII

8.5.1 The fishery

In the assessment area, the bulk of the landings of roundnose grenadier is caught from trawl. To the west of the British Isles, in divisions Vb, VIa, VIb2 and sub-areas VII, French trawlers catch roundnose grenadier in a multispecies deepwater fishery. The Spanish trawling fleet operates further offshore along the western slope of the Hatton Bank in ICES divisions VIb1 and XIIb.

8.5.1.1 Landings trends

Over the past two decades, in division Vb, the landings has reached more than 3 800 t in 1991 and more than 2000 t in 2001. Between these two periods, the landings was low in the mid-1990s (less than 700 t in 1994). After 2001, it decreased to about 1 000 t in 2002 but increase further to about 1 800t in both 2005 and 2006. These landings are almost exclusively from French and Faroese trawlers (Table 8.5.1).

In sub-area VI, the highest landings was observed in 2001 (close to 15 000 t) and has decreased to less than 4 500 t in 2005. About 2/3 of these landings are caught by French trawlers.

In sub-area VII, landings close to 2 000 t were recorded in 1993-94, recent annual landings are much lower (from 200 to 600 t/year in 2004-2006).

Landings reported in previous ICES sub-area XII from USSR/Russia, Latvia and Poland were caught on the mid-Atlantic ridge (see section 11.2) and are not accounted for here. In ICES division XIIb, the main fishery is by far from Spanish trawlers. After a peak to more than 19 000 t in 2003, the reported landings have decreased to about 4 200 t in 2005. 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 1 700 t in 2004 and has strongly since that year.

The landing data for the whole assessment area is 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. Therefore countries are strongly encouraged to provided landings data by new ICES divisions, or better by ICES rectangles. Lastly significant unallocated landings occurred in 2005 (Table 8.5.2).

8.5.1.2 ICES advice for this stock in 2005–2007.

The ICES advice applicable to this assessment unit is as follows "*For sub-areas VI and VII and divisions Vb and IIIa a reduction in effort of 50% from the 2000-2002 effort is required*".

In 2006, the ICES advice was: *For the fishery in Divisions Vb, VI, VII, and XIIb, the fishing pressure should be reduced considerably to low levels and should only be allowed to expand again very slowly if and when reliable indicators show that increased harvests are sustainable. ICES recommends a 50% reduction of effort compared to the level before the expansion of the fishery started (1990-1996). This is interpreted as a reduction in catches of 50% over that period. This means that the catch level in 2007 should be at most 6 000 t.*

8.5.1.3 Management

TACs for EU vessels for deepwater species has 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 roundnose grenadier, there is a mismatch between the assessment areas (ICES divisions Vb and XIIb and sub-areas VI and VII) and management areas for which TACs are set. TACs are set for:

- ICES division Vb and sub-areas VI and VII
- ICES sub-areas VIII, IX, X, XII and XIV.

For division Vb and sub-areas VI and VII, a TAC have been set at 5106 in 2003-2004 and 5253 t in 2005-2006. The increase in the TAC in 2005 and 2006 is due to the entry of new member countries which previously caught roundnose grenadier in EU. These countries (Estonia, Lithuania, Latvia and Poland) accounted for 912 tonnes in 2005-2006 TAC, so that the actual change from 2003-04 to 2005-06 TAC aimed at reducing the catch in 2003-04 by 15 %, as were the national quotas. This TAC was reduced to 4600 t in 2007-2008.

In sub-areas VIII, IX, X, XII and XIV the TAC was set at 7190 t in 2005-2006 and 6114 t in 2007-2008. 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 sub-area XIV). Catches from non EU countries in international waters are not counted under this TAC. 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 Landings Vb, VI, VII, XIIb
	EU TAC	Landings	EU TAC	Landings XIIb	
2002	No	13623	No	10 730	24353
2003	5106	8718	No	19 945	28663
2004	5106	8149	No	10 353	18502
2005	5253	6553	7190	4818	11391
2006	5253	na*	7190	na*	
2007	4600		6114		
2008	4600		6114		

* data available to the working group were incomplete

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.

For better management, there is a need to match assessment and management areas. However, due to current uncertainties in stock identities, it cannot be ascertain that the area used for assessment purposes (Vb, VI, VII and XIIb) will not change in the future if new knowledge of stock structure is gained (see section 4 and 8.5.5).

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.

8.5.2 Stock identity

See section 4.3.8.

8.5.3 Data available

8.5.3.1 Landings and discards

Landings time series data per ICES areas are presented in Tables 8.5.1 and 8.5.2.

Landings data by new ICES areas was available from France, Norway and UK (England and Wales) for 2005 and 2006. No other country provided data by new ICES area. Catch in sub-area XII were allocated to division XIIb (western Hatton bank) or XIIa,c (mid-Atlantic ridge) according to knowledge of the fisheries from WG members.

Landings per ICES rectangle in 2005 and 2006 were available from France, UK Scotland and Ireland and were plotted to display the geographical distribution of the fishery (Figures 8.5.1 & 8.5.2).

Catch and discards by haul become available from observer programs. From the French observer program, 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, 2004-06 (carried out in application of EU Council Regulation (EC) No 2347/2002 of 16 December 2002) and from Scottish observers on-board of French vessels, 1997-2001.

Based on EU observer program 2004-05, about 30% of the catch in weight of roundnose grenadier is discarded, due to small size (Figure 8.5.3). This figure is higher than in previous sampling were the discarding rate in the French fisheries was estimates slightly above 20% from sampling in 1997-98 (Allain, 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.

Length distribution of discards was available from the French observer program, from on-board observations on French vessels in 1997-98 and from Scottish observation on French vessels in 1997-2001. The length distribution of discards from all these observation seem quite consistent.

The main discarded lengths seem to have remained the same, 12-13 cm pre anal length, (Figures 8.5.3-8.5.5).

The mode of the length distribution of the discards from the Spanish fleet in divisions VIb and XIIb seem slightly smaller, probably due to different sorting habits in relation to different markets (Figure 8.5.6). It is therefore important that length distribution of the landings and discards are provided to the working by all fleets exploiting the stock.

8.5.3.2 Length and age composition of the landings.

Size and age frequency data of the landings available to last year meeting were not updated this year.

8.5.3.3 Weight at age

No new data.

8.5.3.4 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.

8.5.3.5 Research vessel survey and CPUE

Research Vessel survey

Only one cruise relevant to roundnose grenadier is currently carried out on a yearly basis by FRS (Scotland) see section 3. Catch rate per depth band and year from this survey were computed (Figure 8.5.7). Due to small number of hauls in each depth stratum/year, the confidence intervals in each strata are wide. Further analysis of this data is required to derive a time series of stratified estimated of the catch rates.

Although still a relatively short time series, this is the only known current trawl survey in the region and therefore represent vital fisheries-independent monitoring of the fish populations in the region.

The length composition observed from the same survey (Figure 8.5.8) seems consistent with formerly published data about the length composition of the roundnose grenadier to the west of Scotland. These pre-exploitation data indicate that roundnose grenadier to the west of Scotland comprise mainly adults in the shallowest (500-750m) part of the range, mixing with juveniles in the mid-range (~ 1000 m), at greater depth, fish of intermediate size become increasingly dominant (Gordon, 1979). However, this pattern was not observed in recently analysed archive data from the slope of the Porcupine Bank (Figure 8.5.9).

Commercial CPUE

Commercial CPUE was available from Faroese trawlers in division Vb (Figure 8.5.10) (WD01). The increasing trend since 2000 cannot be ascribed to increasing abundance and might come from changing of fishing ground, target species or technical factors in that fishery.

8.5.3.6 Effort data

No new effort data was presented at this meeting.

Table 8.5.1 Roundnose grenadier (Coryphaenoides rupestris), WG estimates of landings

Table 8.5.1a. Roundnose grenadier (*Coryphaenoides rupestris*) Vb1a (2004-06)

Year	Faroes	France	Norway	Germany	Russia/USSR	UK (E+W)	UK (Scot)	TOTAL
2004								0
2005		3	1			0	0	4
2006*		16	0			0	0	16

Table 8.5.1b. Roundnose grenadier (*Coryphaenoides rupestris*) Vb1b (2004-06)

Year	Faroes	France	Norway	Germany	Russia/USSR	UK (E+W)	UK (Scot)	TOTAL
2004		179						179
2005	80	75	0			0	0	155
2006*	183	109	0			0	0	292

Table 8.5.1c. Roundnose grenadier (*Coryphaenoides rupestris*) Vb2 (2004-06)

Year	Faroes	France	Norway	Germany	Russia/USSR	UK (E+W)	UK (Scot)	TOTAL
2004		559						559
2005	383	666	0			0	0	1049
2006*	737	668	0			0	0	1405

Table 8.5.1d. Roundnose grenadier (*Coryphaenoides rupestris)* Vb (2004-2006, not reported into smaller divisions)

Year	Faroes	France	Norway	Germany	Russia/USSR	UK (E+W)	UK (Scot)	TOTAL
2004	508	247			6		76	837
2005	440	139	0		1	0	48	628
2006*		82	0			0	0	82

* Preliminary

Table 8.5.1e. Roundnose grenadier (*Coryphaenoides rupestris*) Vb (1998-2006)

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	768				81		1025
2003	490	1032				10		1532
2004	508	985	0	0	6	0	76	1575
2005	903	883	1	0	1	0	48	1836
2006*	920	875	0	0	0	0	0	1795

Table 8.5.1f. Roundnose grenadier (*Coryphaenoides rupestris*) VIa (2004-06)

Year	Estonia	Faroes	France	Germany	Ireland	Lithuania	Norway	Poland	Russia	Spain	UK (E+W)	UK (Scot)	**TOTAL**
2004			3007										**3007**
2005		24	2358				0				0	38	**2420**
2006*		24	1658		4		0		0		0	15	**1701**

Table 8.5.1g. Roundnose grenadier (*Coryphaenoides rupestris*) VIb1 (2004-06)

Year	Estonia	Faroes	France	Germany	Ireland	Lithuania	Norway	Poland	Russia	Spain	UK (E+W)	UK (Scot)	**TOTAL**
2004			704										**704**
2005			202				0				0	0	**202**
2006*			83				0		0		0	0	**83**

Table 8.5.1h. Roundnose grenadier (*Coryphaenoides rupestris*) VIb2 (2004-06)

Year	Estonia	Faroes	France	Germany	Ireland	Lithuania	Norway	Poland	Russia	Spain	UK (E+W)	UK (Scot)	**TOTAL**
2004			874										**874**
2005			354				0				0	0	**354**
2006*			190				0		0		0	0	**190**

Table 8.5.1i. Roundnose grenadier (*Coryphaenoides rupestris*) VI (2004-06, not reported in smaller divisions)

Year	Estonia	Faroes	France	Germany	Ireland	Lithuania	Norway	Poland	Russia	Spain	UK (E+W)	UK (Scot)	**TOTAL**
2004	26	12	1	0	8	961		13	72	252		72	**1417**
2005		0	29	0	17	939	1	0			0	6	**992**
2006*			0	0	0	0	0	0	0		0	0	**0**

* Preliminary

Table 8.5.1j. Roundnose grenadier (*Coryphaenoides rupestris*) VI (1998-2006)

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	4586	0	8	961	0	13	72	251	0	72	**6001**
2005	80	24	2943	0	17	92	1	0	0	468	0	44	**3669**
2006*	0	24	1931	0	4	0	0	0	0	0	0	15	**1974**

* Preliminary

Table 8.5.1k. Roundnose grenadier (*Coryphaenoides rupestris*) VIIb,c2,g,h,j2,k2

Year	Faroes	France	Ireland	Spain	UK (Scot)	TOTAL
2004		92				92
2005		135				135
2006*		237	4			241

Table 8.5.1l. Roundnose grenadier (*Coryphaenoides rupestris*) VIIc1,k1,j1

Year	Faroes	France	Ireland	Spain	UK (Scot)	TOTAL
2004		6				6
2005		6				6
2006*		11				11

Table 8.5.1m. Roundnose grenadier (*Coryphaenoides rupestris*) VII non reported in smaller divisions

Year	Faroes	France	Ireland	Spain	UK (Scot)	TOTAL
2004		155	320			475
2005		5	55			60
2006*		0	212			212

Table 8.5.1n. Roundnose grenadier (*Coryphaenoides rupestris*) 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		889				889
2001		947	416			1363
2002	1	451	605		3	1060
2003		374	213		1	588
2004	0	253	320	0	0	573
2005	0	146	55	0	0	201
2006*	0	248	216	0	0	464

* Preliminary

Table 8.5.1o. Roundnose grenadier (*Coryphaenoides rupestris*) 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					1800					**2049**
1998		19	116					4262					**4397**
1999		29	287					8251	6				**8573**
2000		6	391	9				5791			6		**6203**
2001		2	156			3		5922			7	1	**6091**
2002			14				18	10696		1	1		**10730**
2003			543			1	31	19367			3		**19945**
2004		8	1707				120	8423	91		4		**10353**
2005	20	4	508				13	4194	81	0			**4820**
2006****		1	85							0			**86**

** French landings reported in former ICES sub-area XII allocated to XIIb
*** Spanish landings for years 2002 and 2003 include VI
**** Preliminary

Table 8.5.1o. Roundnose grenadier (*Coryphaenoides rupestris*) 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**

* Preliminary

Table 8.5.2. Roundnose grenadier (*Coryphaenoides rupestris*), catch in ICES divisions VIb and XIIb and sub-areas VI and VII, best WG estimates available for assessement purposes.

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	2049	0	8182	**10231**
1998	1667	5207	1157	4397	0	8031	**12428**
1999	1996	5642	896	8573	0	8534	**17107**
2000	1791	8956	889	6203	0	11636	**17839**
2001	2016	14773	1363	6091	208	18152	**24243**
2002	1025	11538	1060	10730	504	13623	**24353**
2003	1532	6598	588	19945	952	8718	**28663**
2004	1575	6001	573	10353	0	8149	**18502**
2005	1836	3669	201	4820	5003	5706	**10526**
2006*	1795	1974	464	86	0	4233	**4319**

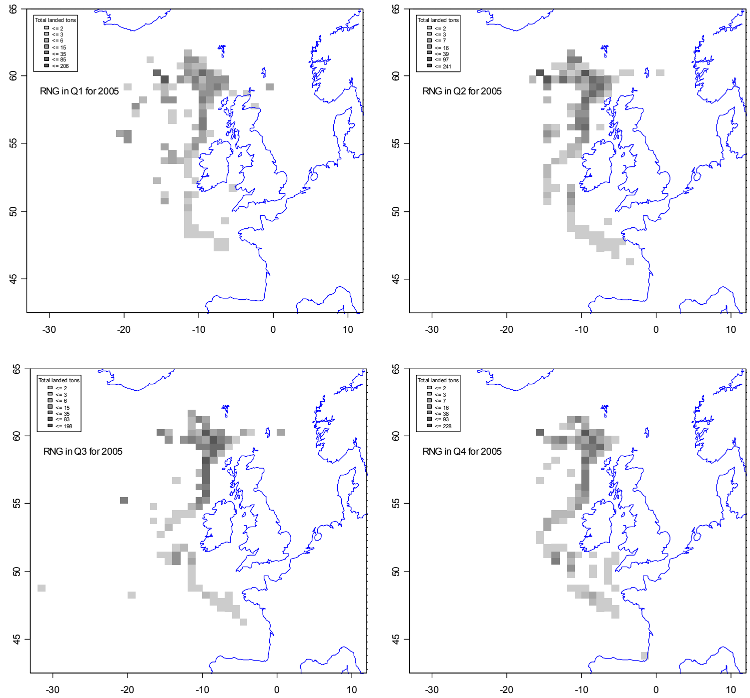


Figure 8.5.1. Aggregated landings of Roundnose grenadier by statistical rectangle and quarter, 2005.

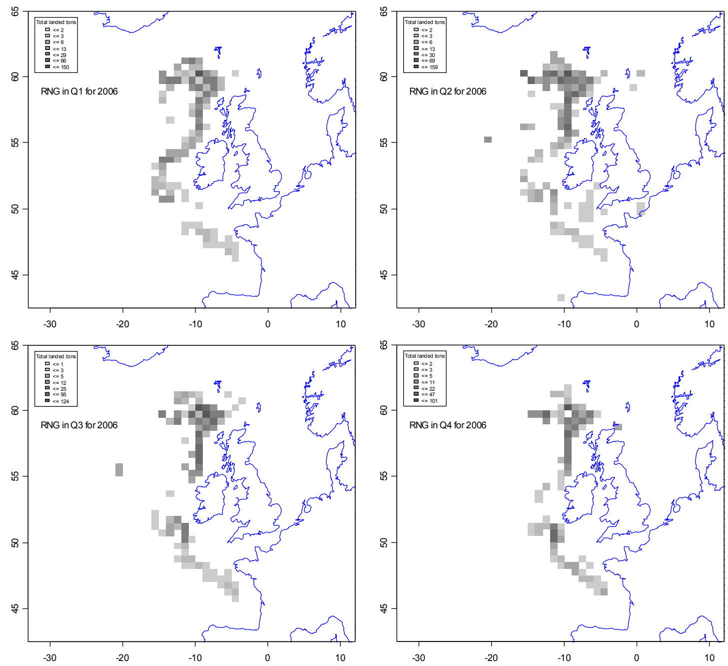


Figure 8.5.2. Aggregated landings of Roundnose grenadier by statistical rectangle and quarter, 2006.

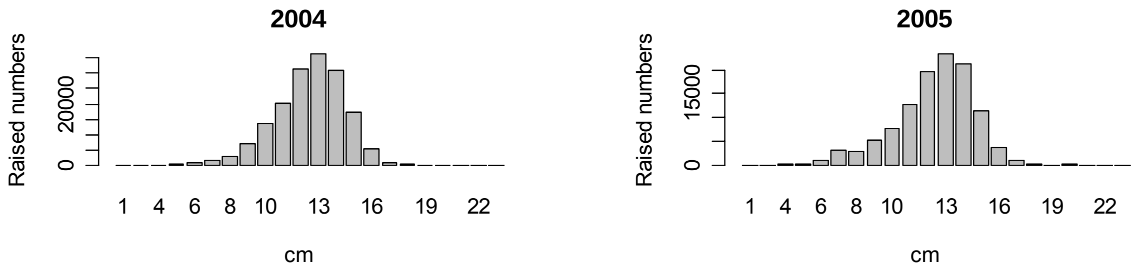


Figure 8.5.3. Length distribution of the discards of roundnose grenadier in 2004 and 2005, from observer program, numbers are raised to the total number of discarded roundnose grenadier in the program (see section 3.1).

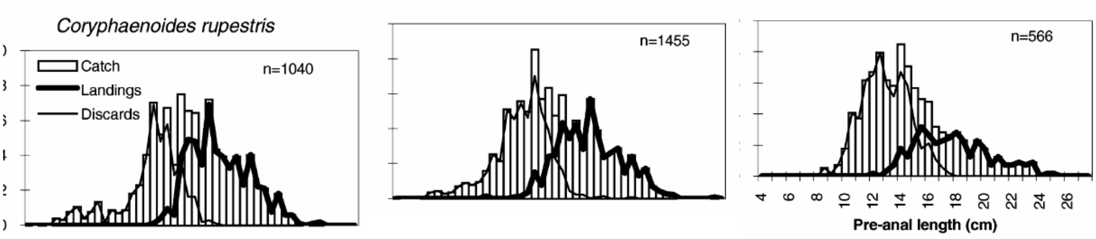


Figure 8.5.4. Length distribution of the discards and landings of roundnose grenadier in 1996-97 by depth, left: 800-1000m, centre: 100-1200m, right: 1200-1400 m, sampled on-board French vessels, (redrawn from Allain, 2003).

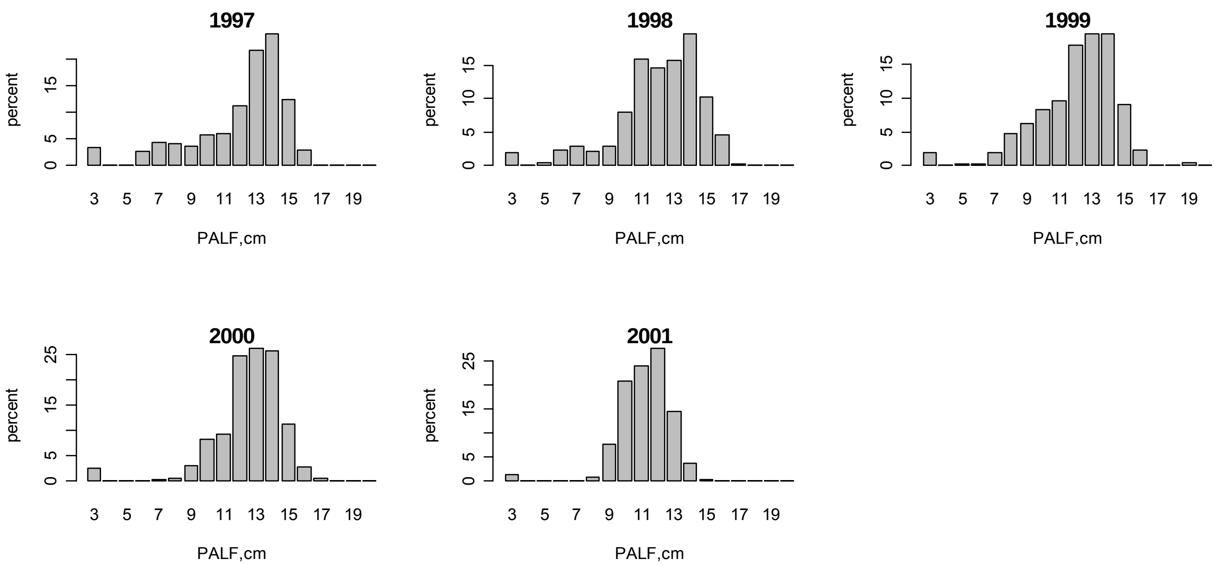


Figure 8.5.5. Length distribution of the discards of the French fleet, sampled on-board French vessels by Scottish observers, 1997-2001.

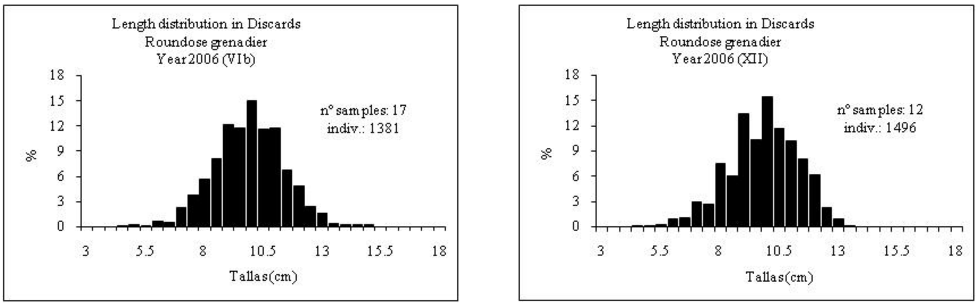


Figure 8.5.6. Length distribution of the discards of the Spanish fleet in divisions VIb and XIIb based on on-board observations in 2006 (P. Durán, *pers. com.*).

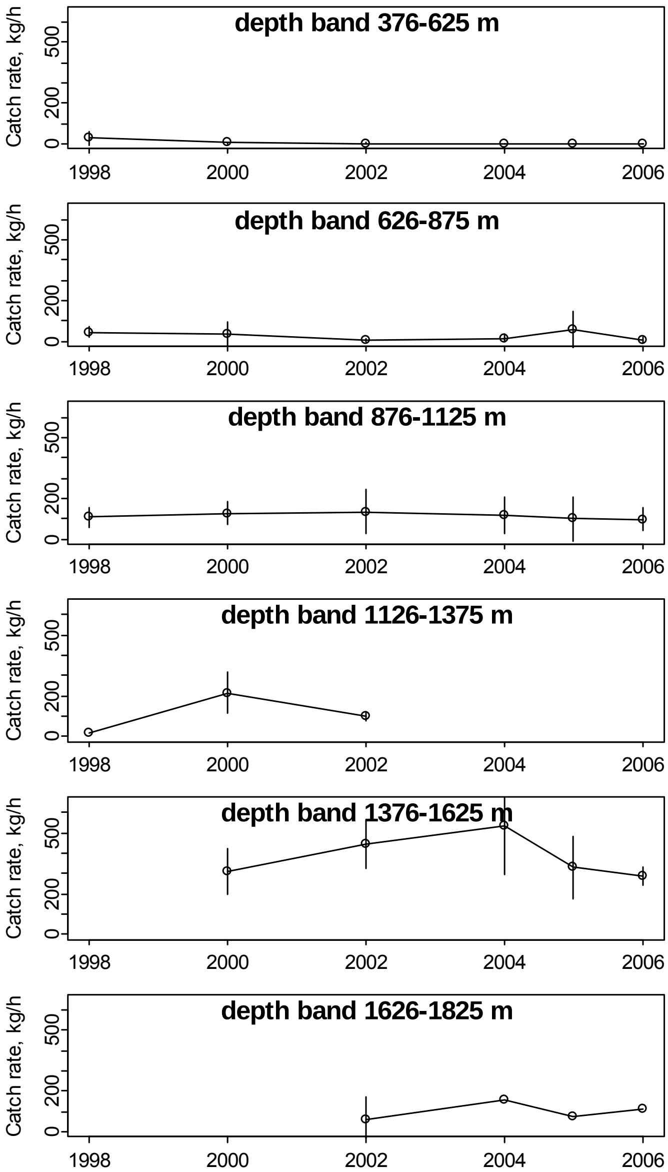


Figure 8.5.7. Catch rates of roundnose grenadier in FRS survey, 1998-2006 per depth band.

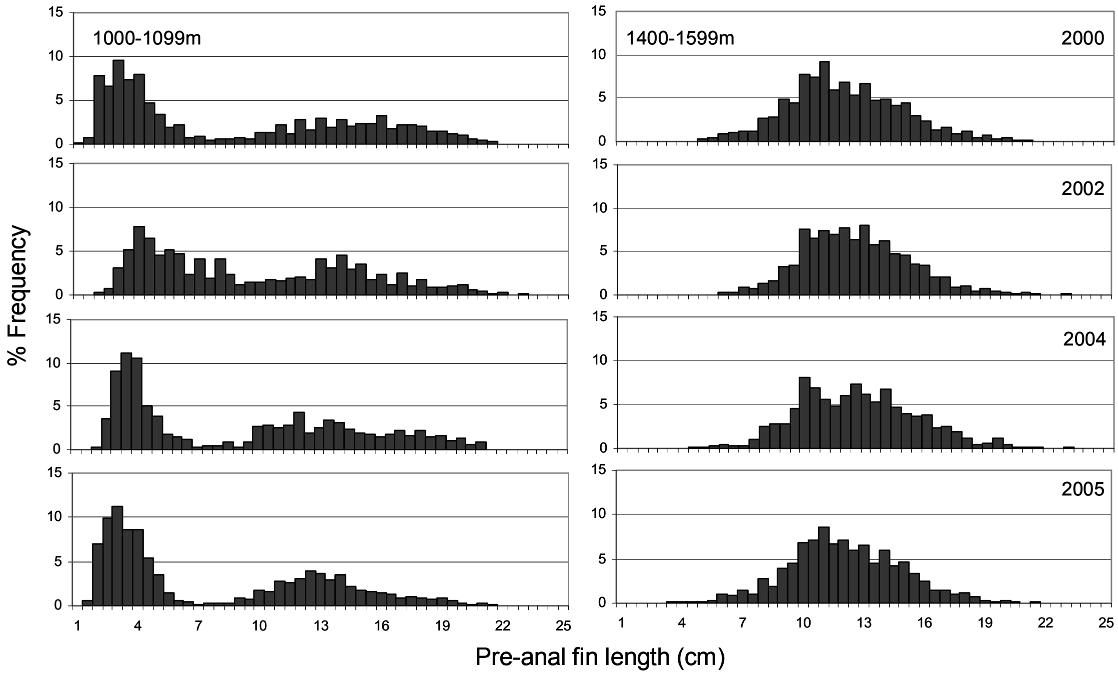


Figure 8.5.8. FRS survey, length frequency distribution (Pre-anal fin length) for *C. rupestris* caught at 1000-1099m and 1400 – 1599m between 55.5 and 58.5° N.

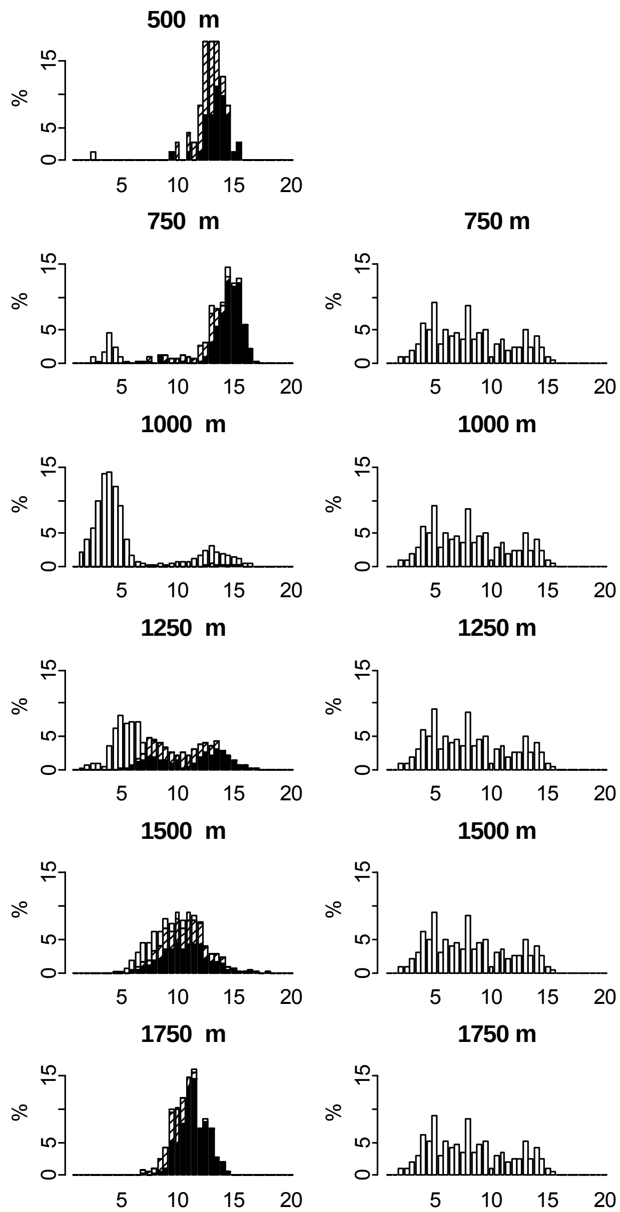


Figure 8.5.9. Length distribution (Head Length) of roundnose grenadier from pre-exploitation period (before the 1980s) per depth band in the Rockall Trough (left) and the Porcupine Seabight (right). Full black bars: females, hatched bars: males; white: immature or unsexed (from Gordon 1979 and SAMS, unpublished data).

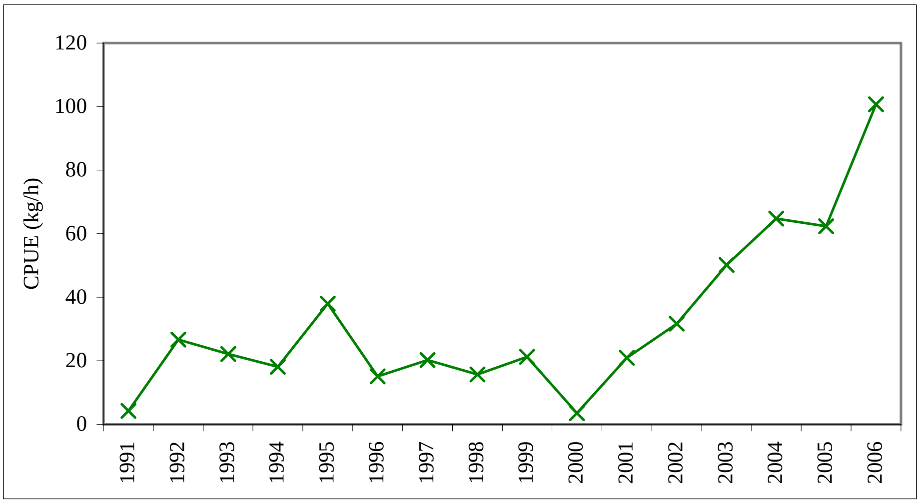


Figure. 8.5.10. Roundnose grenadier in Vb (Faroes). CPUE (kg/h) from Faroese otterboard trawlers >1000HP.

8.6 Black Scabbardfish (*APHANOPUS CARBO*) in Division Vb, Subareas VI, VII & XII

8.6.1 The fishery

The Faroese fisheries that take mostly place inside the Faroese zone (Division Vb), do not greatly differ from the description made in 2005 (ICES, 2005).

England and Wales UK(E+W) fisheries do not greatly differ from the descriprion made in 1998 (ICES, 1998) however looking at the landings there is some evidence of displacement of gill net effort to ICES areas VIII and IX as a result of the gillnet ban in depths greater than 600m in ICES areas VI and VII.

Scottish deep-water fisheries do not greatly differ from the descriprion made in ICES (2002). The Irish deepwater fishery commenced in 2000 with 10 boats fishing on the west and north of the Porcupine Bank The largest Irish deepwater fishery was the directed Orange Roughy trawl fishery, mainly based on the continental slopes of the Porcupine Bank in Divisions VIIc and VIIk, the "Peak" fishery. This fishery reached its maximum in 2002 and declined thereafter. Subsequently black scabbardfish became one of the main target species of the Irish deepwater fleet on the so-called "Flats" fishery, (ICES, 2005) with highest landings in 2003 and 2004. Since then the Irish deepwater fisheries are decreasing and this trend is continuing in 2006 with lowest landings recorded since the development of this fishery.

The French deep-water trawl fisheries do not greatly differ from the description made in in previous reports (e.g. ICES, 2002).

The Spanish fisheries carried out by Spanish stern bottom freezer trawlers in international waters of the Hatton Bank area (ICES XII & VIb) were described in 2005 by Muñoz et al. (2005).

8.6.1.1 Landings trends

Aggregated landings of black scabbard fish by statistical rectangle and quarter in 2005 and 2006 are presented in Figures 8.6.1 and 8.6.2. Landings from the subareas Vb, VI, VII and XII showed a markedly increasing trend from 1999 to 2002 followed by a decreasing trend (Figure 8.6.3). In recent years, landings in those subareas are at levels similar to those registered from 1992 to 1996. In Subareas VI and VII, French landings represent more than 90% of the total landings and 2006 French landings showed a marked decrease in subarea VII (Figure 8.6.4).

8.6.1.2 ICES advice

The ICES advice statement set in 2006 was: Given the perceived decrease in stock abundance in the northern areas, ICES recommends a reduction in exploitation to the level before the expansion of the fishery started (1990–1996) in Subareas V, VI, VII, and XII, corresponding to landings of no more than 3500 t.

8.6.1.3 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´s adopted for 2005& 2006 and 2006&2007, as well as the total landings in Subareas V, VI, VII and XII are next presented

V, VI, VII & XII	
Uptake in 2005	3714
Uptake in 2006*	3118
TAC (2005 & 2006 2007&2008)	3 042

* some member states did not reported 2006 landings

8.6.2 Stock identity

Black scabbardfish has a wide distribution in the NE Atlantic at depths between 200-1600m but there is very little objective information available on the stock structure of this species. Distribution of the species has led to hypothesis of a single stock but this remains uncertain. It is hypothesized that the species life cycle is not completed in just one area and also that either small or large scale migrations seem to occur seasonally.

8.6.3 Data available

Landing data were available for most of the relevant fleets. New revised Faroese CPUE data and French CPUE per depth strata and when black scabbardfish was the the target species were available. There was information on length from French landings and from Spanish observer programm.

8.6.3.1 Landings and discards

Landings per ICES rectangle in 2005 and 2006 were available from France, UK Scotland and Ireland and were aggregated by quarter and plotted to display the geographical distribution of the fishery. No new data on discards was made available.

8.6.3.2 Length compositions

Length frequency distributions by depth strata and quarter based on samples from French commercial bottom trawlers from 2004 to 2006 in subareas VIa and Vb are presented in Figures 8.6.5 and 8.6.6. The analysis of these Figures suggests the existence of two modes during the first and second quarter at depth strata 800 and 900 m. In deeper strata the length distributions are unimodal and larger fishes tend to occur at greater depths. Length frequency distributions from Spanish observer programm that is carry on onboard fishing vessels operating in Hatton Bank are presented in Figure 8.6.7.

8.6.3.3 Age compositions

No reliable age determinations are available yet.

8.6.3.4 Weight at age

No reliable age determinations are available yet.

8.6.3.5 Maturity and natural mortality

Information available on the species for ICES subareas Vb, VI, VII and XII consistently pointed out to the predominance of immature small specimens. At the Rockall Trough there is a weak indication that juveniles enter this region during the last quarter of the year (ICES, 2001).

8.6.3.6 Catch, effort and research vessel data

New information on CPUE from Faroese otterboard trawlers was presented (Ofstad; 2007 WD1) using the data from all available logbooks from 8 otterboard trawlers (HP>2000) that are stored in the Faroese Fisheries Laboratory database (Figure 8.6.8). The data retrieved from otterboard trawlers trawling at depths > 350 m and the area are west of the Faroe Islands. The effort was obtained from the logbooks is estimated as number of fishing (trawling) hours from the trawlers and the catch as kg reported to the Fisheries authorities.

8.6.3.7 Data analyses

No assessment trials were performed.

Table 8.6.1. Black scabbardfish in Division Vb

Year	Faeroe Islands Vb 1	Faeroe Islands Vb 2	Faeroe Islands Vb	France	Germany Vb1	Scotland	E&W&NI	Total
1988					-	-	-	0
1989	-	-		170	-	-	-	170
1990	2	10		415	-	-	-	417
1991	-	1		134	-	-	-	134
1992	1	3		101	-	-	-	102
1993	202	-		75	9	-	-	286
1994	114	-		45	1	-	-	160
1995	164	85		175	-	-	-	339
1996	56	1		129	-	-	-	185
1997	15	3		50	-	-	-	65
1998	36	-		144	-	-	-	180
1999	13	-		135	-	6	-	154
2000			116	186	-	9	-	195
2001	122	281		447	-	20	0	589
2002	222	1138		311	-	80		613
2003	222	1230		171	-	11		404
2004	80	625		93	-	70		243
2005	65	363		106	-	20		191
2006	106	579		93	-			198

Table 8.6.2. A71Black scabbardfish in Sub-area VI

Year	France VIa	France VIb	Faroes VIa	Faroes VIb	Germany VIa	Germany VI b	Ireland VIa	Scotland VIa	Scotland VIb	Netherlands VIa	**Lituania	**Estonia VIb	**Poland VIb	**Russian Federation VIb	Total
1988					-	-									0
1989	138	0	46		-	-		-	-	-	.	.	-	.	184
1990	971	53			-	-		-	-	-	.	.	-	.	1023
1991	2244	62			-	-		-	-	-	.	-	-	.	2307
1992	2998	113	3		-	-		-	-	-	-	-	-	-	3113
1993	2857	87		62	48	-		-	-	-	-	-	-	-	3054
1994	2331	55			30	15		2	-	-	-	-	-	-	2433
1995	2598	15			-	3		14	4	-	-	-	-	-	2634
1996	2980	1			-	2		36	<0.5	-	-	-	-	-	3019
1997	2278	16		3	-	-		147	88	-	-	-	-	-	2533
1998	1094	3			-	-		142	6	-	-	-	-	-	1246
1999	1610	8			-	-		133	58	11	-	-	-	-	1820
2000	2695	25			-	-		333	41	7	-	-	-	-	3101
2001	3269	28		3	-	-		486	145	-	3	225	-	2	4162
2002	3473	131	2		-	-		603	300	21	9	-	2	-	4541
2003	2830	60	45		-	-		78	9	-	12	7	2	-	3043
2004	2595	98	59		-	-		100	24	-	85	5	-	-	2967
2005	2533	59	38		-	-		18	62	-	5	11	-	-	2727
2006	1714	36	49		-	-	1	63			-	-			1863

Table 8.6.3. Black scabbardfish in Subaraea VII

Year	France	France	France	France	France	France	Ireland	Ireland	Ireland	Scotland	E&W&NI	Spain	
	VIIa	VIIb	VIIc	VIId-h	VIIj	VIIk	VIIb;VIIj	VIIc	VIIk	VIIb,c,j,k	VIIj;VIIk	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	60	6	45	79				0			205
1999	0	7	97	3	70	177				0			354
2000	0	25	169	4	88	238				3			527
2001	0	39	227	6	161	249				41			723
2002	0	29	102	6	115	51				53			356
2003	0	15	28	4	157	36				1			241
2004	0	31	28	16	124	63				0			262
2005	5	6	11	19	105	23							168
2006		3	10	24	315	20	1	32	37	0	2	1	446

Table 8.6.4. Black scabbardfish in Sub-areas VI and VII

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
2006		-		0

Table 8.6.5. Black scabbardfish in Sub-area XII

Year	Faroes	France	Germany	Spain	Scotland	Ireland	E&W&NI	Iceland**	Lituania	Estonia	Poland	Total
1988												0
1989		0							.	.	-	0
1990		0							.	.	-	0
1991		2							.	-	-	2
1992		7							-	-	-	7
1993	1051	24	93						-	-	-	1168
1994	779	9	45						-	-	-	833
1995	301	8							-	-	-	309
1996	187	7		253				0	-	-	-	447
1997	102	1		98					-	-	-	201
1998	20	0		134					-	-	-	154
1999		3		109	0				-	-	-	112
2000	1	6		237					-	-	-	244
2001		3		115					-	-	-	118
2002		0		1059	1		0		-	-	-	1060
2003		7		403		1			1	-	1	413
2004	95	10		165	1				1	-	-	272
2005	127	14		0		0			-	1	-	143
2006	8	0		-								8

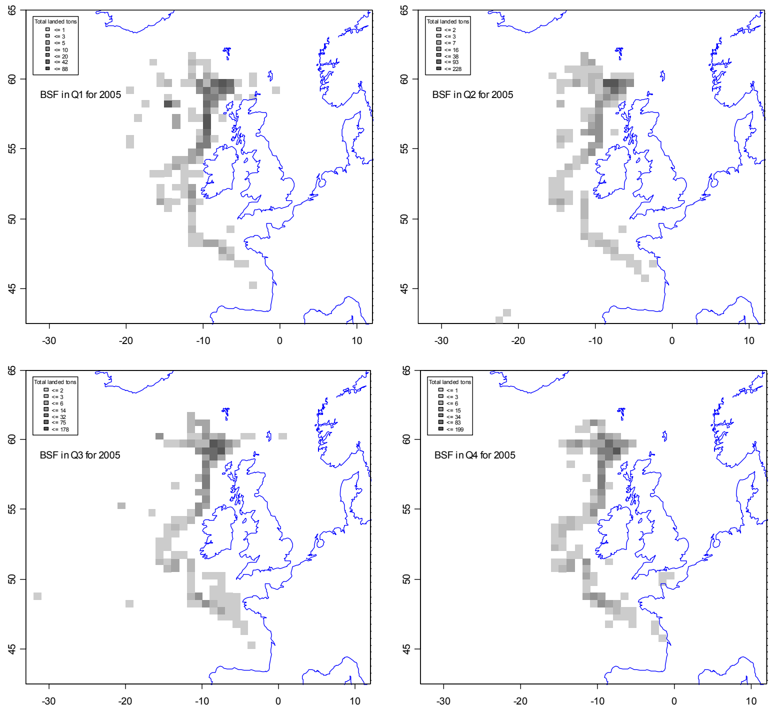


Figure 8.6.1 – Aggregated landings of Black scabbard fish by statistical rectangle and quarter, 2005

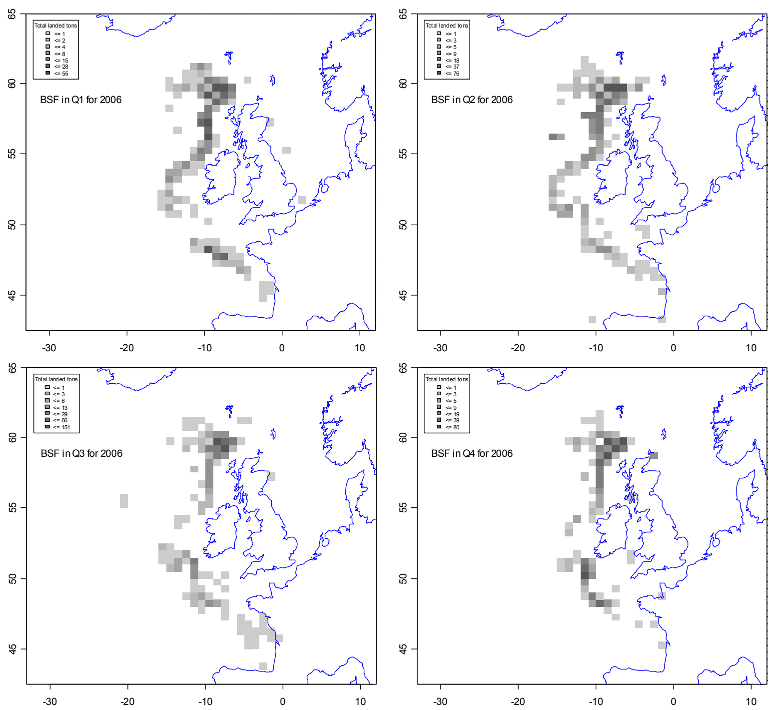


Figure 8.6.2 – Aggregated landings of Black scabbard fish by statistical rectangle and quarter, 2006.

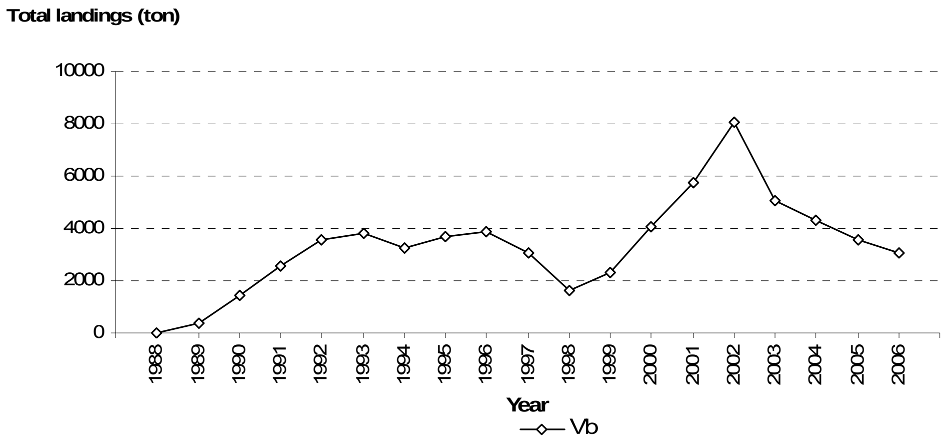


Figure 8.6.3 – Annual total landings (tons) in subareas Vb, VI+VII and XII from 1988 to 2006.

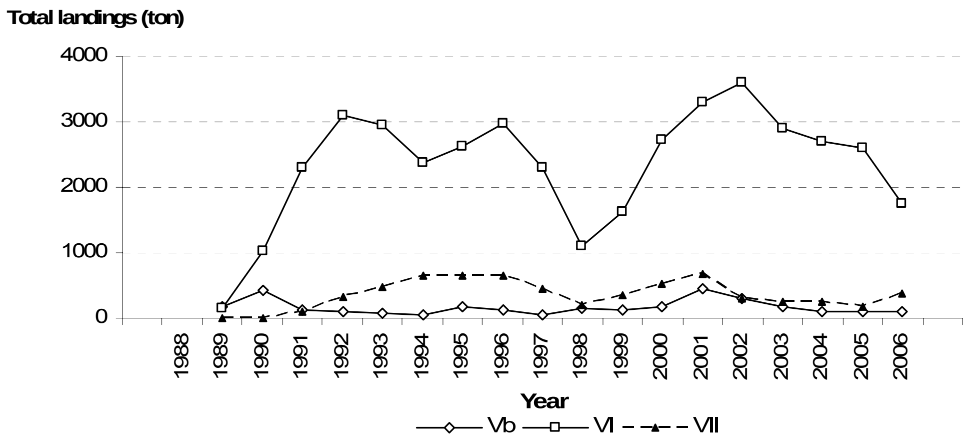


Figure 8.6.4 – French annual total landings (tons) in subareas Vb, VI and VII from 1988 to 2006.

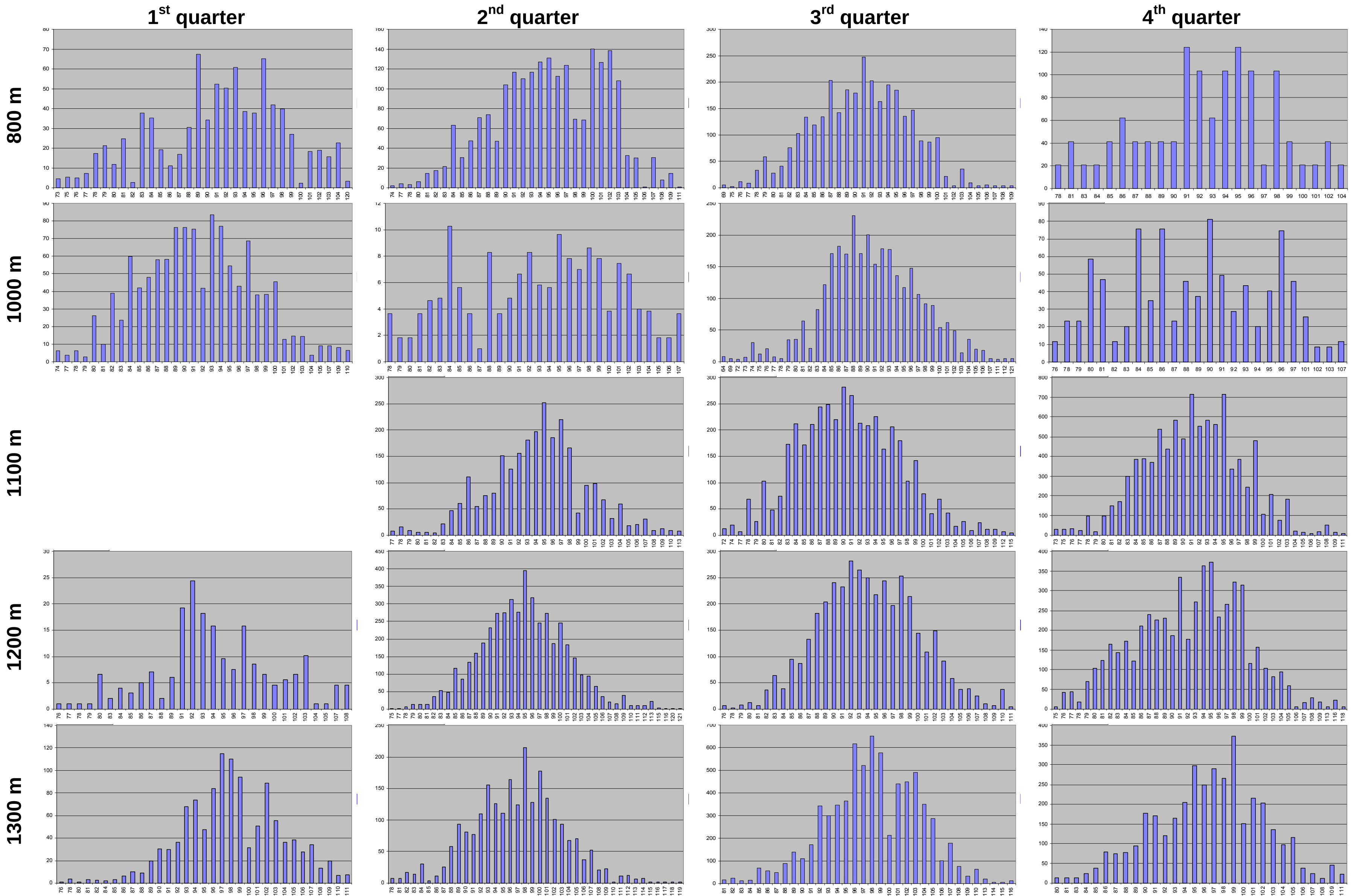


Figure 8.6.5. Length frequency distribution by quarter and depth of French catches, from on-board observations 2004-2006 in Sub-area VIa.

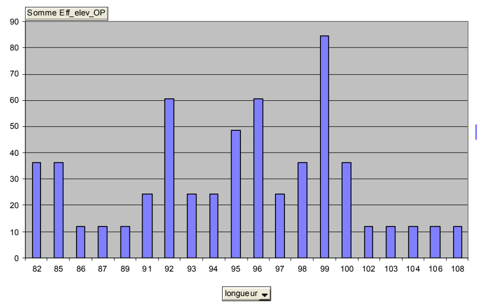


Figure 8.6.6 - Length frequency distribution on French trawler samples collected from 2004 to 2006 in Sub-area Vb during the 1st quarter at 1200m.

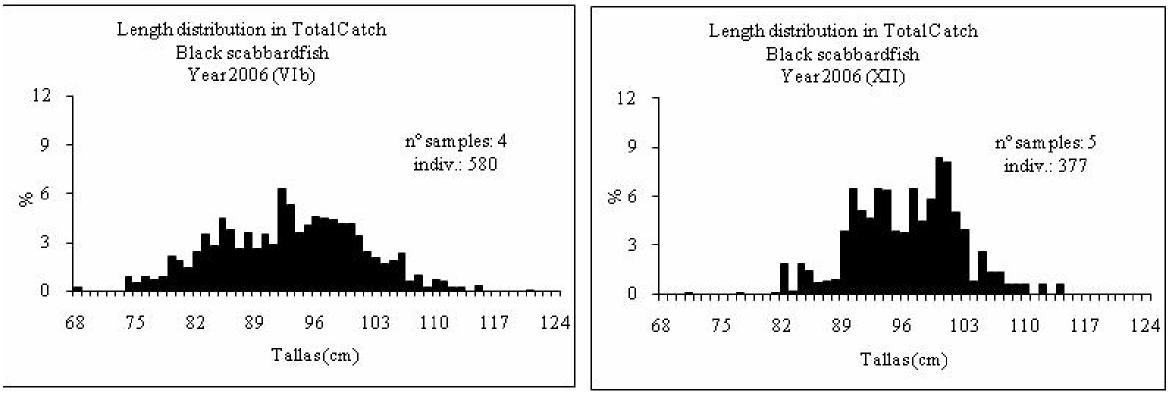


Figure 8.6.7 - Length frequency distribution on Spanish observer program in 2006.

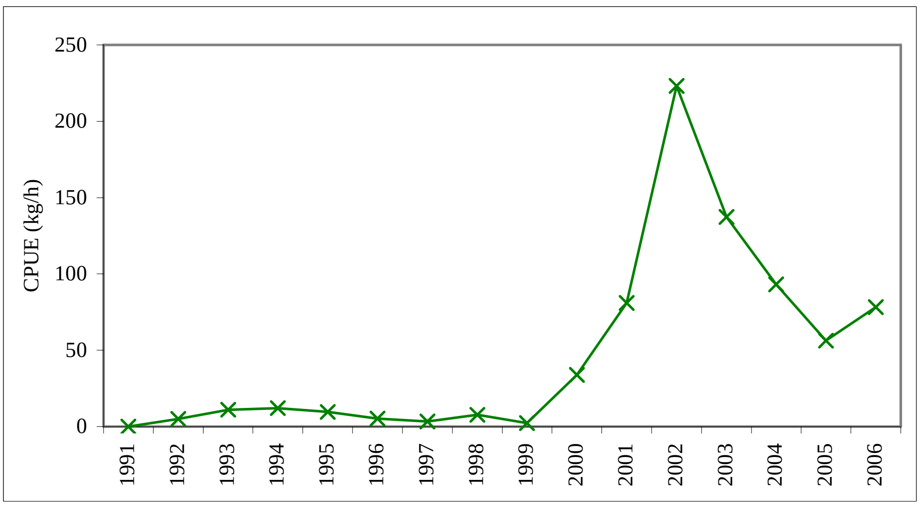


Figure 8.6.8 - Black scabbard fish in Vb (Faroes). CPUE (kg/h) from otterboard trawlers > 1000 HP.

9 Stocks and fisheries of the North Sea

9.1 Fisheries overview

9.1.1 Trends in fisheries

A landings overview is shown in Figure 9.1.1. At present, the main fisheries currently targeting deep sea species in the IIIa and IV are the following:

- By-catches of ling and tusk are taken in the U.K. 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). By-catches of deep-sea fish species, such as Anglerfish, tusk and witch flounder, are also landed. Also by-catches 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 by-catch. Further information on these fisheries and the by-catches is found in ICES WGPAND reports.
- Bottom trawl fisheries mainly in the northeastern North Sea directed at mixed demersal species including ling, tusk and anglerfish.
- Minor fisheries in Skagerrak (IIIa) targeting witch flounder by Denmark and Sweden. Mainly trawl fisheries, but also Danish seine has been used. Further information is found in ICES WGNEW report.
- A Danish directed trawl fishery for roundnose grenadier in the deeper parts of Skagerrak carried out by very few vessels.
- A directed midwater trawl fishery for greater silver smelt, conducted mainly by Norway, in IVa.

Table 9.1.1 gives an overview of the landings by country for the area.

The fishery for roundnose grenadier in Skagerrak.

As mentioned above, minor catches of roundnose grenadier are taken as by-catch by shrimp (*Pandalus*) trawlers in IIIa (Skagerrak) and occasionally landed (mainly for reduction). However, since the 1980s a Danish directed fishery for roundnose grenadier has been conducted in the deeper part of Skagerrak. in 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 characterised by a mesh size < 70 mm in the codend, most often 55 mm has been recorded. Vessel sizes are around 30 m. Due to 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 in recent years 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 have since 2003 increased to more than 10000 t in 2005. Landing decreased, however, again in 2006 to around 2300 tons. In the recent 4 years a total of 2-3 vessels have participated significantly in the fishery, see Sect. 9.2.

Table 9.1.1 Landings by country, division and species in 2006 for Division IIIa and Subarea IV.

Country	Division	Greater Silver smelt	Blue Ling	Ling	Roundnose Grenadier	Tusk	Witch Flounder	Lantern sharks	Rabbitfish	Sharks	Greater forkbeard	Others
DK	III a	370.1	42.4	94.9	2261.4	3.6	636.6	8.8	0.0			
	IV a	177.7	5.7	637.2	0.0	155.2	481.4	6.9	1.3			
	IV b	0.0	0.2	52.7	0.0	1.6	197.2	0.0	0.0			
	IV c	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0			
UK-e+w												
	IVa			54.9		5.1					3.0	
	IVb			19.6		0.0				1.0		
	IVc			0.2						4.0		
UK-scot												
	IVa	1.6	1.6	1454.5		119.8			0.4	3.4	2.7	6.9
	IVb			7.7		0.1				0.8		0.4
	IVc			0.1								
FRO												
	IVa			1.7		0.0						
	IVb											
	IVc											
NOR												
	IIIa	0.4	0.4	62.1	0.0	21.2						
	IVa	3467.4	81.7	4437.2	3.6	1853.5			11.6		130.0	
	IVb	0.0		16.1		29.7			0.9		4.5	
	IVc											
FRA												
	IVa		6.4	72.9	7.4	13.8			3.3			49.3
	IVb			0.0					0.0			
	IVc			0.0								
		4017.1	138.4	6911.8	2272.4	2203.6	1315.4	15.7	17.4	9.2	140.1	56.6

9.1.2 Technical interactions

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

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

The fishery for roundnose grenadier is directed at the aggregations of this species in the deepest part of Skagerrak, and the reported by-catch in this fishery seems rather insignificant, consisting of: Greater silversmelt, rabbitfish, blue ling and lantern shark.

9.1.3 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 deepwater 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, as such are particularly vulnerable to localized population depletion through heavy exploitation. There are a number sites in the north-east 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*.

9.1.4 Management measures

Management of fisheries in IIIa.

ICES Sub-div. 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 situation for the management of the Danish fishery for roundnose grenadier in IIIa in 2006 is described in Sect. 9.2.

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, while the fisheries in the Norwegian zone IV are managed according to Norwegian regulations following the EU-Norway negotiations.

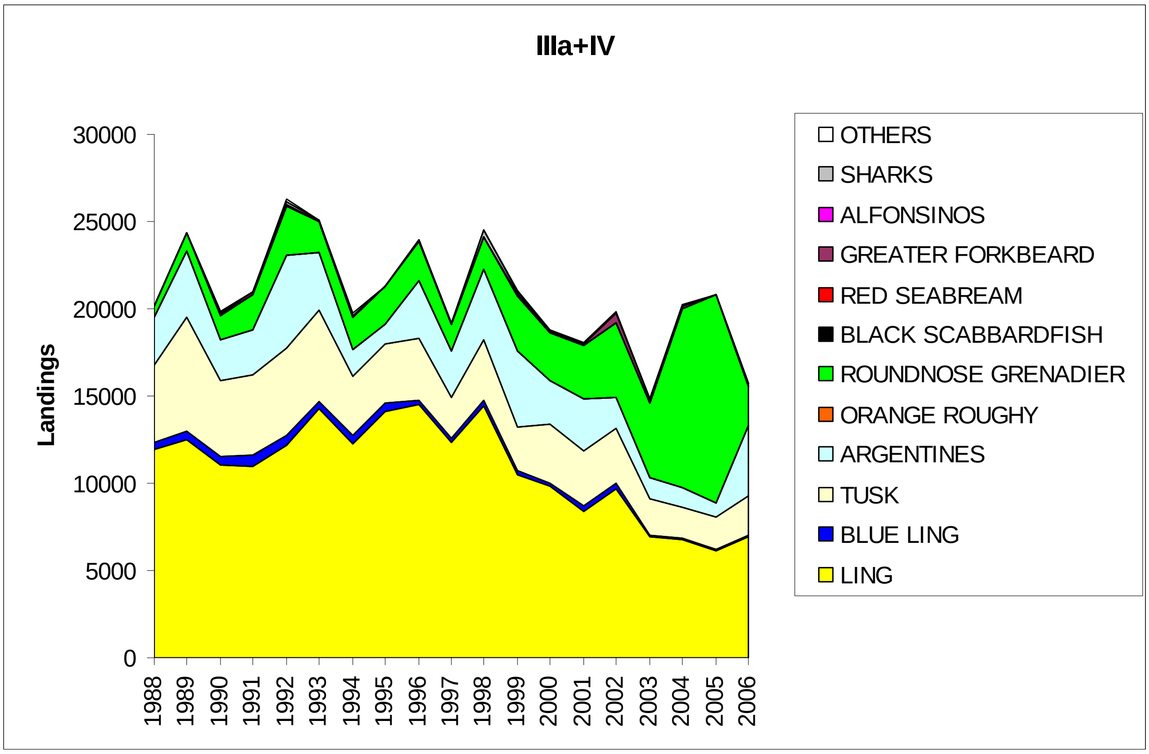


Figure 9.1.1. Overview of deep-sea species landings over 1988-2006 (tonnes).

9.2 Roundnose Grenadier (*Coryphaenoides rupestris*) in Division IIIa

9.2.1 Fishery

The stock of roundnose grenadier has been the basis for commercial exploitation by a few Danish vessels, in some years mainly a single vessel, since the late 1980s. 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 Fig. 9.2.1 and Tables 9.2.2 A-C. It is seen that a major part of the catches is taken in the Norwegian zone of Skagerrak. By-catch of roundnose grenadier is also taken in the fisheries for *Pandalus*. However, the landings of this by-catch (for reduction) are generally insignificant

9.2.1.1 Landings trends

WG figures for total landings, 1988-2006, by all countries are shown in Table 9.2.0 It is seen that only Denmark has contributed significantly to this fishery. Table 9.2.1 shows the total Danish landings of this species split in landings for H.C. and for reduction. These landings figures are 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 9.2.1 and Fig. 9.2.2). From a level of around 2000 t up to 2002, taken by a mainly a single vessel, total landings have since 2003 increased to more than 11000 t in 2005. Landings decreased, however, again in 2006 to 2261 tons. In the recent 4 years a total of 2-3 vessels have participated significantly in the fishery.

9.2.1.2 ICES advice

No assessment of stock status was possible in the 2004 WGDEEP meeting and no alarming new development in the fishery had been observed. Therefore, ICES could only give a general species relevant statement for this stock in 2004:

"*Due to its biological parameters, the species can only sustain low fishing mortality and recovery of depleted stock(s) can only be slow*".

For roundnose grenadier ICES recommended:

"For subareas VI and VII and Divisions Vb and IIIa a reduction in effort by 50% from 2000-2002 effort is required. In all other areas, the expansion of fisheries should not be allowed until reliable assessments indicate that increased harvests are sustainable"

In 2005 ICES (ACFM) did not update the advice, because the ICES WGDEEP did not have a regular meeting and hence did not provide any assessment or full evaluation.

However, the continuing high fishing pressure in 2005 lead to a request by Norway to the EU for a more precautionary (and restrictive) management of this particular fishery (see 9.2.1.3).

Based on the high fishing pressure in Division IIIa in 2004 and 2005 ICES (ACFM) in 2006 advised: *For this fishery, the fishing pressure should be reduced considerably to low levels and should only be allowed to expand again very slowly if and when reliable indicators show that increased harvests are sustainable. ICES recommends a 50% reduction of effort compared to the level before the fishery expanded (1991–1999). This is interpreted as a reduction of 50% in landings and corresponds to a catch level around 1000 t in 2007.*

9.2.1.3 Management

The directed fishery for grenadier is mainly carried out in the Norwegian EEZ, and the fishery has been 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 in April 2006.

9.2.2 Stock identity.

Based on investigations on: 1) geographical distribution patterns of both juveniles and adults, 2) spawning patterns and eggs and larvae distributions (Bergstad 1990; Bergstad and Gordon 1994; Mauchline et al. 1994; Bergstad et al. 2003) it is likely that the stock of Roundnose grenadier found in the deepest parts of Skagerrak (IIIa) and the Norwegian Deep (north eastern part of the North Sea) constitute a stock separated from the other stock(s) of this species found on in other areas in the North Atlantic.

9.2.3 Data available.

9.2.3.1 Size frequency data.

Length frequency data (and corresponding weight 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 is 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 shown 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

Figs. 9.2.3 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. One may interpret the small one as recruits to the fishery. In the 2005 and 2006 distribution no such clear mode of small individuals is seen, and it looks as if the 2004 mode now is merging with the larger group.

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.

9.2.3.2 Effort and CPUE.

Tables 9.2.2 A-C and Fig. 9.2.2 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 shown here differ slightly from the final (adjusted) landings figures (Table 9.2.1) due to the species allocation procedures in the recording the industrial landings.

9.2.4 Data analyses.

Trends in effort and CPUE.

The catch, effort and CPUE remain more or less at the same level up to and including 2002 (Tables 9.2.2 A-C). Catches and effort increased in 2003 while CPUE was stable. In 2004 and 2005 the catches increased dramatically. The CPUE decreased between 2003 and 2004 but increased again between 2004 and 2005 to the second highest level in the time series. 2005 saw a decline in recorded effort, while CPUE increased slightly to the highest level in the time series compared to 2004. In 2006 catches decreased to the level before 2003 and the effort was reduced to a little above ½ the effort before 2003, while the CPUE increased slightly. The overall (average) CPUE figures could, however, be blurred by a shift in the geographical distribution of the fishery in the last years possibly including hitherto unexploited parts of the stock in the fishery (Tables 9.2.2 A-C).

- Part of the explanation of the increasing CPUEs may reflect enhanced skills or recent technological improvements in the fishery.
- Another explanation could be enhanced production in the stock. An increase in recruitment and growth conditions may have happened, perhaps facilitated by favourable environmental conditions or other environmental changes, e.g. changes in species composition. Currently there is no information on recruitment variation for grenadier.

The directed fishery in 2006 was closed in April.

Stock situation

Considering the limited geographical distribution of this stock and the (likely) slow growth of the individuals in the stock on the one side and increasing fishing effort on the other one would expect some responding signals from the stock to the increasing fishing pressure in recent years. However the insufficient data available for the stock do not give conclusive signals on the stock situation:

- Assuming that the larger of the two size groups contains many age groups the decrease in mean length, observed by comparison of the 1987 size distribution with the ones for 2004 - 2006, could indicate an increasing fishing pressure on the stock during this period.
- Independent of the number of age groups in the each of the two distinct size groups <u>the difference</u> of the 2004 and 2005 size distribution suggests that recruitment to the fishery was larger in 2004 than in 2005 and 2006.
- The trends in the Danish CPUEs based on logbook records (Table 9.2.2 C) does not indicate any signs of decline in stock abundance.

Thus, even if more biological and fisheries data for this stock were available to WGDEEP in 2007 than in previous years for this stock, it was not possible assess the status of the stock. However, assuming the growth of this species is as slow as indicated from the 1987 investigation, then a collapse of this stock will be highly probable with a fishing pressure at the level observed in 2005. The group therefore stress the urgent need for further biological information to elucidate the dynamics of this stock. Such investigations should include 1) fishery independent abundance estimates (Norwegian survey data exist) with special focus on the recruiting size (age) groups, 2) analyses of the current age composition in the stock with special reference to growth, production and exploitation. In this connection WGDEEP points out that this stock is particular suited for such investigations, since it is geographically isolated from other stocks of roundnose grenadiers.

Table 9.2.0. Roundnose grenadier in Division IIIa. 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**

* Preliminary data

Table 9.2.1. 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	2207000	**2213**
1997		1356280	**1356**
1998	635	1489000	**1490**
1999		3113000	**3113**
2000	315	2400000	**2400**
2001	6401	3061000	**3067**
2002	4	4195738	**4196**
2003	7	4301661	**4302**
2004	3129	9870664	**9874**
2005	17056	11904545	**11922**
2006	2448	2259000	**2261**

Table 9.2.2 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**

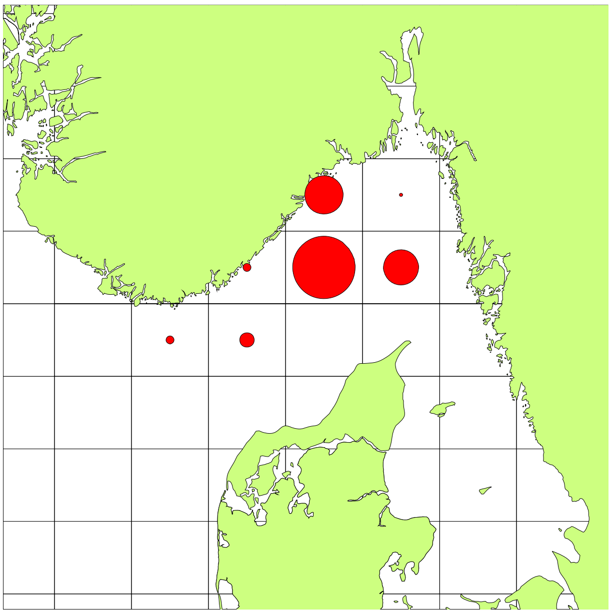


Figure 9.2.1 Geographical distribution of the fishery for roundnose grenadier in IIIa in 2006.

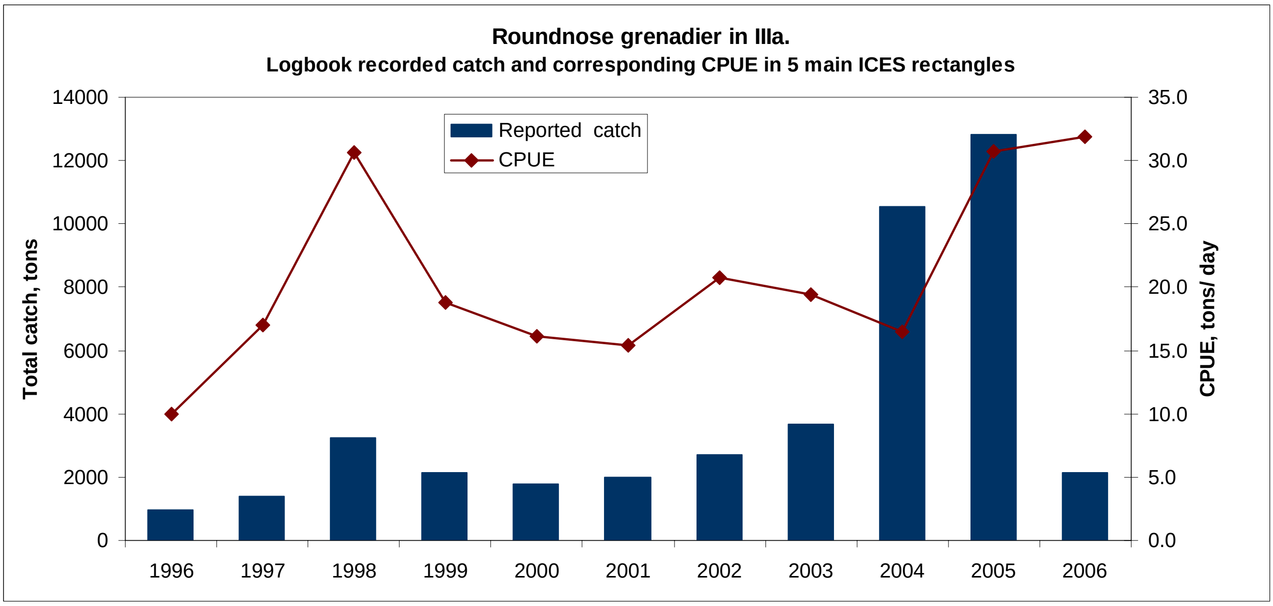


Figure 9.2.2. Danish catches and CPUE by main ICES rectangle. Based on logbook records.

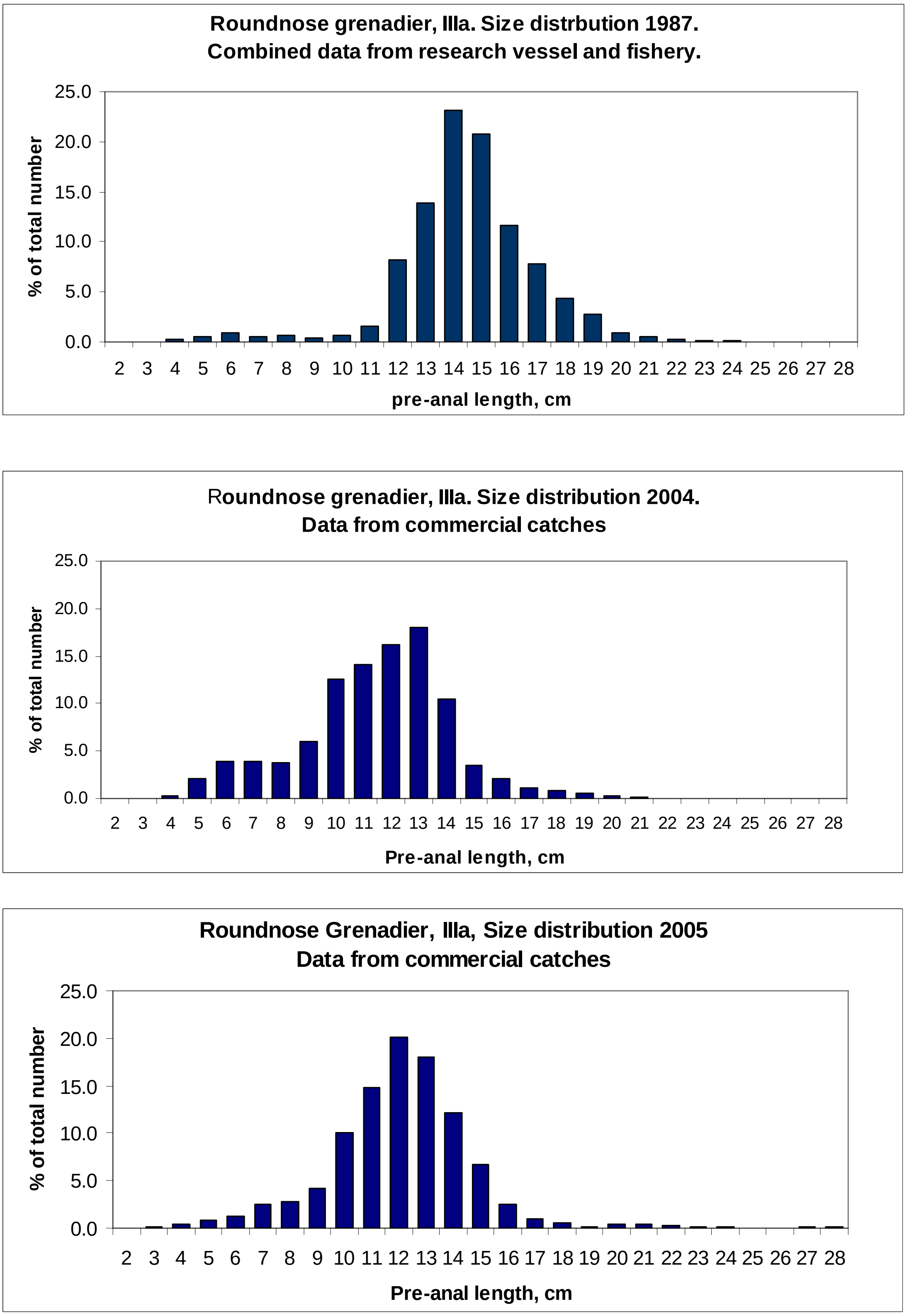


Figure 9.2.3 A-C. Length distribution Danish catches of roundnose grenadier.

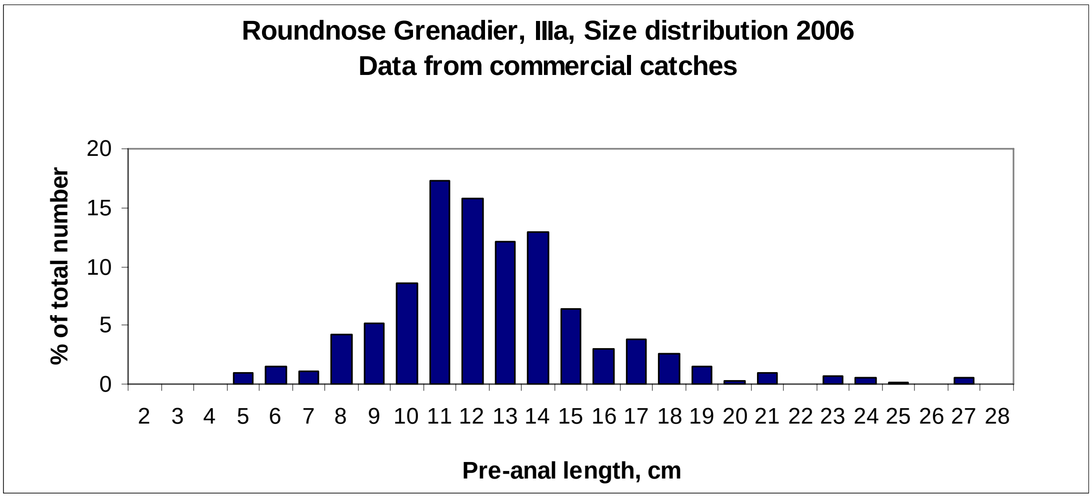


Figure 9.2.3 D. Length distribution Danish catches of roundnose grenadier.

10 Stocks and fisheries of the South European Atlantic Shelf

10.1 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 by-catch of deepwater species. These include *Molva spp*., *Phycis phycis*, *Phycis blennoides*, *Conger conger*, *Helicolenus dactylopterus*, *Polyprion americanus*, *Beryx spp* and *Pagellus bogaraveo*.
- ✓ Longline fishery mainly targets deepwater species on conger, greater forkbeard and ling.

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 deepwater 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 by-catches 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*).

In 2006 a new deep-water gillnet **UK (E+W) fishery** was initiated in Subareas VIII and IX. In Subarea VIII the main target species of this fishery are deep-water-sharks (23 tons) and the deep-water crab (*Chaceon spp.*) 22 tons. In Subarea IX the target species are deep-water crab (283 tons) and several deep-water sharks (135 tons, plus 31 tons of livers and oil)

10.1.1 Trends in fisheries

Although since 1988 from six to seventeen deep species are usually landed, historically the catches of *Aphanopus carbo* (45,0%) *Lepidopus caudatus* (21,3%) *Pagellus bogaraveo* (11,2%), *Molva molva* (10,6%), *Phycis blennoides* (4,9%), *Polyprion americanus* (3,3%) and *Beryx spp*.(1,5%) represent on average the 98 % of otal Subarea VIII and IX landings.

Since 1988 on average 7221 ton of these species are landed from these subareas, but in last 7 years this amount has been never reached (Table 10.1.1). In 1995 an important peak of 12678 ton is observed due to an increase of *L. caudatus* landings in Subarea IX.

Other deep species as *Conger conger* have been landed in last years by Spanish longline and trawlers in VIII and Portugal trawlers in IX, in comparable amounts to *Aphanopus carbo* 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's worthy of remark that most of *A. carbo* and *L. caudatus* landings come from Subarea IX. Landings of Black scabbarfish never has been lower than 2500 tons/year, and in 1993 reached its higher value (4524 tons). Since this year the trend indicates a decrease until 2002, and after this year the landings remained around 2500 ton.

The trend of Silver sacabbarfish landings is very variable along the period 1988-2006. Landings have been often lower than 2500 tons, except in 1995 in which 5672 tons were reached.

In 2000 only 16 tons are recorded but in 2006 the landings of this species were increased up to 620 ton. (Figure 10.1.1).

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

Historically the main landings of Red seabream come from Subarea IX (82% on average). From 1988 to 1998 the landings rank between 800 and 1000 tons, but since 1999 the total landings have been always below 700 ton.

Almost the 100% of total landings of ling come from Subarea VIII. The series shows 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 tons) is raised. However from 1999 to 2006 landings of this species have been decreased strongly (Figure 10.1.1).

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

Since 1997 the 85% of Greater forkbeard landings belongs to Subarea VIII. The landings show a clear increase from 1988 to 1998. After this year the reported data rank between 400 and 600 tons/year.

The wreckfish landings don not show a clear trend, and during the historical series landings from 123 tons to 410 ton per annum can be observed.

The most important landings of Alfonsinos in Subareas VIII and IX ware recorded in 1995. Although a noticeable decline in catches is recorded in 2003, from 1995 to 2005 an increase of landing trends is observed. Landings in 2006 decreased up to 94 ton, one of the lowest levels of the series (Figure 9.1.1).

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

For this species there are no historical landings in Subareas VII and IX. However in 2006 the level of landings in Subarea VIII reached 22 tons and 283 tons in Subarea IX. In this new fishery deep-water sharks are the main by-catch species .

10.1.2 Technical interactions

The new two 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.

An update of information provided in WGDeep 2006 of gear interaction of Spanish fleet and new information on UK (E & W) fishing deep-water species during the period 2005-2006 is shown in tables 10.1.2, and 10.1.3 respectively.

10.1.3 Ecosystem considerations

Chaceon affinis is normally found on seamounts and escarpments at depths over 500 m., and has already been shown to be vulnerable in certain areas of the Atlantic. Available data suggests that king crab can be taken as by-catch in the gillnet fishery for anglerfish and deepwater shark but there is also some evidence of directed fishing in some areas for this species, as it seems to be in 2006 in Subareas VIII and mainly in IX.

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 north east Atlantic fishery for shark and monkfish. The problem of ghost fishing in deep-water gillnet fisheries appears to be of a different order of magnitude compared to other fisheries in the EU, and as such warrants immediate action and research by the EU, Member States and the industry involved.

10.1.4 Management measures

Caution should be taken with the Deep-water crab fishery due to the lack of biological information of this species.

The use of fixed gillnets at depths of over 200 metres has already been banned in the Macaronesian archipelagos of the Azores, Madeira and the Canary Islands. Council Regulation 51/2006 prohibited Community vessels from deploying gillnets at a depth greater than 200 m in ICES Divisions VIa and b, VIIb, c, j and k and in Subarea XII east of 27º West before the complete prohibition on February 1, 2006.

Table 10.1.1. Overview of landings in Sub-Areas VIII & IX.

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

Table 10.1.2. Quantitative description of fishing gears and deepwater species interaction of Spanish fleets in Subareas VIII and IX.

		2005		2006*	
Species	**Gear**	**VIII**	**IX**	**VIII**	**IX**
Molva molva	Hooks and (long)lines	47	0	48	0
	Gillnets	16	0	8	0
	Bottom trawl	12	0	17	0
	Others	66	0	0	0
Molva dypterygia	Hooks and (long)lines	3	0	4	0
	Gillnets	7	0	8	0
	Bottom trawl	14	8	12	3
	Others	23	0	0	0
Brosme brosme	Hooks and (long)lines	0	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	0
	Others	0	0	0	0
Argentina silus	Hooks and (long)lines	0	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	0
	Others	0	0	0	0
Hoplostethus atlanticus	Hooks and (long)lines	0	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	0
	Others	0	0	0	0
Coryphaenoides rupestris	Hooks and (long)lines	0	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	1	0
	Others	0	0	0	0
Aphanopus carbo	Hooks and (long)lines	0	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	1	0	0	0
	Others	0	0	0	0
Pagellus bogaraveo	Hooks and (long)lines	44	334	28	369
	Gillnets	6	0	7	0
	Bottom trawl	16	2	21	4
	Others	24	29	1	66
Phycis spp	Hooks and (long)lines	148	0	80	1
	Gillnets	8	0	21	1
	Bottom trawl	97	39	84	26
	Others	0	18	0	40

		2005		2006*	
Species	**Gear**	**VIII**	**IX**	**VIII**	**IX**
Beryx spp	Hooks and (long)line	21	0	26	2
	Gillnets	35	0	13	0
	Bottom trawl	19	0	7	1
	Others	62	6	1	2
Macrourus berglax	Hooks and (long)line	0	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	0
	Others	0	0	0	0
Mora moro	Hooks and (long)line	9	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	0
	Others	0	0	1	0
Chimaera monstrosa & Hydrolagus spp.	Hooks and (long)line	0	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	0
	Others	0	0	0	0
Alepocephalus bairdii	Hooks and (long)line	0	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	0
	Others	0	0	0	0
Polyprion americanus	Hooks and (long)line	15	0	2	1
	Gillnets	0	0	0	0
	Bottom trawl	0	1	0	2
	Others	0	5	0	6
Helicolenus dactylopterus	Hooks and (long)line	4	8	6	18
	Gillnets	3	0	1	1
	Bottom trawl	33	81	44	62
	Others	8	3	3	5
Lepidopus caudatus	Hooks and (long)line	0	449	0	563
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	51
	Others	0	59	0	0
Epigonus telescopus	Hooks and (long)line	2	0	0	0
	Gillnets	0	0	0	0
	Bottom trawl	0	0	0	0
	Others	0	0	0	0

Table 10.1.3. Quantitative description of fishing gears and deepwater species interaction of England and Wales fleets in Subareas VIII and IX.

		2005	2006	
Species	**Gear**	**VIII**	**VIII**	**IX**
Alfonsino (Beryx)	Nets		3	
Bairds Smoothhead	Nets		14	
Birdbeak dogfish	Nets		0,2	4
Bluemouth redfish	Nets		8	
Conger eels	Bottom trawl	1		
	Lines	76	72	
	Nets	1	2	
Deepwater red crab	Nets		22	283
	Pots			6
Dogfish (scyliorhinidae)	Bottom trawl	3		
Greater forkbeard	Bottom trawl	0,01		
	Lines	0,03		
Gulper shark	Nets		0,1	9
Kitefin shark	Nets		0,1	4
Leafscale gulper shark	Nets		2	3
Ling	Bottom trawl	0,02		
	Lines	17	30	
	Nets	1	15	
Livers and oils	Lines			
	Nets		3	31
	Pots			1
Longnose velvet dogfish	Lines			13
	Nets		17	82
Portuguese dogfish	Lines			1
	Nets		1	17
Sea breams	Lines		0,1	
	Nets		0,03	
Unidentified sharks	Nets		1	1

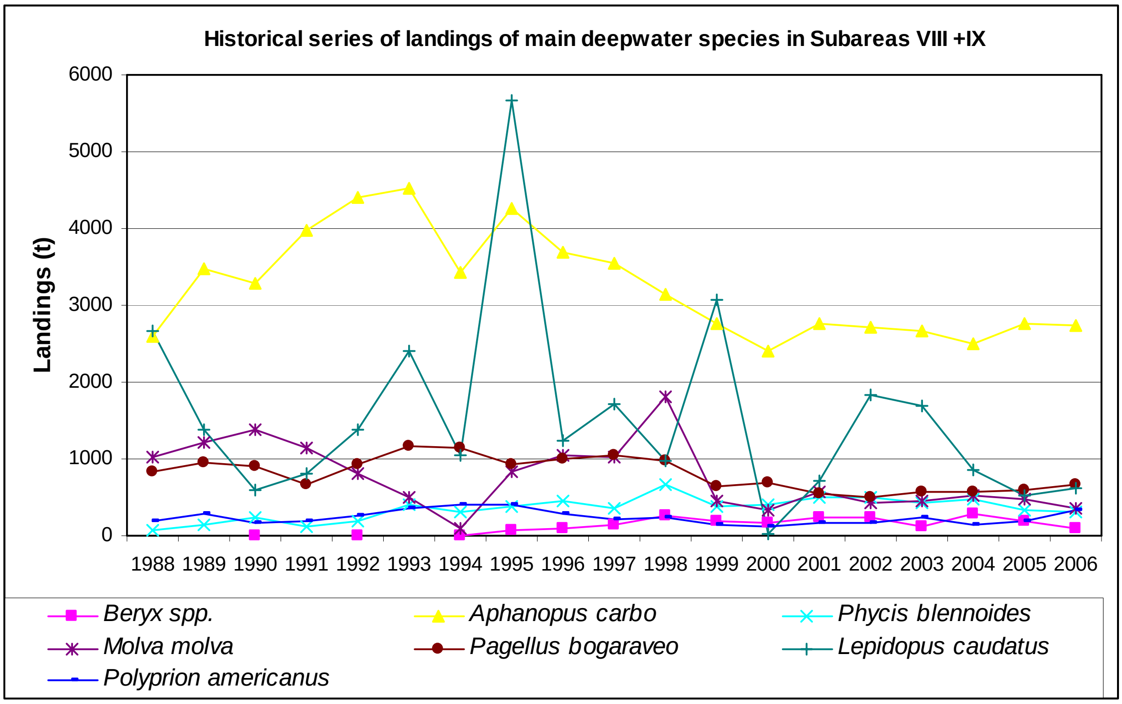


Figure 10.1.1. Historical series of seven main species landed in combined Subareas VIII + IX since 1988.

10.2 BLACK SCABBARDFISH (*APHANOPUS CARBO*) IN SUB-AREAS VIII & IX

10.2.1 The fishery

The fishery for black scabbardfish has an artisanal character and it was initiated in the Portuguese continental slope in 1983 at grounds around Sesimbra port (south of Lisboa – Latitude 38º 20' N), following a series of exploratory surveys conducted by the Portuguese Fisheries Research Institute (former IPIMAR). At present, the fishery for black scabbardfish occurs in three geographic areas (A, B and C) of the Portuguese continental slope (Fig. 10.2.1). During the early years of the fishery (in the 80's) only fishing grounds from area A were targeted by the fleet. Only in the mid 90's, new vessels entering the fleet started targeting the grounds in area C. In 2000, the fleet experienced technological improvements and some vessels began to target grounds in area B located farther away (> 65 nm) from Sesimbra port. Soon after these vessels started to fish in area B, they moved to Peniche port in order to reduce the time spent in navigation to and from the targeted grounds. The landings, however, continued to be registered in Sesimbra port due to market opportunitiThe longline fishery targetting black scabbardfish in continental Portugal takes place on hard bottoms along the slopes of canyons off Sesimbra at depths normally ranging from 800 to 1200 m. This fishery is restricted to a fraction of the area identified as the areas of distribution of the species during the 80´s scientific longline surveys conducted along the Portuguese continental coast (Bordalo_Machado and Figueiredo, 2007 WD8). The French bottom trawlers operating in subareas mainly VI and VII have a small marginal activity in subarea VIII (Figure 10.2.2).

10.2.1.1 Landings trends

Landings in subareas VIII and IX are almost all derived from the Portuguese longline fishery that takes place in subarea IX (more than 99% of the total landings) (Table 10.2.1,and 10.2.2). The remaining landings are derived Spanish and French landings both in subarea VIII. French landings are mainly derived from subarea VIIIa and had some expression after 2000 and in last six years landings increased up to 50 tons. In Subarea IX Portuguese landings peaked in middle 90´s; after 2000 landings remained stable around to 3000 ton (Figure 10.2.3)

10.2.1.2 ICES advice

The advice statement from 2006 was: In Division IXa the adoption of a status quo exploitation level is advised.

10.2.1.3 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 TAC adopted for 2005 and 2006 as well as the total landings in Subareas VIII, IX and X are next presented

VIII, IX & X	
Uptake in 2005	3151
Uptake in 2006	2791
TAC (2005 & 2006)	4 000

10.2.2 Stock identity

Black scabbardfish has a wide distribution in the NE Atlantic at depths between 200-1600m but there is very little objective information available on the stock structure of this species.

Distribution of the species has led to hypothesis of a single stock but this remains uncertain. It is hypothesized that the species life cycle is not completed in just one area and also that either small or large scale migrations seem to occur seasonally.

10.2.3 Data available

Landings were available for all relevant fleets. Portuguese longliner CPUE series and length frequency distribution of the landings were available.

10.2.3.1 Landings and discards

The onboard discards sampling for longline Portuguese commercial continued in 2006 as a part of the Portuguese discard sampling programme, included in the EU DCR/NP.

10.2.3.2 Length compositions

In the scope of the National Minimum Landings Sampling Program, length frequency and biological samples from Portuguese landing port at Sesimbra were collected on a monthly basis during 2006. Length ranges were similar between different years and varied between 71 and 135 cm with a mean around 106 cm (Figure 10.2.4).

10.2.3.3 Age compositions

No reliable age determinations are available yet.

10.2.3.4 Weight at age

10.2.3.5 Maturity and natural mortality

Data available for Subarea IX showed a predominance of immature specimens even among the large specimens. Furthermore in this region only few specimens can reach early maturity condition however most of early developing females exhibit atresia in their ovaries (Bordalo et al., 2001).

10.2.3.6 Catch, effort and research vessel data

Preliminary CPUE data of the Sesimbra fishing fleet targeting black scabbardfish was presented in previous WGDEEP reports (ICES, 2001; ICES, 2002; ICES, 2003; ICES, 2004) New CPUE series was presented based on daily landings statistics from the period 1995-2006 provided by the Portuguese General Directorate of Fisheries with information on: catch by species, date, fishing port and vessel. Standardized monthly effort was estimated through a Generalized Linear Models (GLM) approach. The log-transformed LPUE (Landings(kg)-Per-Unit-Effort) was regressed against a group of explanatory variables that included Month, Year and Vessel. The general expression of the model is presented below:

log(LPUE) ~ as.factor(Year)+ as.factor(Month)+as.factor(Vessel)+ε,

where $\varepsilon \sim N(0,\sigma^2)$. The nominal effort unit used was number of trips by month and the vessels considered in the analysis were restricted to those with monthly landings values on black scabbardfish higher than 1 ton. The CPUE series is presented at Figure (10.2.5).

Table 10.2.1. Black scabbardfish in Sub-areas VIII

Year	France VIIIa	France VIIIb,c	France VIIId	Spain	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	11	0	21	1	33
2001	15	0	7	1	23
2002	16	2	14	1	33
2003	25	0	8	1	34
2004	24	0	13	1	39
2005	19	0	6	1	26
2006	30	2	19	0	52

Table 10.2.2. Black scabbardfish in Sub-areas IX

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

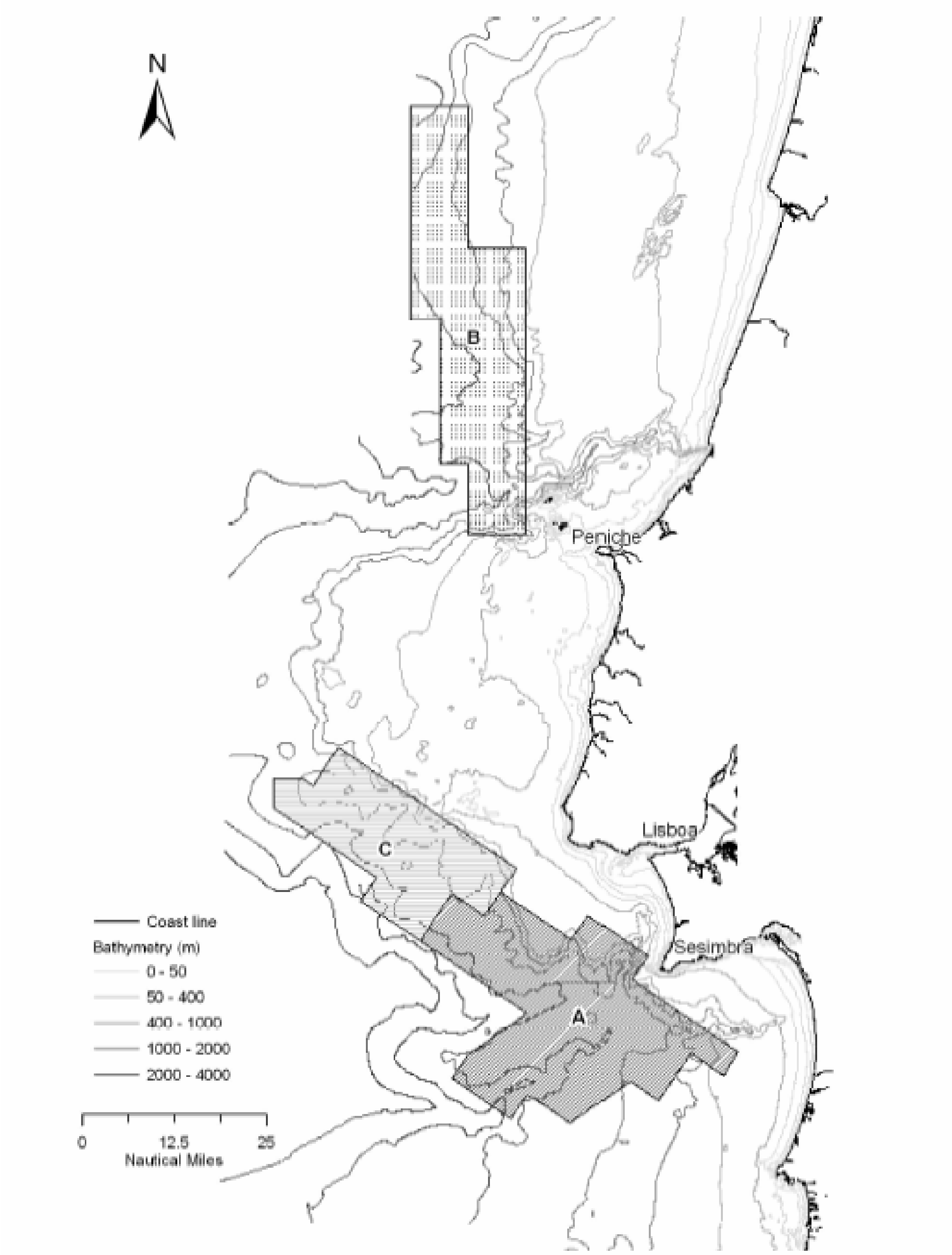


Figure 10.2.1 – Main fishing areas (A, B and C) of the black scabbardfish in the Portuguese continental slope.

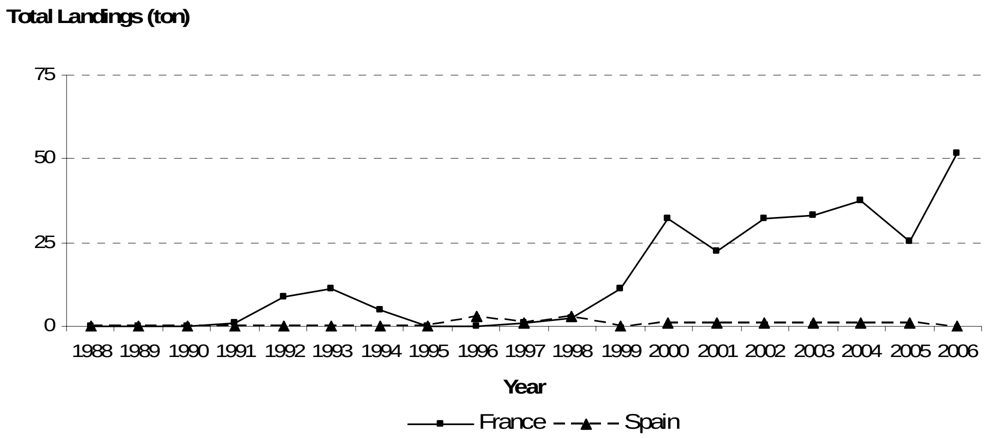


Figure 10.2.2 – French (squares) and Spainish (triangle) annual landings of black scabbardfish from 1988 to 2006.

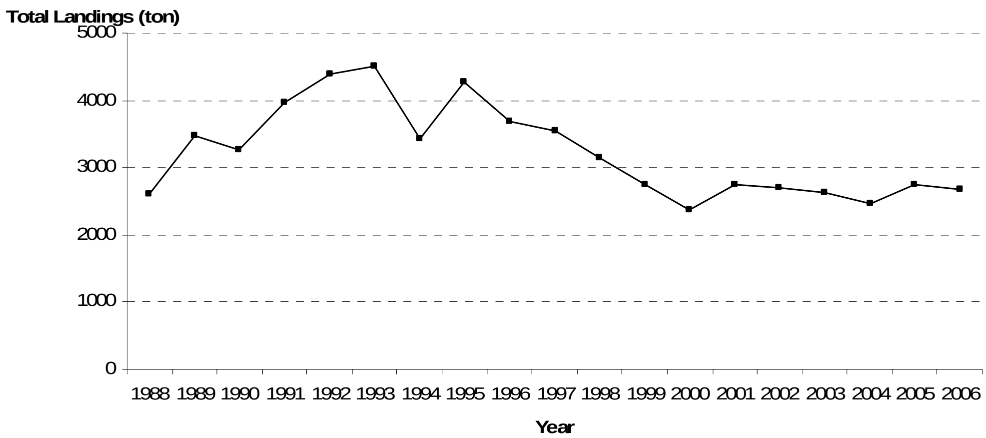


Figure 10.2.3 - Portuguese annual landings of black scabbardfish from 1988 to 2006.

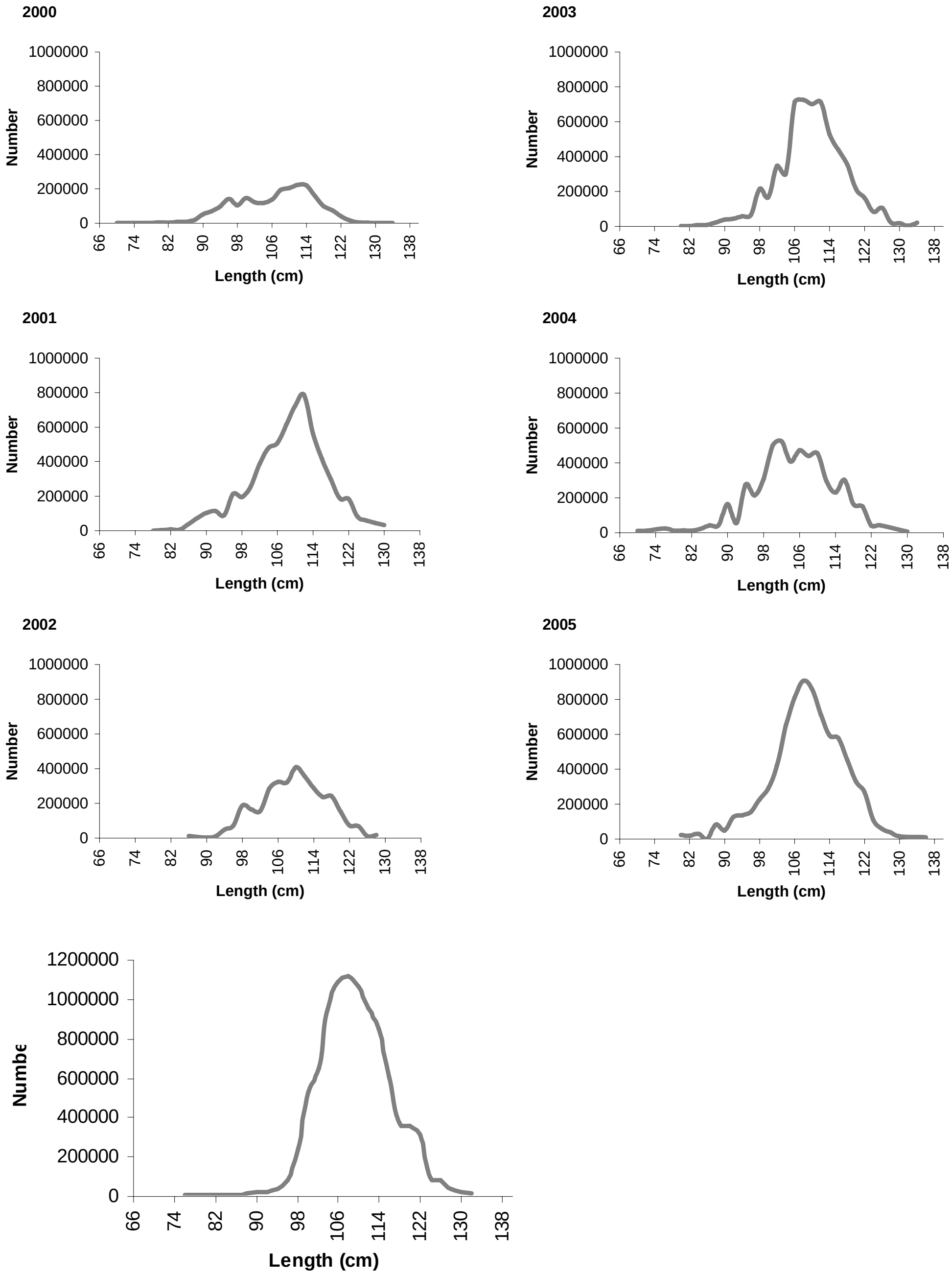


Figure 10.2.4 - Annual length frequencies distribution of black scabbardfish from Portugueses longline landings (extrapolated for total landings) in the period 2000 – 2006.

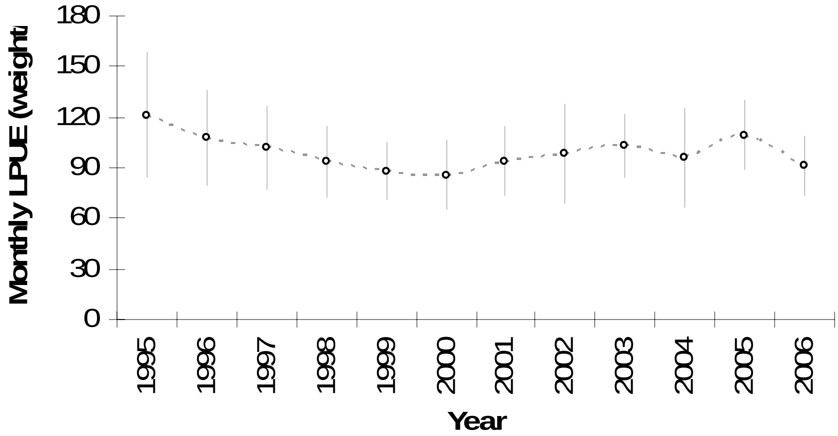


Figure 10.2.5 – Mean annual LPUE +/- standard deviation of the black scabbardfish fleet for the period between 1995 and 2006.

10.3 RED SEABREAM (*PAGELLUS BOGARAVEO*) IN SUB-AREAS VI, VII & VIII

10.3.1 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 last report of WGDEEP. The fishery in North East Atlantic strongly declined in the mid−1970s, and it still continues in a "quasi depleted" situation. Sincet 1988 years landings from sub-area VIII represents the 62% and VI and VII the 28% of total accumulated landings. At present most of the Spanish red seabream catches in this area, are almost all by-catches of longliner fleet, trawlers and also some landings for "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 seabream specially 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 60s. 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 80s 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 north eastern Atlantic (Lucio, 2002).

10.3.1.1 Landings trends

Landings data for red (blackspot) seabream, *Pagellus bogaraveo*, by ICES Subareas/Divisions as reported to ICES or to the Working Group are shown in Table 10.3.1. Landings in the Subareas VI, VII and VIII are given from 1988 onwards, as since then the landings values are more reliable to correspond to *Pagellus bogaraveo sensu stricto*. For this three subareas combined landings fell from more than 461 tons in 1989 to 52 tons in 1996, then they increased until 2000 (290 tons), and since 2001 they have been decreased continuously (146 tons in 2006). In the period considered (1988-2003), most of the estimated landings from the Subareas VI, VII and VIII were taken by Spain (68 %), followed by France (15 %), UK (14 %) and Ireland (2 %).

Portuguese landings data in CECAF area are available at least from 1990 to 1999. In this period they have ranged from 4 to 14 tons. From 2000 to 2004 there are no available data but in 2005 the catches reported by Portugal reached 270 tons.

In Subarea XII, landings data are available from only one year (1994). They amount to 75 tons and were reported by Latvia.

A Spanish, French and UK extended landing series in North East Atlantic have been improved from a table performed for P. Lucio in WGDEEP 2004. This long historical series is important to have a clear perspective of the important decline of this fishery in North East Atlantic in last 30 years. The Figure 10.3.1 tries to show the landing trend since 1948, but because the difficulty to distinguish between subareas in the first decades of series the landings are shown combined for Subareas VI, VII and VIII. Some of the high historical catches could be included other species of *Pagellus* and/or other *Sparidae*, i.e. "seabream", as some landings could be also misreported. In relation to this they are 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.

Any case, and taking into account the constraints of data collected (specially 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 tonnes are recorded after 1986 and in last 10 years the annual catches have been always below of 300 tonnes.

10.3.1.2 ICES advice

Red seabream can only sustain low rates of exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data and should expand very slowly until reliable assessments indicate that increased harvests are sustainable.

10.3.1.3 Management

The Council Regulation (EC) No 2015/2006 maintained for *Pagellus bogaraveo* the same TAC for 2007 and 2008 that in two previous years. In following table a summary of red sea bream international TACs since 2005 in Subareas VI, VII and VIII and 2005-2006 landings. Noticed that the TAC is by far never reached in last two years.

Pagellus bogaraveo	TAC	landings		TAC
SUBAREA	**2005-2006**	**2005**	**2006**	**2007-2008**
VI, VII, VIII	298	153	146	298

10.3.2 Stock identity

Information on Red (blackspot) Seabream, *P. bogaraveo*, has been split into three different components, as referred to in the previous Reports (ICES C.M.1996/Assess:8; ICES C.M.1998/ACFM:12; ICES C.M. 2001/ACFM:23; ICES C.M. 2002/Assess:16):

- • *P. bogaraveo* in Subareas VI, VII and VIII
- • *P. bogaraveo* in Subarea IX
- • *P. bogaraveo* in Subarea X (Azores region)

No more information was available to the Working Group

10.3.3 Data available

10.3.3.1 Landings and discards

Historical series of landings data available to the Working Group have been described in text and tables of section 10.3.1. No discard data were available to the Working Group.

10.3.3.2 Length compositions

No length data were available to the Working Group.

10.3.3.3 Age compositions

No age data were available to the Working Group.

10.3.3.4 Weight at age

No weight at age data were available to the Working Group.

10.3.3.5 Maturity and natural mortality

No maturity and natural mortality at age data were available to the Working Group.

10.3.3.6 Catch, effort and research vessel data

No catch, effort and research vessel data were available to the Working Group.

10.3.4 Data analyses

No data analysis was carried out by the Working Group.

Table 10.3.1. Red seabream in VI, VII & VIII. WG estimates of landings by country.

RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*) VI and VII

Year	France	Ireland	Spain	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	0	8	0	15		**23**
2000	4	n.a.	3	13		**20**
2001	1	11	2	37		**51**
2002	3	0	9	13		**25**
2003	11	0	7	20		**38**
2004	19		4	18		**41**
2005	27		4	7		**38**
2006	31		8	19		**58**

RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*) VIII

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	20	84	0	**104**
2000	81	189	0	**270**
2001	11	168	0	**179**
2002	19	111	0	**130**
2003	6	83	0	**89**
2004	3	82	8	**94**
2005	25	90	0	**115**
2006	31	57	0	**88**

(1) in 2005 England & Wales

Table 10.3.1 (continued).

RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*) XII

Year	Latvia	France	TOTAL
1988			
1989			
1990			
1991			
1992			
1993			
1994	75		**75**
1995			
1996			
1997			
1998			
1999			
2000			
2001			
2002			
2003			
2004			
2005			
2006		0	**0**

Table 29.1 continued

RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*) in Madeira (Portugal) (CECAF area)

Year	Portugal	TOTAL
1988		
1989		
1990	6	**6**
1991	8	**8**
1992	7	**7**
1993	8	**8**
1994	7	**7**
1995	8	**8**
1996	4	**4**
1997	5	**5**
1998	14	**14**
1999	13	**13**
2000		
2001		
2002		
2003		
2004		
2005	270	**270**
2006		

RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*) in VI, VII, VIII, XII ICES Subareas and CECAF

Year	VI+VII	VIII	XII	CECAF	TOTAL
1988	252	137			**389**
1989	189	272			**461**
1990	134	312		6	**452**
1991	123	134		8	**265**
1992	40	124		7	**171**
1993	22	175		8	**205**
1994	10	131	75	7	**223**
1995	11	110		8	**129**
1996	29	23		4	**56**
1997	56	25		5	**86**
1998	17	104		14	**135**
1999	23	104		13	**140**
2000	20	270			**290**
2001	51	179			**230**
2002	25	130			**155**
2003	38	89			**127**
2004	31	95			**126**
2005	38	115		270	**423**
2006	58	88			**146**

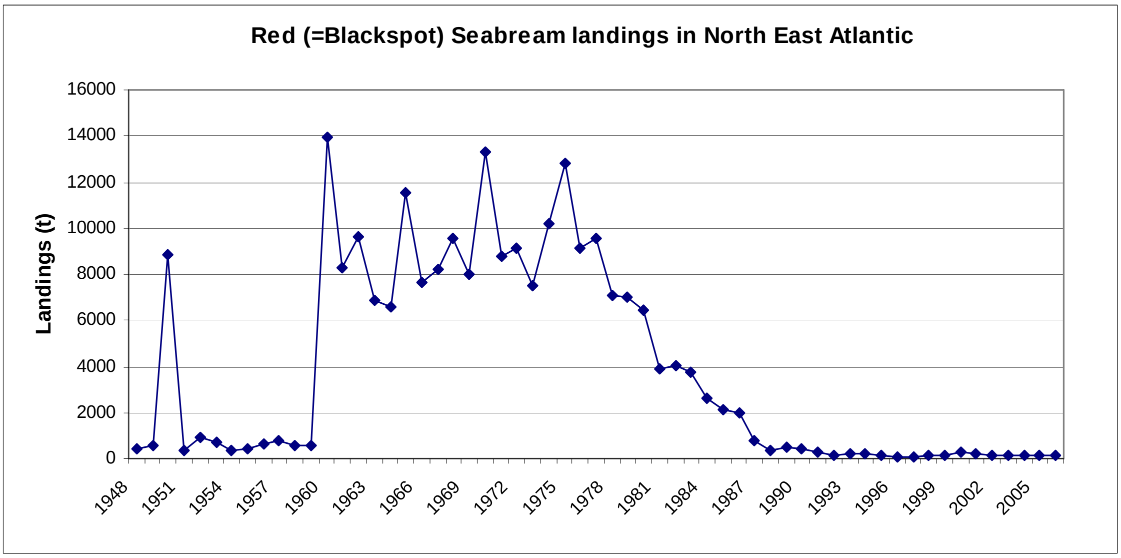


Figure 10.3.1. Historical series of Red Seabream landings since 1948 in North East Atlantic (sub-areas VI +VII + VIII) by the Spanish, French and E & W fleets.

-. 1948-1978: Data extracted from Table 16.3 ICES WGDEEP 2004 (French landings in VI, VII and VIII suba-areas, Spanish landings in North East Atlantic, E & W landings in VI, VII and VIII suba-areas)

-. 1979-1985: Data extracted from Table 14.2.1. ICES SGDeep 1996

-. 1986-1987: Data extracted from Table 16.3 ICES WGDEEP 2004

-. 1988-2004: Data extracted from Table 16.3 ICES WGDEEP 2004 (French landings in VI, VII and VIII suba-areas, Spanish landings in North East Atlantic, E & W landings in VI, VII and VIII suba-areas)

-. 2005-2006: ICES WGDEEP 2007 International landings of French, Spanish, E & W in VI, VII and VIII suba-areas

10.4 RED SEABREAM (*PAGELLUS BOGARAVEO*) IN SUB-AREA IX

10.4.1 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 seabream landings reflect a seasonal activity probably related with a larger availability of the species or market demands that lead fishermen to spend some time targeting this species (I. Figueredo, *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*. (WD4, 2007), that complete the information offered in the previous WGs (Gil *et al*., 2000; 2003, 2005 and 2006; Gil & Sobrino, 2001, 2002 and 2004). This artisanal longline fishery targeted red seabream has been developed along the Strait of Gibraltar area. Actually this fishery covers almost the 70 % of the landings for the species in the IXa. 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 due to 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 were as below (from Gil *et al*., 2000):

Port	Length (m)	G.T.R. (t)	N
Tarifa	8.95	5.84	79
Algeciras	6.52	4.00	28

From 2002 onwards artisanal boats from other port, Conil, have began to direct its fishing activity to *P. bogaraveo* in different fish grounds than the boats of Tarifa and Algeciras.

10.4.1.1 Landings 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 1 000 t) and the minimum in 2002 (359 t). Catches in 2006 amount to 544 t. Almost all Spanish catches in this area are taken in waters close to the Strait of Gibraltar. 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.

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 more recent years there was a sligth increasing trend till 2004 (183 t). In 2005 and 2006 landings stabilized around 100 tons.

10.4.1.2 ICES advice

Red seabream can only sustain low rates of exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data and should expand very slowly until reliable assessments indicate that increased harvests are sustainable.

10.4.1.3 Management

For 2003, by first time, a regime of TAC and Quotas has been applied also to the *P. bogaraveo* fishery in Subarea IX. The following table shows 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
IX	1271	471 - 480	1080	494 - 544*	1080

* 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 (15th January - 31st March), minimum size of fish retained or landed (33 cm total length), authorised 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 seabream catches (only Tarifa and Algeciras)…

10.4.2 Stock identity

Information on Red (blackspot) Seabream, *P. bogaraveo*, has been split into three different components, as referred to in the previous Reports (ICES C.M.1996/Assess:8; ICES C.M.1998/ACFM:12; ICES C.M. 2002/ACFM:8; ICES C.M. 2002/Assess:16; ICES C.M. 2004/Assess:15 and ICES C.M. 2006/ Assess: 28):

- • *P. bogaraveo* in Subareas VI, VII and VIII
- • *P. bogaraveo* in Subarea IX
- • *P. bogaraveo* in Subarea X (Azores region)

This separation does not pre-suppose that there are three different stocks of *P. bogaraveo*, but it offers a better way of recording the available information. The inter-relationships of the red seabream from Subareas VI, VII, VIII and the northern part of Division IXa, and their migratory movements within these areas have been described in the past by tagging methods (Gueguen, 1974; ICES, C.M.1996/Assess:8).

Possible links between red seabream of the Azorean region with the southern Subarea IX, Moroccan waters, Sahara Bank and Subareas VI+VII+VIII and the northern part of Division IXa have not been studied extensively. In Menezes *et al.* (2001), genetic studies show that there are no differences between populations from different ecosystems within the Azores region (Eastern, Central and Western group of Islands, and Princes Alice Bank) but there are genetic differences between Azores (ICES area X) and mainland Portugal (ICES area IXa).

Migration patterns have been studied using tagging surveys in the Spanish South Mediterranean region and the Strait of Gibraltar (Gil *et al.*, 2001; Sobrino and Gil, 2001). Trap gears were utilised to catch red seabream juveniles in the Mediterranean Sea and adults in the commercial fishery area were caught with the “voracera” gear. Since 1997, 7066 samples were tagged (juveniles + adults) and at the moment 396 recaptures were notified (J. Gil, *pers. com.*). Recaptures from tagged juveniles show significant displacements from Southmediterranean breeding areas toward the Strait of Gibraltar. However, recaptures from tagged adults did not reflect big displacements, which are limited to feeding movements between the different fishing grounds where the “voracera” fleet works (Gil, 2006).

Thus, due to the very different present status of the red seabream fishery in the three areas and the current scientific information on migration and genetics relevant to each, it has been considered appropriate to continue to present the following chapter split by sea area.

10.4.3 Data available

10.4.3.1 Landings and discards

Historical series of landings data available to the Working Group have been described in text and tables of section 10.4.1. No discard data were available to the Working Group, but for this species this could be considered minor. The landings included Spanish and Portuguese landings from 1990 onwards. The full time-series are presented in Table 10.4.1.

10.4.3.2 Length compositions

Length frequency data are only available for Spanish red seabream catches landed in the Strait of Gibraltar fishery (1990-2006). Figure 10.4.1 reflects the updated information regards the mean length of landings from the Strait of Gibraltar fishery (WD4, 2007).

10.4.3.3 Age compositions

No new information is available in relation to the presented to the ICES WGDEEP in 2006 (ICES C.M. 2006/Assess:28).

10.4.3.4 Weight at age

No new information is available in relation to the presented to the ICES WGDEEP in 2006 (ICES C.M. 2006/Assess:28).

10.4.3.5 Maturity and natural mortality

No new information is available in relation to the presented to the ICES WGDEEP in 2006 (ICES C.M. 2006/Assess:28).

10.4.3.6 Catch, effort and research vessel data

Figure 10.4.2 updated the catch and effort data available only for the Strait of Gibraltar fishery, which were presented by Gil et al. (WD4, 2007). It is important to emphasize also that the effort unit chosen (number of sales) can not 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 LPUE values does not inspired confidence.

No research vessel data were available for the species in this Subarea.

10.4.4 Data analyses

After de decreasing trend iniated in 1998, from 2003 onwards landings present a slightly increase. Also the LPUE available shows this slightly increase, although it should be interpreted with caution. The fishery resource suffers a decrease of the landing mean length mainly from 1995 to 1998. It is necessary to point out that species probably does not have an homogeneus geographic and bathymetric distribution related to their length. This fact could explain the different landed mean length between ports. The mean length of the landings get progressively increasing from 1999 on, with the introduction of the recovery plans. However, last years landing mean length decreased in both ports.

Table 10.4.1. Red seabream (*Pagellus bogaraveo*) in Subarea IX: Working Group estimates of landings (tonnes).

RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*) IX

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

* Preliminary

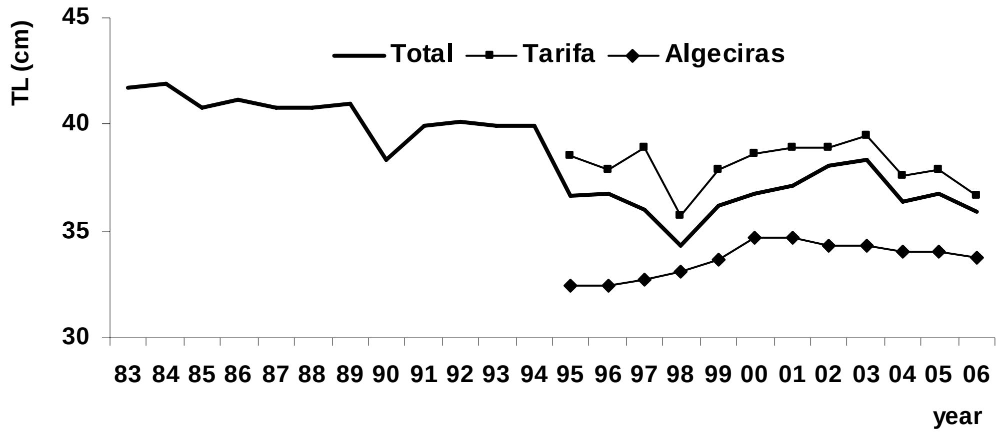


Figure 10.4.1. Red seabream fishery of the Strait of Gibraltar (ICES Subarea IX): 1983-2006 landings mean length distribution (from Gil *et al.*, WD4, 2007).

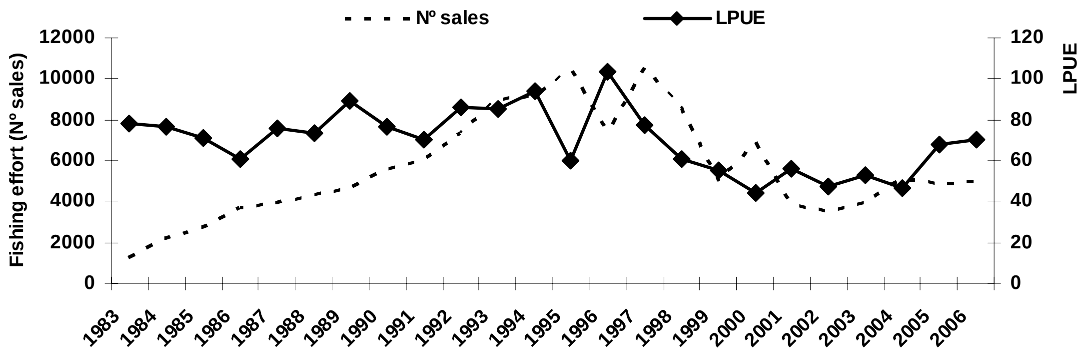


Figure 10.4.2. Red seabream fishery of the Strait of Gibraltar (ICES Subarea IX): 1983-2006 landings mean length distribution (from Gil *et al.*, WD4, 2007).

11 Stocks and fisheries of the Oceanic northeast Atlantic

11.1 Fisheries overview

11.1.1 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 seems to change seasonally according abundance, species vulnerability and market.

The fishery is clearly a typical small scale one, where the small vessels (<12m; 90% of the total fleet) predominate, using mainly traditional bottom longline and several types of hand lines. 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.

11.1.1.1 Trends in fisheries

Since mid-nineties the global landings of deep water species show a decreasing tendency (Figure 11.1.1), reflecting the change in the fleet behaviour, that has since started to target on blackspot seabream.

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 hand lines 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.

11.1.1.2 Technical interactions

The reported by-catch in this fishery seems rather insignificant, according to a pilot study conducted in 2004 (ICES, 2006).

11.1.1.3 Ecosystem considerations

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 below 600 meters while 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 hand lines are used.

11.1.1.4 Management of fisheries

The only known deep water fisheries in ICES Sub-div. 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, TAC's where introduced for some species, e.g. blackspot seabream, black scabbardfish, and deep-water sharks. 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, fishermen are encouraged by local authorities to exploit the deeper strata (>700m), but the poor response of the market has been limiting the expansion of the fishery.

11.1.2 Mid-Atlantic Ridge

The Northern Mid-Atlantic Ridge (MAR) is a huge area located between Iceland and Azores. There are more then 40 seamounts of commercial importance (Table 11.1.1). The deepwater 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*) and blue ling (*Molva dypterigia)* were found. Trawl and longline fisheries were conducted in Subareas XII, X, XIV and V (Figure 11.1.2) by Russian, Iceandic, Faroese, Polish, Latvian and Spanish vessels.

11.1.2.1 Trends in fisheries

The greatest annual catch of roundnose grenadier (almost 30,000 t) in that area was taken by the Soviet Union in 1975, fluctuating in subsequent years between 2,800 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 200–3,200 t), Poland (500–6,700 t), Latvia (700–4,300 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 then 232,000 t, mostly from ICES Sub-area 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 8,000 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 3,000 t also in 1993, it declined sharply to 300 and 117 t for next two years and no fishery was reported later. Fishery on the seamount resumed by Spanish trawlers in 2000s with biggest catch about 1,000 t.

Orange roughy occurs in restricted areas of the Reykjanes Ridge, 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. Catches from 6 to 470 t per annum were also made in ICES Sub-area X in 1996-1998, 2000-2001 and 2004-2006.

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 (ocean perch *Sebastes marinus*) 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. 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 2005-2006 by Russian longliners.

Spain carried out 5 limited exploratory trawl surveys to seamounts on the MAR between 1997-2000 and a longline survey in 2004 but except for sporadic fisheries in the northern area (ICES 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 deepwater species, mostly alfonsino, but also commercial catches of black 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 black 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 2,800 t over the next 7 years. In recent years there have been no indications of fishable concentrations of alfonsino. Since the discovery of the seamounts in the North Azores area Soviet and Russian vessels have taken about 6,000 t, mainly of alfonsino. Vessels from the Faroe Islands and the U.K have also small catches of the species in the area.

11.1.2.2 Technical interactions

The by-catch in pelagic trawl fishery (roundnose grenadier and alfonsino) seems rather insignificant, according to daily vessel reports and Soviet studies in 1970-1980s. The mixed bottom trawl Faroese fishery directed for orange roughy, black scabbardfish and roundnose grenadier took place in Division Xb. There was mixed Norwegian and Russian longline fisheries of 'giant' redfish, tusk and sharks on the Reykjanes Ridge in 1996-1997 and 2005-2006. There were no discards on Russian trawlers where smallest fish and waste were used for fish meal processing. Data on discards in other countries fisheries are absent.

11.1.2.3 Ecosystem considerations

Most of Divisions XIIa, XIIc, Xb, XIVb1, Va are covered in abyssal plain with an average depth of >ca 4000m which currently remains largely unexploited. The major topographic feature is the Northern part of the Mid-Atlantic Ridge, located between Iceland and the Azores. Numerous seamounts of variable heights occur all long 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, brittle stars, 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 due to 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 amongst 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).

11.1.2.4 Management of fisheries

There is TAC-based species-specific management of the deepwater fisheries in Subareas I, II, IV, VIII, IX, X, XII, XIV and Division Va for European Community vessels. In the international waters there are NEAFC regulation of efforts in the fisheries for deepwater species and closed area to protect vulnerable habitats

Table 11.1.1. Summary data on seamount fisheries on the MAR

Main species	Discovery		No. of commercial seamounts	Maximum catch/yr (‘000 t)
	Year	Country		
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

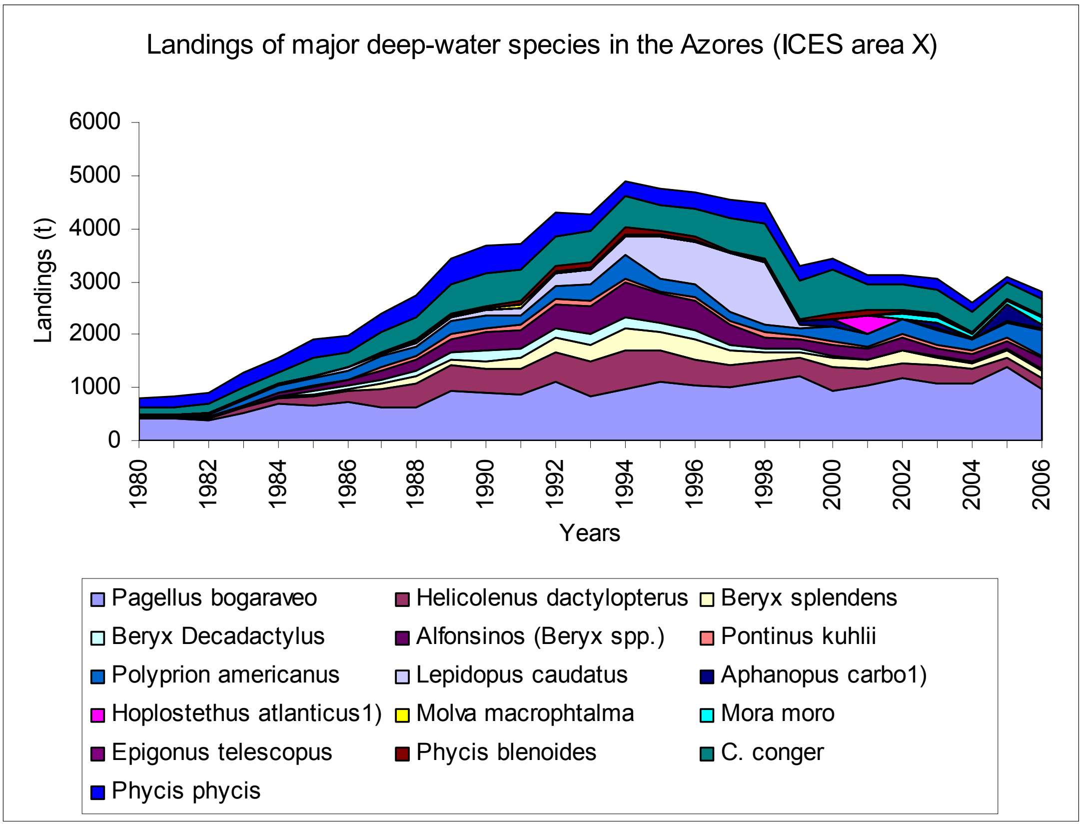


Figure 11.1.1. Annual landings of major deep water species in Azores from hook and line fishery (1980-2006).

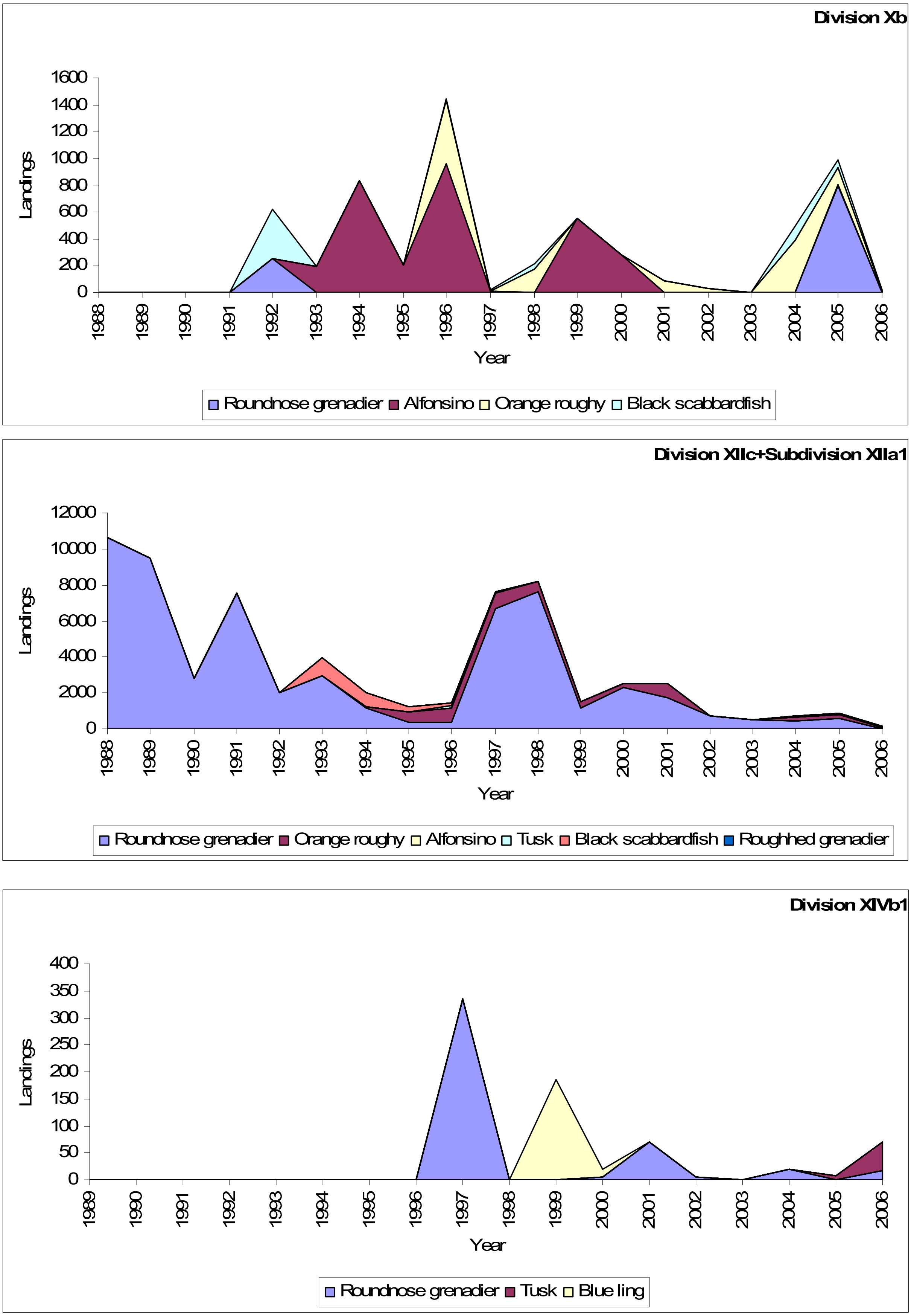


Figure 11.1.2. Annual catch of major deep water species on MAR in 1988-2006.

11.2 ROUNDNOSE GRENADIER (*CORYPHAENOIDES RUPESTRIS*) IN DIVISIONS Xb, XIIc AND SUB-AREAS Va1, XIIa1, XIVb1

11.2.1 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.

11.2.1.1 Landings trends

The greatest annual catch (almost 30,000 t) in that area was taken by the Soviet Union in 1975 (Table 11.2.1, Fig. 11.2.1) and in subsequent years the Soviet catch varied from 2,800 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 200–3,200 t), Poland (500–6,700 t), Latvia (700–4,300 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. Faroese trawler targeting orange roughy had small bycatch (total 1 t) of this species.

11.2.1.2 ICES advice

Due to absent of an assessment ICES could only give a general recommendation for MAR stock in 2006: "…Fishery on such species should be permitted only when accompanied by programmes to collect data. The expansion of the fisheries should not be allowed until reliable assessments indicate that increased harvests are sustainable."

11.2.1.3 Management

There is TAC-based species-specific management of the roundnose grenadier fisheries in Subareas I, II, IV, VIII, IX, X, XII, XIV and Division Va for European Community vessels (Tab. 11.2.3). In the international waters there are NEAFC regulation of efforts in the fisheries for deepwater species.

11.2.2 Stock identity

The intraspecific stock status for MAR roundnose grenadier is unclear.

11.2.3 Data available

11.2.3.1 Landings and discards

Data on catches are given in Table 11.2.1. There were no discards of roundnose grenadier on Russian trawlers where smallest fish and waste were used for fish meal processing. There is no information on discards by other countries vessels.

11.2.3.2 Length compositions

No new data on length compositions were available.

11.2.3.3 Age compositions

No new data on age compositions were presented.

11.2.3.4 Weight at age

No new weight at age data are available.

11.2.3.5 Maturity and natural mortality

New data on maturity and natural mortality are unavailable.

11.2.3.6 Catch, effort and research vessel data

Catch and CPUE data are given in Table 11.2.1 and Figure 11.2.1. The data for 2000-2005 are shown together with the data for the period 1973-1999. There are gaps in the CPUE time series due to lack of catch statistics for 1973 and 1982 and absence of target fishery in 1994-1995 and 2006. Effort data separated by Sub-areas are available for Russian fleet in 2003-2005 only (Table 11.2.1). There were no research vessel data presented for 2006.

11.2.4 Data analyses

The only source of information on abundance trends was the CPUE series from the Soviet/Russian official data (Table 11.2.1, Figure 11.2.1). The CPUE varied strongly, but generally declined in the 1978, then the level appears to have remained comparatively stable till to 1990. Further declining took place in 1991-1993 and 1998-2000. There is some increasing of CPUE in the recent years but it remains at a low level, almost half that observed in the early 1970s when a virgin stock was exploited. These data must be treated with caution because the fishery on MAR is very difficult and its effectiveness depends on many factors (distribution of pelagic concentrations, experience of vessel crew, environmental conditions, etc.) that could not be taken in account during current analysis ofCPUE dynamics.

According to Soviet trawl acoustic survey data and analytical assessments in the 1970-1980s a stock size was estimated as 400,000-800,000 t, and the possible annual catches were estimated to be 30,000-200,000 t (Baidalinov 1979; Pavlov et al. 1991; Shibanov 1998). In the 1990s no research surveys were conducted.

The most recent Russian trawl acoustic survey was carried out in 2003 in the area between 47° and 58°N. According to results of this survey the biomass of the pelagic component of the grenadier only amounted to about 130,000 t (Gerber et al., 2004). It was concluded that the distribution and structure of grenadier aggregations on MAR have changed considerably as compared to 1970-1980s. The depths of aggregations and the number of small immature fish may have increased.

Table 11.2.1. Roundnose grenadier catches (t) by area, nation and Soviet/Russian efforts and CPUE on the MAR

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
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]					336[1]		
	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		
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]					20[1]		
	Xb				1		1		
2005	XIIa1+XIIc	600					600	42	17.7
	Xb	799					799	37	
2006[3]	XIIc				1		1		
Total		208143	13182	8831	1670	507	232333		

[1]– revised catch data [2]– official ICES data [3]– preliminary data

Table 11.2.2. Annual fishing opportunities applicable for European Community vessels for roundnose grenadier fisheries by countries and by areas (EC and international waters).

Country	TAC, t
Areas I, II, IV, Va	
Denmark	2
Germany	2
France	14
United Kingdom	2
Total for EC vessels	20
Areas VIII, IX, X, XII, XIV	
Germany	47
Spain	5 165
France	238
Ireland	10
United Kingdom	21
Latvia	83
Lithuania	10
Poland	1 616
Total for EC vessels	7 190

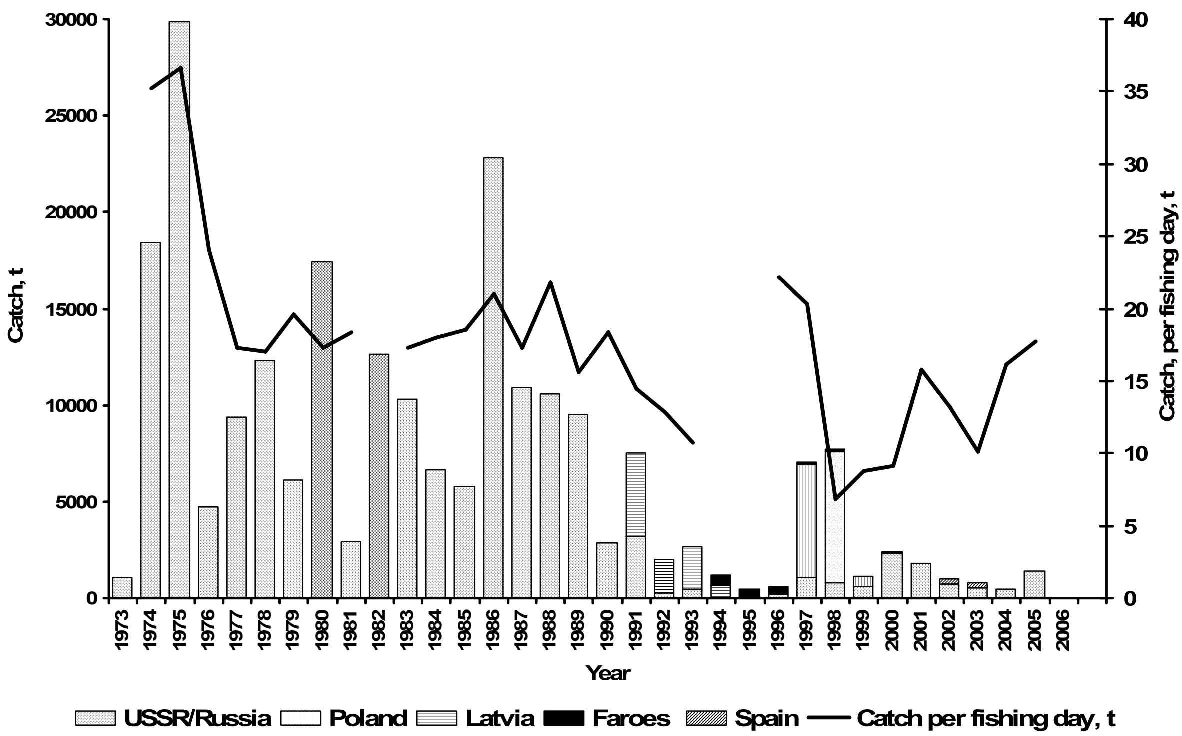


Figure 11.2.1. International catch and Soviet/Russian CPUE of roundnose grenadier on the MAR in 1973-2006

11.3 RED SEABREAM (*PAGELLUS BOGARAVEO*) IN DIVISION Xa

11.3.1 The fishery

Blackspot seabream 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 (hand lines) and the longliners (Pinho *et al.,* 1999; Pinho, 2003). The artisanal fleet is composed of small open deck boats (<12m) that operate on local areas near the coast of the islands using several types of hand lines. Longliners are closed deck boats (>12m) that operate in all areas, including banks and seamounts. The tuna fishery caught, until the end of the nineties, juveniles (age 0) of blackspot seabream as live bait, but in a seasonal and irregular way because these catches are dependent 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.

11.3.1.1 Landings trends

Historically the landings increased from 100t at the start of the seventies to proximally 1000t at the start of the nineties (Fig. 11.3.1), due to the development of new markets, increased fish value, entry of new and modern boats, better professional education of the fisherman, 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 1000t.

11.3.1.2 ICES advice

Red seabream can only sustain low rates of exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data and should expand very slowly until reliable assessments indicate that increased harvests are sustainable.

11.3.1.3 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 2006 (EC. Reg. 2270/2004).

2003		2004		2005		2006	
TAC	Landings	TAC	Landings	TAC	Landings	Landings	TAC
1116	1068	1116	1075	1116	1113	958	1116

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).

A minimum size of capture of 25 cm (0.24 kg) was implemented during 2005.

11.3.2 Stock identity

Stock limits are generally determined not only by biological considerations but also by agreed boundaries and coordinates. ICES considered three different components for this species: a) areas VI, VII, and VIII; b) area IX, and c) area Xa2 (Azores region), (ICES, 1996, 1998a). This separation does not pre-suppose that there are three different stocks of red (blackspot) seabream, but it offers a better way of recording the available information. In fact, the inter-relationships of the (blackspot) seabream from areas VI, VII, and VIII, and the northern part of area IXa, and their migratory movements within these sea areas have been confirmed by tagging methods (Gueguen, 1974). Possible links between (blackspot) seabream from the Azores region (area Xa2) with the others areas are not yet fully studied. However, recent studies show 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 Xa2 component of this stock can be considered as a separate management unit.

11.3.3 Data available

11.3.3.1 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 11.3.1. Discards of blackspot seabream have not been reported or observed in the Azorean fleets. Bycatch were reported by boats of silver scabbardfish (*Lepidopus caudatus*) fishery from mainland (Portugal) operating in the Azores between 1991 and 1998 (Pinho *et al.,* 1999). Red (blackspot) seabream was also caught by the kitefin shark (*Dalatias licha*) fishery, using bottom gillnets, but these catches were landed in the Azores ports. A recent study shows that almost no blackspot seabream is discarded on the target demersal fishery (Catarino, 2006).

11.3.3.2 Length compositions

Annual length composition from ICES area Xa2 is available since 1990 (ICES, 2006) (Fig. 11.3.2). Length composition is stable along time with a mode in general on age 4 (30cm). However, for some years (e.g. 1999, 2000 and 2005) high amounts of large individuals were caught.

11.3.3.3 Age compositions

Fishery annual age composition from ICES area Xa2 is available since 1990 (ICES, 2006).

11.3.3.4 Weight at age

No new information was presented to the group.

11.3.3.5 Maturity, Sex-ratio and natural mortality

No new information was presented to working group.

11.3.3.6 Catch, effort and research vessel data

A standardized CPUE, using the generalized linear model (GLM) to adjust the CPUE trend of blackspot seabream stock was presented to the group during the 2006 meeting (ICES, 2006) (Fig. 11.3.3). This information is available but was not updated on time for this meeting.

Abundance indices from surveys are available since 1995 (Fig. 11.3.4). 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 behavior (benthopelagic) and reproduction (protandric forming spawning aggregations) of the species.

The survey and CPUE indices show similar trend in abundance but survey indices presents high inter annual variability.

Length composition from the survey is presented in Fig. 11.3.5.

Survey data was not updated this year because there was no survey during 2006.

11.3.4 Data analyses

No new information because no assessment was performed.

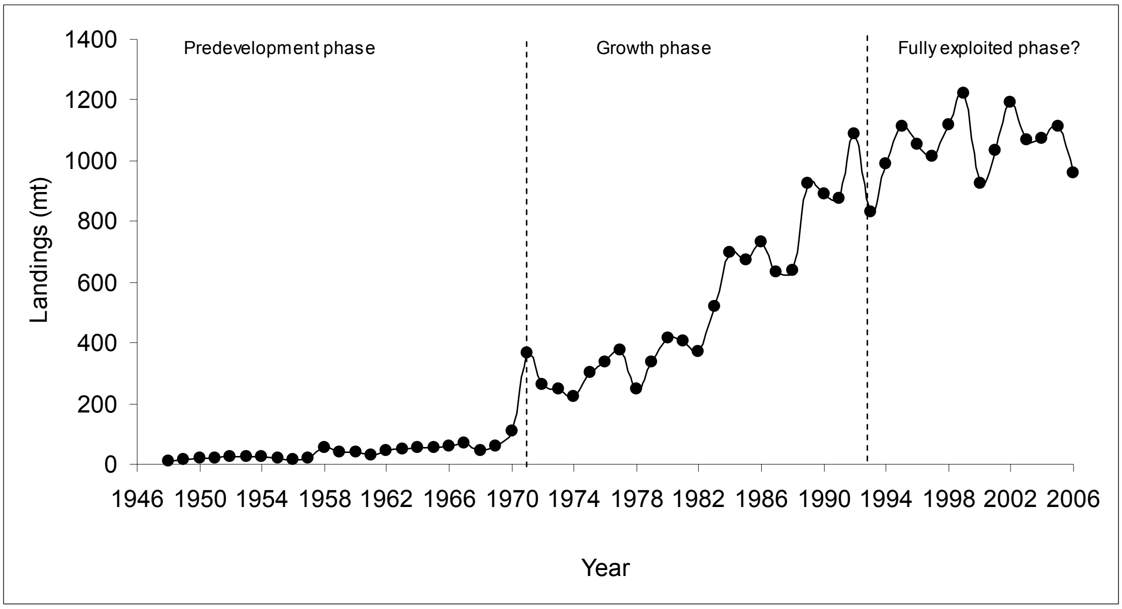
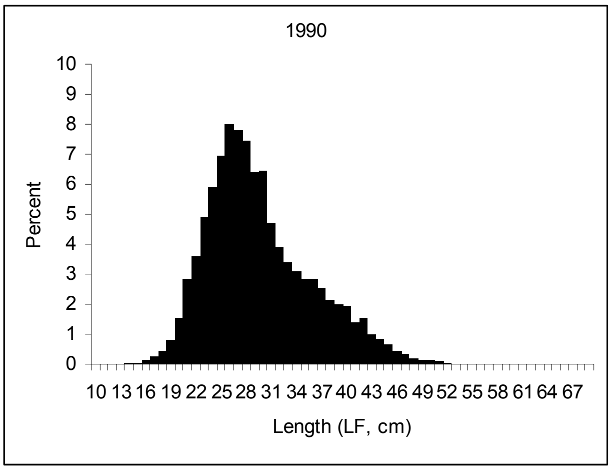
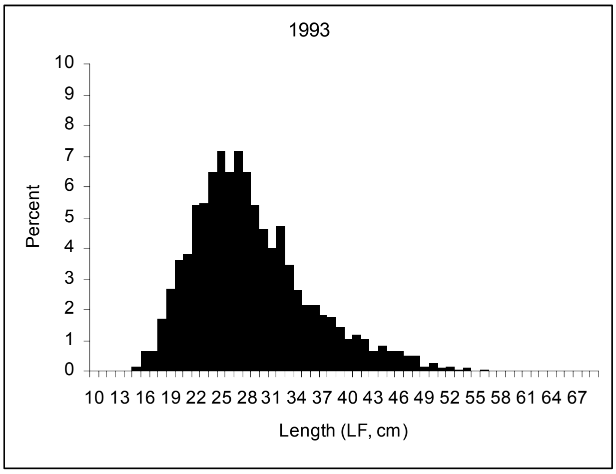
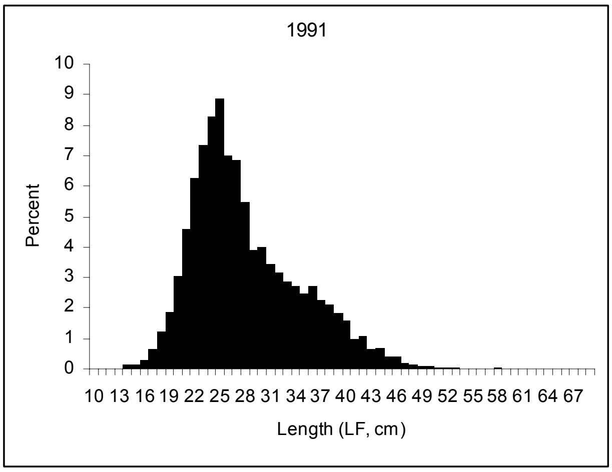
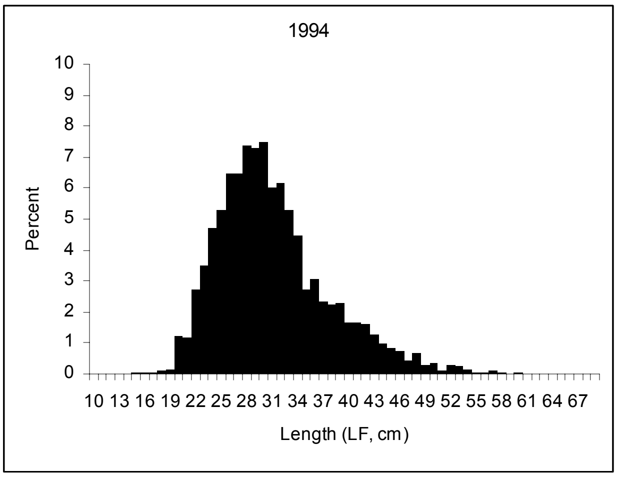


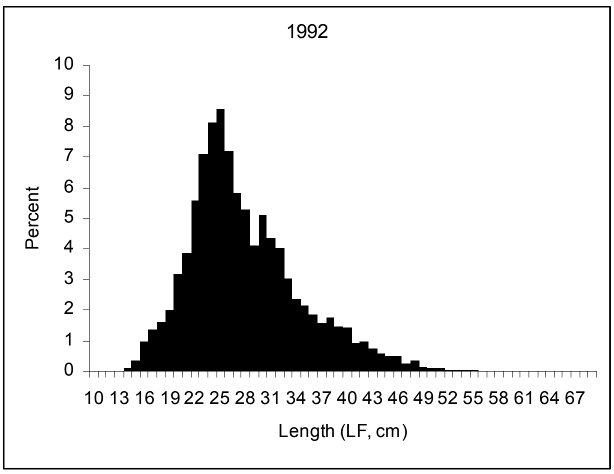
Figure 11.3.1. Historical landings of *Pagellus bogaraveo* from the Azores (ICES area Xa2).

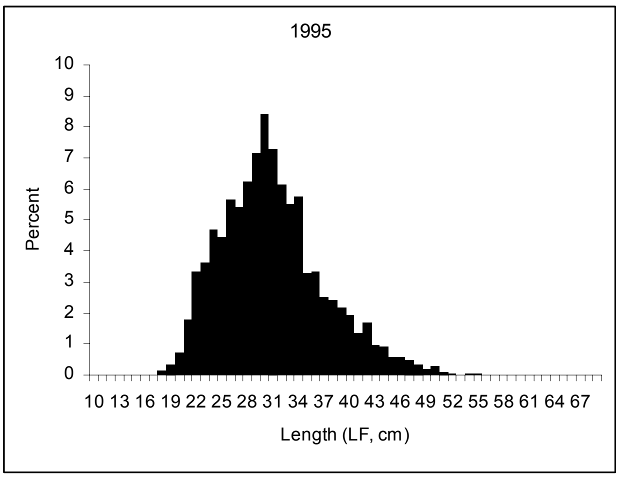

1990
Percent
Length (LF, cm)

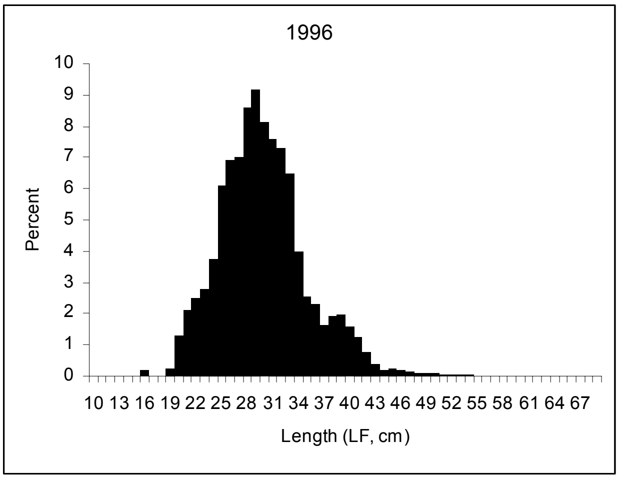

1993
Percent
Length (LF, cm)

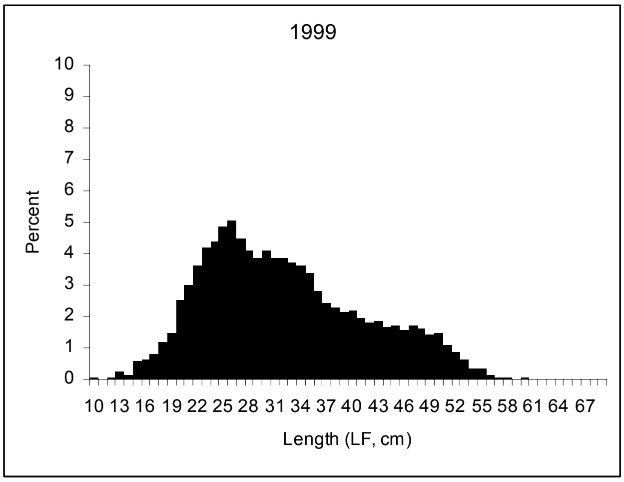

1991
Percent
Length (LF, cm)

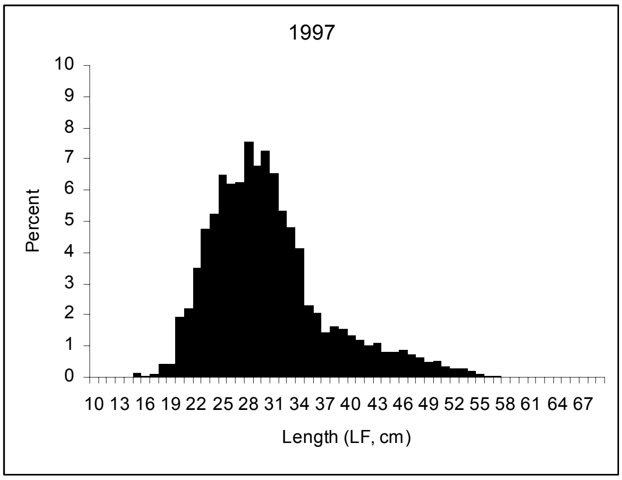

1994
Percent
Length (LF, cm)

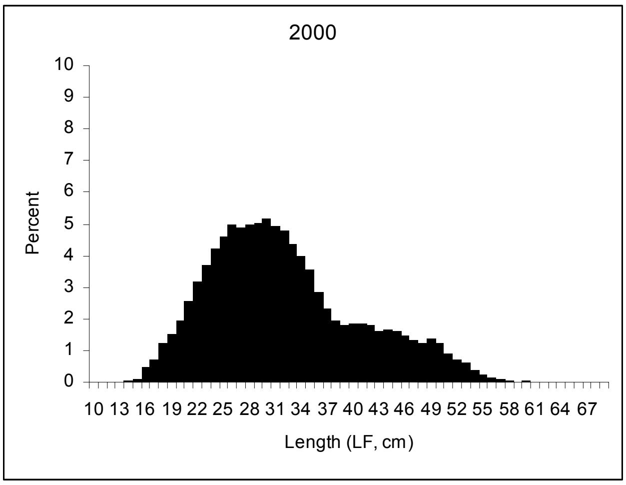

1992
Percent
Length (LF, cm)

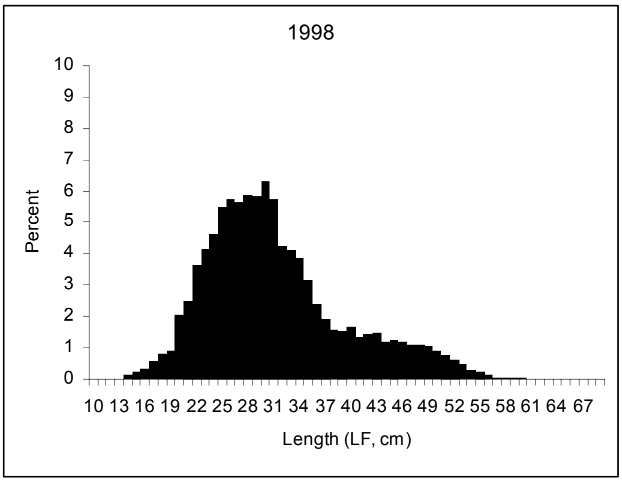

1995
Percent
Length (LF, cm)

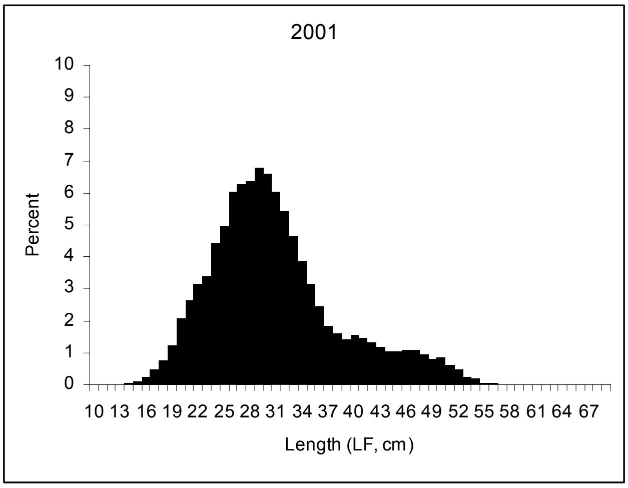

1996
Percent
0 1 2 3 4 5 6 7 8 9 10
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


1999
Percent
0 1 2 3 4 5 6 7 8 9 10
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


1997
Percent
0 1 2 3 4 5 6 7 8 9 10
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


2000
Percent
0 1 2 3 4 5 6 7 8 9 10
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


1998
Percent
0 1 2 3 4 5 6 7 8 9 10
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


2001
Percent
0 1 2 3 4 5 6 7 8 9 10
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)

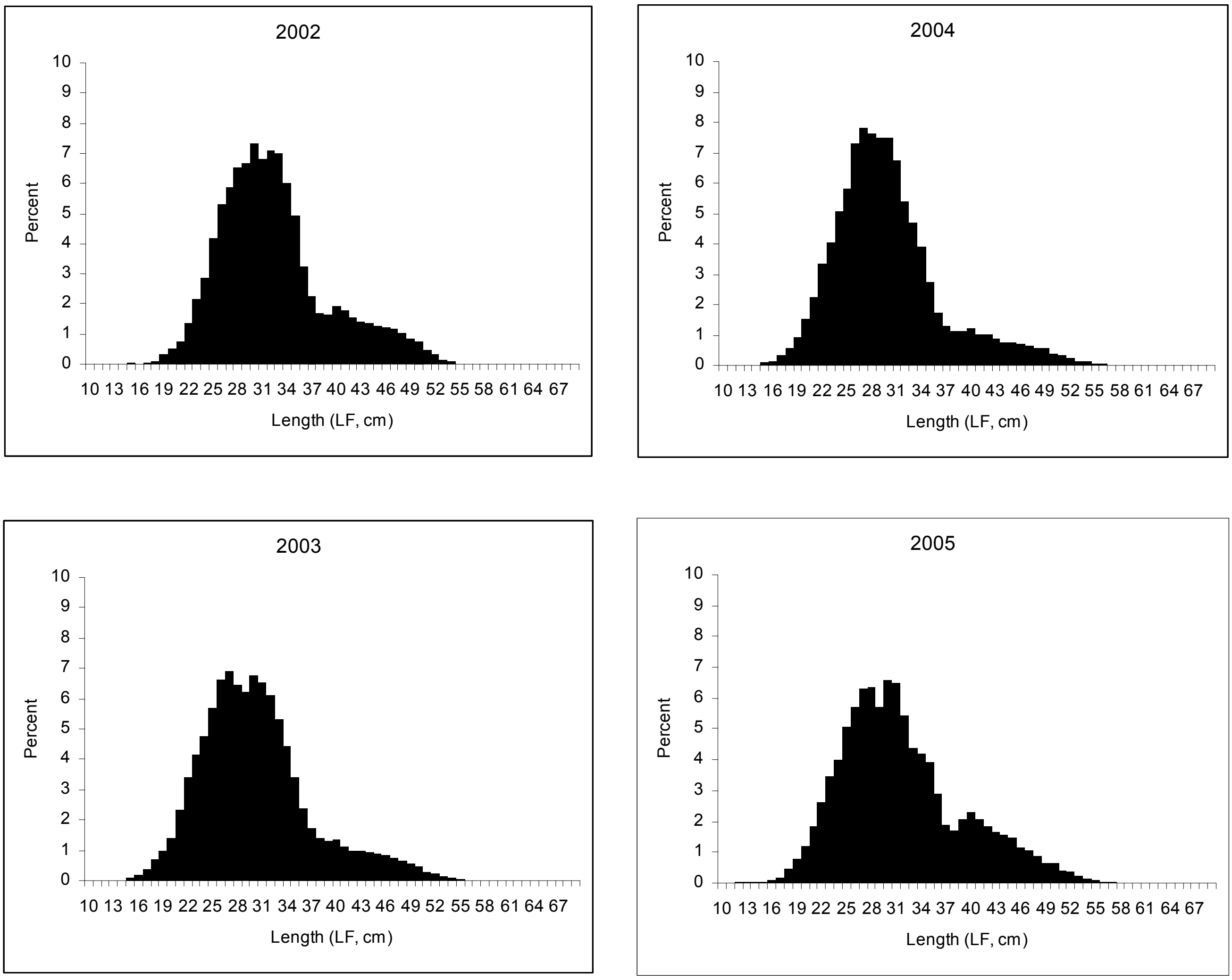


Figure 11.3.2. Fishery length composition of *Pagellus bogaraveo* from ICES area Xa2, (Azores).

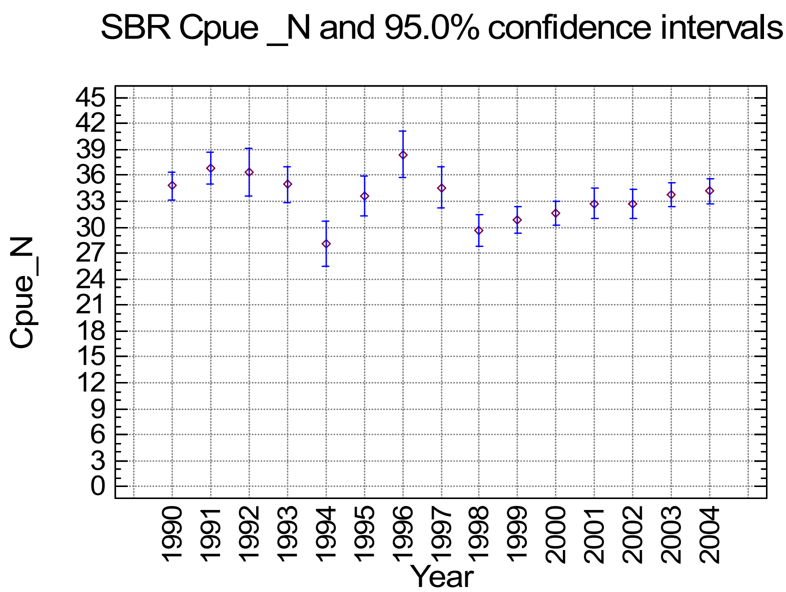


Figure 11.3.3. Annual standardized CPUE in number per thousand hooks and 95% confidence intervals for the Azores bottom longline blackspot seabream

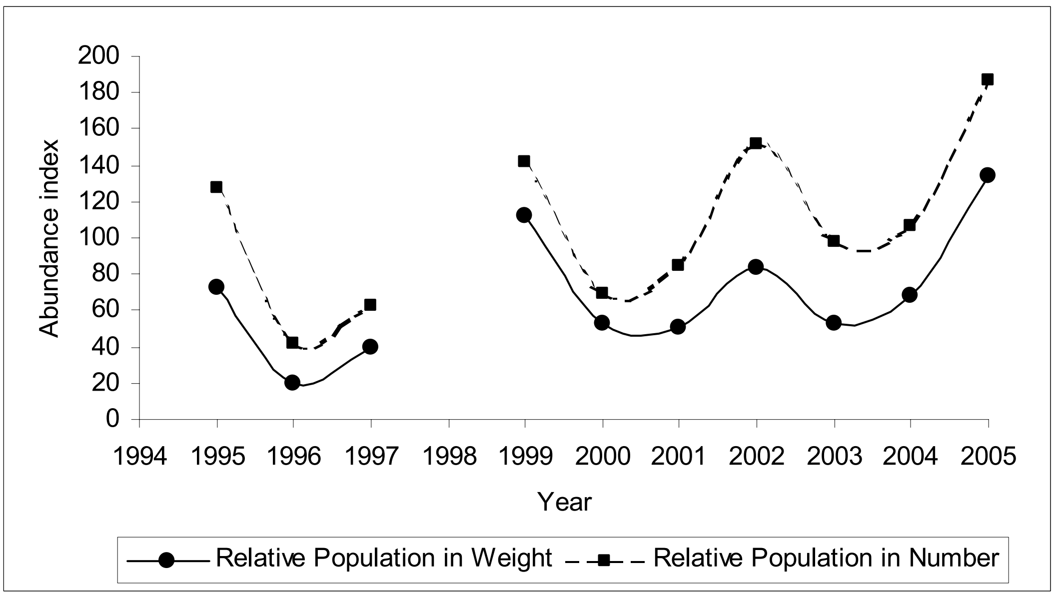


Figure 11.3.4. Annual abundance in number (Relative Population Number) and in weight (Relative population weight) of *Pagellus bogaraveo* from surveys for the ICES area Xa2.

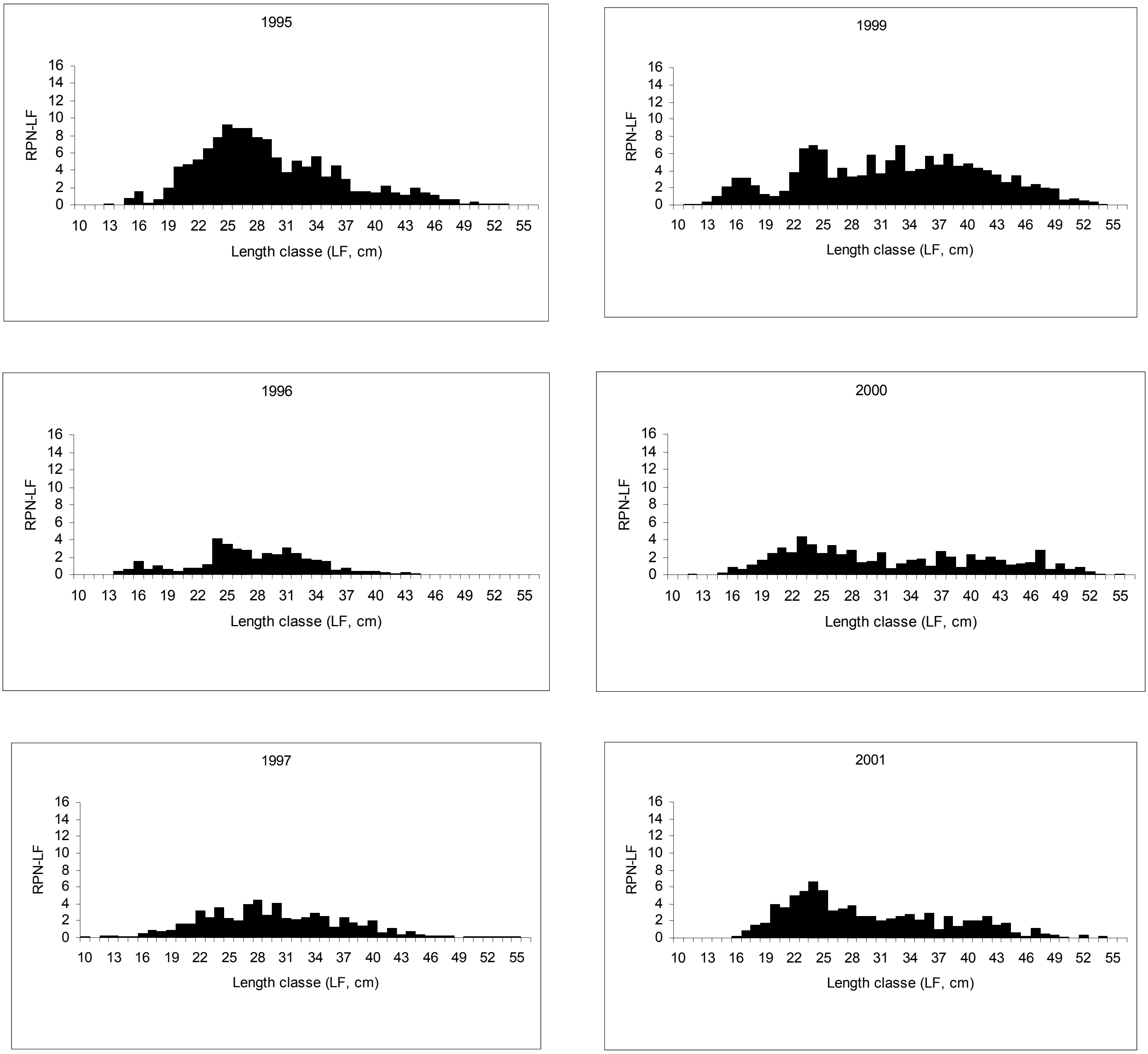
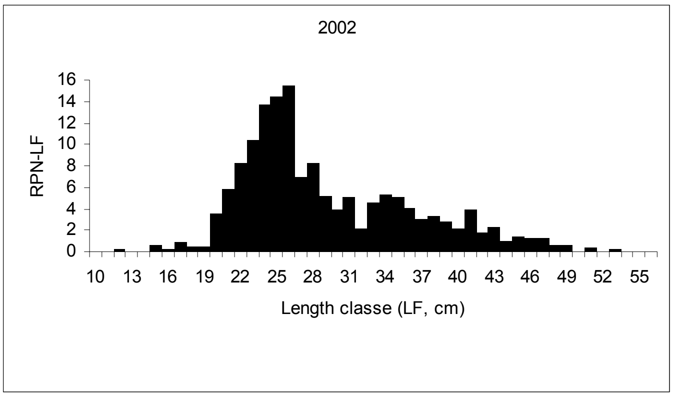
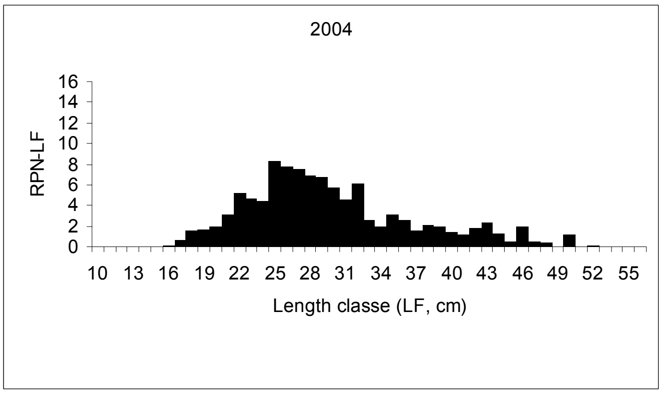
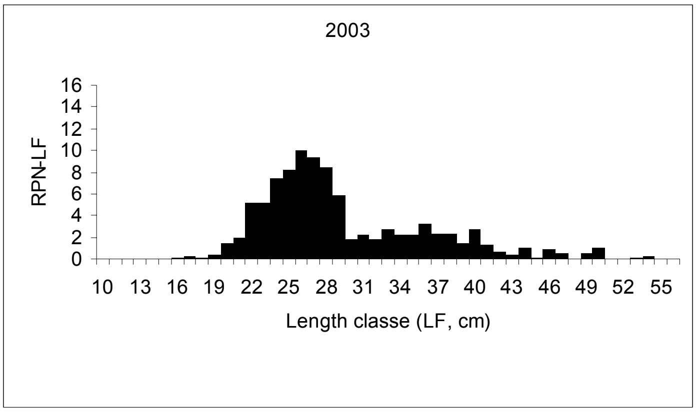


Figure 11.3.5. Annual length composition of *Pagellus bogaraveo* from the Azorean spring bottom longline survey for the period 1995-2005 (ICES area Xa2).







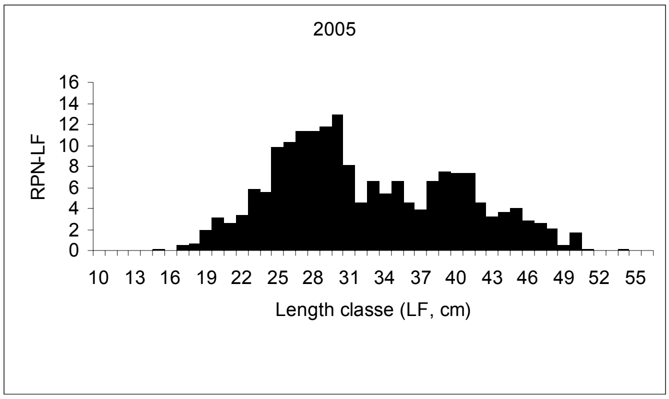


Figure 11.3.5. Cont. Annual length composition of *Pagellus bogaraveo* from the Azorean spring bottom longline survey for the period 1995-2005 (ICES area Xa2)

Table 11.3.1. 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

12 Stocks and fisheries of combined eco-regions

12.1 LING (*MOLVA MOLVA*) IN IIIa, IV, VI, VII, VIII, IX, X, XII, XIV

12.1.1 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 presently, the major aimed ling fishery in IVa is the Norwegian longlining conducted around Shetland and in the Norwegian Deep. There is little activity in IIIa. Of the total Norwegian landings about 75% are taken by longline, 15% by gillnet, and the remainder by trawl. The bulk of the landings from other countries were taken by trawl as by-catches in other fisheries, and the landings from the United Kingdom (Scotland) are the most substantial. The comparatively low landings from the central and southern North Sea (IVb,c), are by-catches in various other fisheries.

The major aimed ling fishery in VI is the Norwegian longlining. Trawl fisheries by the United Kingdom (Scotland) and France primarily take ling as by-catch.

In Sub-area 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 aimed longline fisheries, whereas other landings are primarily by-catches in trawl fisheries. Data split by gear type was not available for all countries, but the bulk of the total landings (at least 60-70%) are taken by trawl in these areas.

In Subarea VIII and IX, XII and XIV all landings are by-catches in various fisheries.

12.1.1.1 Landings trends

Landing statistics by nation in the period 1988-2006 are given in Table 12.1.0. In Division IVa the total landings has varied between near 10,000 and 13,000 t until 1998, but declined until 2005 to about half that level, in 2006 there was an increase in total catches. The provisional figure for 2006 is 9713 tonnes.

In Division VIa the statistics are incomplete for the period 1989-1993. In the period 1994-2006 when the data are complete, they show 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 have also declined in the last decade 1994-2006, primarily due to reduced Norwegian contributions.

In Subarea VII there appears to have been an increasing trend in the 1990s and landings in the period 1995-1997 were above 10 000 t. In 1998 the total landing was 11,100 t. Subsequently there has been a decline in most areas, and the figure for 2006 is only 4038 t.

In Subarea VIII landings appear to have declined in the most recent years. And in Subareas IX, XII, and XIV the ling landings have remained minor.

12.1.1.2 ICES advice

The advice statement from 2004 was: *The overall fishing effort in Subareas IV, VI, VII, and VIII should be reduced by 30% as compared to the 1998 level.*

No advice was given for the remaining subareas where landings are minor.

12.1.1.3 Management

Since 2003 an annual unilateral TAC was introduced by the EC for all the Subareas, and the regulation is valid for EU vessels fishing in the EU EEZ and in international waters. There is no species-specific regulation in the Norwegian EEZ, but a TAC is negotiated for Norwegian vessels fishing in EU waters.

EU TACs (Valid after 2003 for community vessels fishing in community waters and waters not under the sovereignty or jurisdiction of third countries):

Subarea III: 136 tonnes
Subarea IV: 4666 tonnes
Subarea VI, VII, VIII, IX, XII, XIV: 14966 tonnes

12.1.2 Stock identity

No new information on stock separation was available. Relevant data were presented and discussed in reports of previous Norwegian and Nordic projects and summarised in the 1998 report of the study group (ICES C.M. 1998/ACFM:12). 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 previously that ling in the Subareas VI-IX could be regarded as one unit, but this remains uncertain, as does its relation to ling in the North Sea (III and IV).

In an ongoing project microsatellite DNA primer development is soon to be completed, Further, samples from several parts of ling’s distribution range are obtained. DNA analysis will be initiated autumn 2007.

12.1.3 Data available

12.1.3.1 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.

12.1.3.2 Length compositions

Length compositions/mean lengths from 1976 to present based on data from the Norwegian longliners were presented in Bergstad and Hareide (1996) and Helle and Pennington (WD6, 2007). In this period, when the ling has been fully or heavily exploited, the mean length has varied without any clear trend.

Length compositions from Spanish experimental longlining in XIIb and VI was presented in a WD by Muñoz (2006).

12.1.3.3 Age compositions

No new age compositions were available.

12.1.3.4 Weight at age

No new data were presented.

12.1.3.5 Maturity and natural mortality

No new data were presented.

12.1.3.6 Catch, effort and research vessel data

Catch and effort data for Norwegian longliners and Danish and Basque trawlers were presented. No research vessel data were available.

The extensive Norwegian longliner CPUE data based on private skipper's 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:

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 2000-2006. 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.

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 and Pennington, WD 2004). 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). And both the analysis form the 1990s and after 2000 include data from Subareas IV, VI and VII.

LPUE data for the period 1994-2003 were presented for the Basque "Baka" trawlers fishing in VI and VII.

CPUE for Danish trawlers fishing in IIIa and IV were available for the period 1992-2006.

12.1.4 Data analyses

No analytical assessments were possible due to lack of age-structured data and/or tuning series.

A source of information on abundance trends was the CPUE series from the Norwegian longliners presented by Helle and Pennington (WD6, 2007). The number of high-seas longliners has declined in recent years (Table 12.1.1), from 72 to 35 in the period 2000-2006. The remaining vessels have maintained an annual landing level of 300-550 tonnes/vessel and the vessels operate in the entire Northeast Atlantic. However, the number of fishing days with ling catch has increased in the same period (Table 12.1.2). The number of hooks set per day and the total set per year has remained rather stable in the relevant Subareas (Table 12.1.2 and 12.1.3), but summed over all areas the total number of hooks declined in the last three years.

Table 12.1.4 gives estimates of CPUE based on the Norwegian official logbooks and the reference vessels. In Figure 12.1.1 the data for 2000-2006 are shown, and in Figure 12.1.2 these recent data are given together with the data for the period 1971-1994 (considered earlier by WGDEEP and presented in Bergstad and Hareide, 1996). There is a gap in the time series between 1995 and 2000, and due to data limitations it was not possible to estimate CPUE for all years in the early period. The data are most extensive and presumably most reliable from the more important Subareas IV and VI.

The CPUE varied strongly, but declined markedly in the 1970s and 1980s, and the level appears to have remained comparatively low from the early 1990s into the 2000-2006 period.

There is an apparent increase in the most recent years, but this must be interpreted with caution since it is based on few logbooks.

Table 12.1.0. 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**

*Preliminary

LING IVa

Year	Belgium	Denmark	Faroes	France	Germany	Neth.	Norway	Sweden[1)]	E&W	N.I.	Scot.	**Total**
1988	3	408	13	1,143	262	4	6,473	5	55	1	2,856	**11,223**
1989	1	578	3	751	217	16	7,239	29	136	14	2,693	**11,677**
1990	1	610	9	655	241	-	6,290	13	213	-	1,995	**10,027**
1991	4	609	6	847	223	-	5,799	24	197	+	2,260	**9,969**
1992	9	623	2	414	200	-	5,945	28	330	4	3,208	**10,763**
1993	9	630	14	395	726	-	6522	13	363	-	4,138	**12,810**
1994	20	530	25	n/a	770	-	5355	3	148	+	4,645	**11,496**
1995	17	407	51	290	425	-	6,148	5	181		5,517	**13,041**
1996	8	514	25	241	448		6,622	4	193		4,650	**12,705**
1997	3	643	6	206	320		4,715	5	242		5,175	**11,315**
1998	8	558	19	175	176		7,069	-	125		5,501	**13,631**
1999	16	596	n.a.	293	141		5,077		240		3,447	**9,810**
2000	20	538	2	146	103		4,780	7	74		3,576	**9,246**
2001		702		125	54		3613	6	61		3290	**7851**
2002	6	578	24	115			4509		59		3779	**9070**
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		4437	3	55		1455	**6713**

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

Table 12.1.0. (continued)

LING IVb,

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	0	3	23	62	60	6	2	**283**
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**

*Preliminary

LING VIa

Year	Belgium	Denmark	Faroes	France [1]	Germany	Ireland	Norway	Spain[2]	E&W	IOM	N.I.	Scot.	**Total**
1988	4	+	-	5,381	6	196	3,392	3575	1,075	-	53	874	**14,556**
1989	6	1	6	3,417	11	138	3,858		307	+	6	881	**8,631**
1990	-	+	8	2,568	1	41	3,263		111	-	2	736	**6,730**
1991	3	+	3	1,777	2	57	2,029		260	-	10	654	**4,795**
1992	-	1	-	1,297	2	38	2,305		259	+	6	680	**4,588**
1993	+	+	-	1,513	92	171	1937		442	-	13	1,133	**5,301**
1994	1	1		1713	134	133	2034	1027	551	-	10	1,126	**6,730**
1995	-	2	0	1970	130	108	3,156	927	560	n/a		1994	**8,847**
1996			0	1762	370	106	2809	1064	269			2197	**8,577**
1997			0	1,631	135	113	2229	37	151			2,450	**6,746**
1998				1,531	9	72	2,910	292	154			2,394	**7,362**
1999				941	4	73	2,997	468	152			2,264	**6,899**
2000	+	+		717	3	75	2956	708	143			2287	**6889**
2001				728	3	70	1869	142	106			2179	**5097**
2002				351	1	44	973	190	65			2452	**4076**
2003				284	1	88	1477	75	108			1257	**3290**
2004				249	1	96	791	43	8			1619	**2807**
2005			18	424		89	1389	61	1			1108	**3072**
2006*			5	499	2	121	998	61	137			811	**2629**

*Preliminary. [1] Includes VIb until 1996 [2] Includes minor landings from VIb.

Table 12.1.0. (continued)

LING VIb

Year	Faroes	France [2]	Germany	Ireland	Norway	Spain [3]	E & W	N.I.	Scotland	Russia	**Total**
1988	196		-	-	1,253		93	-	223		**1,765**
1989	17		-	-	3,616		26	-	84		**3,743**
1990	3		-	26	1,315		10	+	151		**1,505**
1991	-		-	31	2,489		29	2	111		**2,662**
1992	35		+	23	1,713		28	2	90		**1,891**
1993	4		+	60	1179		43	4	232		**1,522**
1994	104		-	44	2116		52	4	220		**2,540**
1995	66		+	57	1,308		84		123		**1,638**
1996	0		124	70	679		150		101		**1,124**
1997	0		46	29	504		103		132		**814**
1998		1	10	44	944		71		324		**1,394**
1999		26	25	41	498		86		499		**1,175**
2000	+	18	31	19	1,172		157		475	7	**1,879**
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	+	7	3	6	717		6		141	182	**1062**
2005		31	4	17	628		9		97	356	**1142**
2006*	30	4	3	48	1171		19		130	6	**1411**

*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 12.1.0. (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	5	91	15			7	**118**
2003	4	2	75	18			11	**110**
2004	3	2	47	11			34	**97**
2005	4	2	28	12			15	**61**
2006*	2	1	50	8			27	**88**

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

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	**1,286**
1993	-[1]	97	224	145		550	9	409	**1,434**
1994	-[1]	98	225	306		530	2	434	**1,595**
1995	78	161	465	295		630	-[2]	315	**1,944**
1996	57	234	283	168		1117	-[2]	342	**2,201**
1997	65	252	184	418		635	-[2]	226	**1,780**
1998	32	1	190	89		393		329	**1,034**
1999	50	4	377	288		488		159	**1,366**
2000	117	21	401	170		327		140	**1176**
2001	80	2	413	515		94		122	**1226**
2002	123	0	315	207		151		159	**955**
2003	88	0	270			74		52	**484**
2004	130	12	255	163		27		50	**637**
2005	144	11	208			17		48	**428**
2006*	173	1	311	147		13		23	**668**

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

Table 12.1.0. (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		**1,389**
1996	15		960		499	3		**1,477**
1997	12		1,049	1	372	1	37	**1,472**
1998	10		953		510	1	26	**1,500**
1999	7		542	-	507	1		**1057**
2000	5		452	1	372		14	**844**
2001	6		399		399			**804**
2002	7		464		386	0		**857**
2003	5		446	1	250	0		**702**
2004	13		542	1	214			**770**
2005	11		665		236			**912**
2006*	9		465		208			**682**

*Preliminary

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	90	1	111		**217**
2001	14	111	-	92		**217**
2002	16	131	3	295		**445**
2003	15	72	1	81		**169**
2004	18	71	5	65		**159**
2005	36	65	7	82		**190**
2006*	10	42	14	64		**130**

*Preliminary. (1) See Ling VII.

Table 12.1.0. (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	-	2,652	1,439	-	-	2	**4,415**
1989	23	-	[-1]	-	301	163		518	-	+	7	**1,012**
1990	20	+	[-1]	-	356	260		434	+	-	7	**1,077**
1991	10	+	[-1]	-	454	-		830	-	-	100	**1,394**
1992	10	-	[-1]	-	323	-		1,130	-	+	130	**1,593**
1993	9	+	[-1]	35	374			1,551	-	1	364	**2,334**
1994	19	-	[-1]	10	620		184	2,143	-	1	277	**3,254**
1995	33	-	1597	40	766	-	195	3046		[-3]	454	**6,131**
1996	45	-	1626	169	771		583	3209			447	**6,850**
1997	37	-	1,574	156	674		33	2112			459	**5,045**
1998	18	-	1,362	88	877		1669	3,465			335	**7,814**
1999	-	-	1235	49	554		455	1619			292	**4204**
2000	17		1019	12	624		639	921			303	**3535**
2001	16		1103	4	727	24	559	591			285	**3309**
2002	16		950	2	951		568	862			102	**3451**
2003	12		1054	5	808		607	382			38	**2906**
2004	14		947		686		530	335			5	**2517**
2005	15		842	12	539		484	313			4	**2209**
2006*	10		674		935		571	262			18	**2470**

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

LING VIII

Year	Belgium	France	Germany	Spain	E & W	Scot.	**Total**
1988		1,018			10		**1,028**
1989		1,214			7		**1,221**
1990		1,371			1		**1,372**
1991		1,127			12		**1,139**
1992		801			1		**802**
1993		508			2		**510**
1994		n/a		77	8		**85**
1995		693		106	46		**845**
1996		825	23	170	23		**1,041**
1997	1	705	+	290	38		**1,034**
1998	5	1,220	-	543	29		**1,797**
1999	22	233	-	188	8		**451**
2000	1	219		106	5		**331**
2001		228		341	6	2	**577**
2002		288		141	10	0	**439**
2003		267		147	36		**450**
2004		362		112	53		**527**
2005		338		141	19		**498**
2006*		323		73	45		**441**

*Preliminary

Table 12.1.0. (continued)

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

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**

*Preliminary

Table 12.1.0. (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**

*Preliminary.

Ling. Total landings by Sub-area or Division.

Year	III	IVa	IVb,c	VIa	VIb	VII	VIIa	VIIb,c	VIId,e	VIIf	VIIg-k	VIII	IX	XII	XIV	All areas
1988	331	11223	379	14556	1765	5057	211	865	779	444	4415	1028		0	3	41056
1989	422	11677	387	8631	3743	5261	311	577	700	310	1012	1221		0	1	34253
1990	543	10027	455	6730	1505	4575	169	678	799	233	1077	1372		3	9	28175
1991	484	9969	490	4795	2662	3977	125	749	680	302	1394	1139		10	1	26777
1992	549	10763	842	4588	1891	2552	105	1286	519	137	1593	802		0	17	25644
1993	642	12810	797	5301	1522	2294	219	1434	436	223	2334	510		0	9	28531
1994	469	11496	323	6730	2540	2185	284	1595	451	400	3254	85		5	6	29823
1995	412	13041	659	8847	1638		305	1944	1389	602	6131	845		50	17	35880
1996	402	12705	569	8577	1124		210	2201	1477	399	6850	1041		2	0	35557
1997	311	11315	699	6746	814		264	1780	1472	547	5045	1034	0	9	61	30097
1998	214	13631	627	7362	1394		198	1034	1500	561	7814	1797	2	2	6	36142
1999	216	9810	446	6899	1175		84	1366	1057	312	4204	451	1	2	1	26024
2000	228	9246	384	6889	1879		73	1176	844	217	3535	331	1	7	26	24836
2001	262	7851	283	5097	788		87	1226	804	217	3309	577	0	59	35	20595
2002	263	9070	309	4076	533		118	955	857	445	3451	439	0	8	20	20544
2003	261	6433	234	3290	660		110	484	702	169	2906	450		19	83	15801
2004	232	6306	241	2807	1062		97	637	770	159	2517	527			10	15365
2005	210	6449	149	3072	1142		61	428	912	190	2209	498		1	0	15321
2006*	188	9713	144	2629	1411		88	668	682	130	2470	411		1	0	18535

*Preliminary

Table 12.1.1. Estimated number of days that the Norwegian long liner fleet (selected using criteria described in the text, Ch 4.2) operated in Subareas III to XIV (not V) in the period 2000-2006

All species	2000	2001	2002	2003	2004	2005	2006
IIIa	+			1			
IVa	20	23	22	18	22	21	39
IVb	1	1	1	1			
VIa	13	13	6	10	15	23	19
VIb	5	4	5	3	6	9	6
VIIc	2	1			1	0,5	
XII	+	3		2			
XIVb	6	4	6	5	5		

Table 12.1.2. Estimated number of hooks that the Norwegian long liners set per day in Subarea III-IV and VI-XIV 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	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
IIIa	30250	4					33037	27						
IVa	29395	664	30827	744	32199	633	33484	510	30933	439	34039	331	34465	348
IVb	30263	38	31478	23	33867	15	32559	34						
VIa	22808	433	24599	435	21465	185	29517	290	25636	308	24807	369	22692	169
VIb	31023	178	30772	127	31597	149	31325	97	31559	111	35949	137	31255	51
VIIc	29383	81	33108	37					25250	28	33427	7		
XII	13500	4	15389	108			12510	51						
XIVa	28333	6												
XIVb	2815	191	2465	135	13177	162	15480	157	12474	105				

Table 12.1.3. Estimated total number of hooks (in thousands) the Norwegian long liner fleet used in Subareas III-IV and VI-XIV for the years 2000-2006 in the fishery for ling (with a by-catch of tusk and blue ling).

All	2000	2001	2002	2003	2004	2005	2006
IIIa	256			1599			
IVa	41333	45176	40764	30621	29196	27463	46630
IVb	2435	1426	1016	1985			
VIa	20914	21077	7942	15349	16976	22312	14914
VIb	11694	7698	9416	5448	7532	12005	6199
VIIc	5040	2413			1520	570	
XII	114	3274		1144			
XIVb	1139	655	4269	4358	2816		

Table 12.1.4. Estimated mean CPUE ([kg/hook]x1000) in IIIa-IV and VI-XIV based on log book data. Standard error (se) and number of catches sampled (n) is also given.

Official logbook data:

Ling

	2000			2001			2002			2003			2004			2005			2006		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
IIA	26,2	727	1	22	1308	0,6	24,2	1346	0,5	29,0	924	0,7	37,3	630	1,4	50,1	770	1,5	35,73	406	1,94
IIIA	5,6	4	13,5							2,4	25	4,1									
IVA	58,7	597	1,1	48,3	694	0,8	55,5	618	0,8	57,2	505	0,9	78,5	439	1,7	85,12	328	2,3	89,08	348	2,1
IVB	8,3	25	5,4	2,4	12	6,6	1,4	3	10,8	2,9	29	3,8									
VIA	102,2	411	1,4	87,9	378	1,2	76,9	176	1,4	74,2	284	1,2	101,7	308	2,0	116,8	369	2,2	88,09	169	3,01
VIB	45,9	127	2,4	35,8	114	2,1	37,6	149	1,5	67,9	85	2,2	71,9	110	3,4	68,8	137	3,6	119,02	51	5,49
VIIC	82,9	78	3	78,4	37	3,7							122	28	6,7	66,4	7	14,4			
XIVA	3,75	6	11,1																		

Reference fleet data:

Ling	2001			2002			2003			2004			2005			2006		
Area	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	47,12	183	2,46	54,4	275	2,4	54,94	366	2,33
IVA							31,1	40	3,71	99,8	83	3,66	82,6	99	4	78,2	90	4,71
VIA							83,3	43	3,58									
VIB				59,4	5	8,71	31,1	34	4,02							113,83	32	7,9

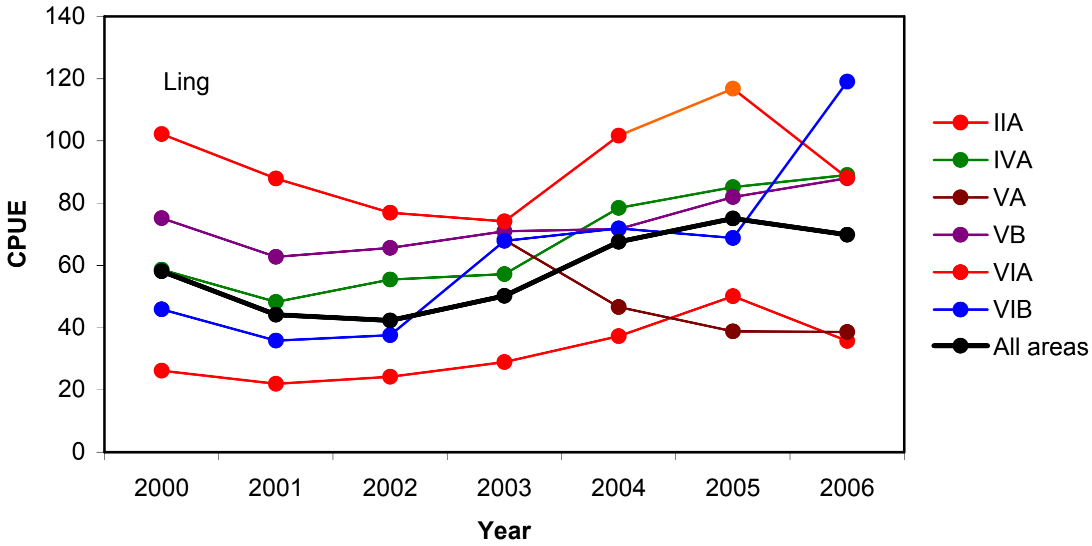


Figure 12.1.1. Estimated mean CPUE ([kg/hook]x1000) based on data from the official log books for tusk and ling in each ICES Subarea and all areas combined for the years 2000- 2006.

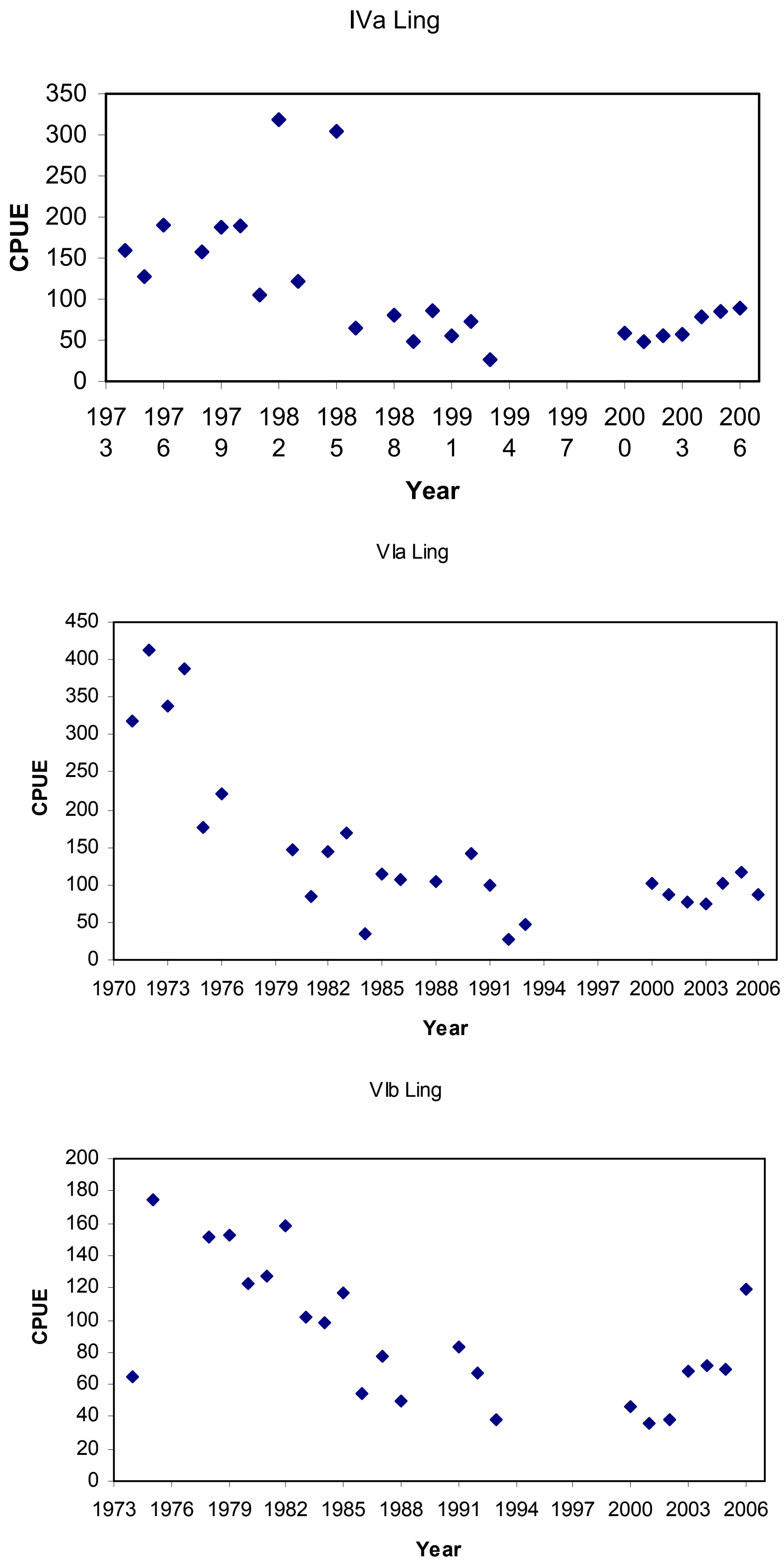


Figure 12.1.2. Estimates of CPUE (kg/1000 hooks) of ling based on skipper's logbooks (pre-2000) and official logbooks (post 2000). Combination of data from Bergstad and Hareide (1996) and WD3 by Helle and Prnnington (2007). Note gap in time series between 1993 and 2000, and the differences in CPUE scale between areas.

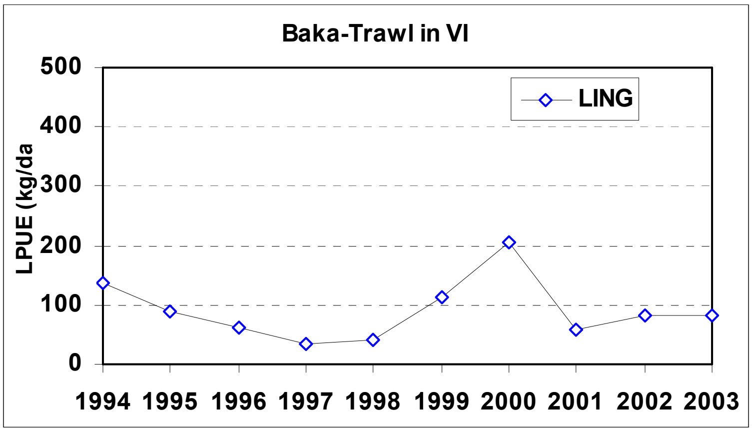


Figure 12.1.3. Landings per fishing effort of ling in ICES Sub-area VI, of "Baka" trawlers of the Basque Country, in 1994-2003. (Data on 2003 are preliminary). LPUE = kg/(Nº trip*(mean fishing days/trip) = kg/day)

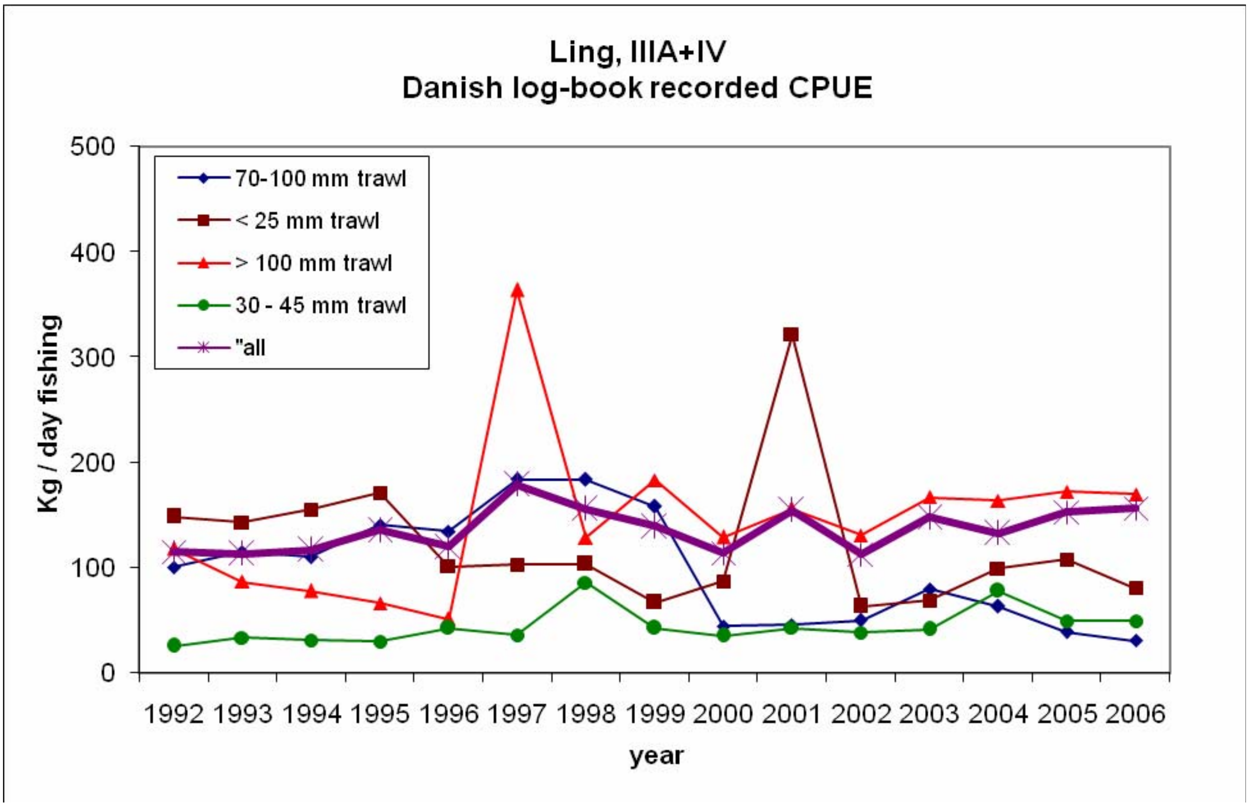


Figure 12.1.4. CPUE of ling for Danish trawlers in Subareas IIIa and IV. Based on logbook data.

12.2 BLUE LING (*MOLVA DYPTERYGIA*) IN I, II, IIIa, IV, VIII, IX, X, XII

12.2.1 The fishery

12.2.1.1 Landings trends

Landings data are shown in Table 12.2.1.

12.2.1.2 ICES advice

The latest advice is from ICES ACFM in October 2006 is:

"Trends in abundance from all areas indicate declines of varying gravity. In Iceland the decline appears to have halted, west of the British Isles it is stable but at a very depleted level, while it appears seriously depleted in Subdivisions I and II. In all areas the species is at a low level of abundance relative to when the fisheries commenced.

In most cases advice is given to stop directed fishing. Where blue ling is taken as a bycatch, seasonal closed areas can be an effective means of reducing exploitation."

12.2.1.3 Management

In 2006 there was an EC TAC for EU vessels fishing for blue ling in EU and international waters in VI and VII of 3137 t and in II, IV and V of 119 t per annum

The TAC in VI and VII in 2006 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) (see below).

EU TAC area	EU TAC in 2006 (t)	EU landings in 2006 (t)
VI and VII	3137	2284
II, IV and V	119	840 (Vb only)

12.2.2 Stock identity

WGDEEP 2007 reviewed existing knowledge and assessed new information on stock identity in blue ling. The results are presented in section 4.3.4 of this report.

The WG considered that available information is inadequate to evaluate the stock structure of blue ling in the NE Atlantic. It is suggested that the current practise of separating blue ling into a northern stock (Va and XIV) and a southern stock (Vb,VI,VII) is continued until information from microsatellite studies is available. The stock structure should then be reviewed.

12.2.3 Data availability

12.2.3.1 Landings and discards

Landings data are shown in Table 12.2.1.

12.2.3.2 Length compositions

No length data are available.

12.2.3.3 Age compositions

No age data are available.

12.2.3.4 Weight at age

No weight at age data are available.

12.2.3.5 Maturity and natural mortality

No new data were available.

12.2.3.6 Catch, effort and RV data

No data are available.

12.2.3.7 Data analyses

No data analyses were carried out.

Table 12.2.1. Blue ling (Molva dypterygia). Working Group estimates of landings (tonnes)

Blue ling 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

*Preliminary.

Blue ling 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*	48	4			148					200

*Preliminary.

Table 12.2.1 (continued). Blue ling 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

*Preliminary.

Blue ling 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

*Preliminary

Table 12.2.1 (continued). Blue ling IVb

Year	France	E & W	Norway	Faroes	Denmark	Germany	Scotland	Total
1988								0
1989	2							2
1990	6							6
1991	7							7
1992	1							1
1993	0	3						3
1994	0							0
1995	3	3						6
1996	5	5	1					11
1997	1							1
1998	5		1					6
1999	0	1	0					1
2000	1							1
2001	0							0
2002			1					1
2003			1		8			9
2004								0
2005	1							1
2006*								0

*Preliminary.

Blue ling IVc

Year	E & W	Norway	Total
1988			0
1989			0
1990			0
1991			0
1992			0
1993			0
1994	3		3
1995			0
1996			0
1997			0
1998			0
1999			0
2000			0
2001			0
2002			0
2003			0
2004			0
2005			0
2006*			0

*Preliminary.

Table 12.2.1 (continued). Blue ling VIII & IX

Year	France	Spain	Total
1997		14	14
1998		33	33
1999	1	3	4
2000	2	2	4
2001	2	4	6
2002	3	26	29
2003	2	20	22
2004*	4	18	22
2005	10	55	65
2006*	13	27	40

*Preliminary.

Blue ling XII

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

*Preliminary.

Table 12.2.1 (continued). Blue ling.Total landings by Subarea/division and grand total. (Landings from areas VIIIIX and X given in previous reports are now considered to represent Molva macrophthalma.

Year	I	II	III	IV	VIII&IX	XII	Total
1988		3537	22	363	0	263	4185
1989		2058	23	459	0	70	2610
1990		1412	21	501	0	5	1939
1991		1479	21	627	0	1147	3274
1992		1039	38	554	0	971	2602
1993		1020	23	415	0	3335	4793
1994	3	419	18	424	0	752	1616
1995	5	359	20	483	0	573	1440
1996	0	267	12	190	0	788	1257
1997	1	291	21	270	14	417	1014
1998	1	278	6	286	33	438	1042
1999	0	291	6	265	4	1353	1919
2000	1	249	14	130	4	594	992
2001	3	208	24	252	6	675	1168
2002	1	149	9	377	29	1270	1835
2003	1	147	19	101	22	1069	1359
2004	0	174	19	83	22	644	942
2005	1	171	49	70	0	0	291
2006*							

*Preliminary

12.3 TUSK (*BROSME BROSME*) IN IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV

12.3.1 The fishery

Tusk is a by-catch species in trawl, gillnet and long line 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 long liners.

12.3.1.1 Landings trends

Landing statistics by nation in the period 1988-2006 are given in Table 12.3.0.

For all Subareas/Divisions there was a declining trend in the catches. This is most pronounced in Division IVa where the catches has declined from about 4000 tonnes in the beginning of the 1990s to about 1500 tonnes/year during the last few years. However, in 2006 there was a slight increase of the catches in most ICES areas.

12.3.1.2 ICES advice

The advice statement from 2004 was: *Effort should be reduced by 30% compared to the 1998 effort.*

12.3.1.3 Management

There is a licencing scheme and effort limitation in Vb. In EU waters the TAC for the EU fleet was 1155 tonnes per year for 2003 onwards (see below). Norway, who also has a licensing scheme, could in 2006 fish 4000 tonnes and in 2007 fish 3 400 tonnes in EU waters, and also has bilaterally agreed quotas in Va and Vb. The effort in the NEAFC regulatory area has been frozen for 2003 and 2004. The minimum landing length for tusk in area Vb is 40 cm.

EU TACs (Valid after 2003 for community vessels fishing in community waters and waters not under the sovereignty or jurisdiction of third countries):

Subarea I, II, XIV: 35 tonnes

Subarea III: 40 tonnes

Subarea IV: 370 tonnes

Subarea V, VI, VII: 710 tonnes

12.3.2 Stock identity

In the 1998 report it was noted that ripening adult tusk and tusk eggs have been found in all parts of the distribution area, but the banks to the west and north of Scotland, around the Faroes and off Iceland, as well as the shelf edge along mid and north Norway seem to be the most important spawning areas (Magnússon *et al.* 1997). Nothing is known about migrations within the area of distribution. Studies of enzyme and haemoglobin frequencies showed no geographical structure, hence it was concluded that tusk in all areas, at least of the North-east Atlantic, belong to the same gene pool (Bergstad and Hareide, 1996).

In 2004 the Group concluded that widely separated fishing grounds may support separate management units, i.e., stocks. It was suggested that Iceland (Va) and the Norwegian coast (I and II) have self-contained units, while the separation among possibly several stocks to the north and west of the British Isles remained unclear.

Tusk is one of the species included in a Norwegian population structure study using molecular genetics (microsatellite DNA). New data presented to the meeting (Section 4) document for the first time geographical heterogeneity within the ICES area at scales that will require a revision of the current perception of population structure. Tusk occurring in sites separated by great depths, i.e. depths beyond 1000m or the normal depth range of tusk, appear to have a separate identity. Thus the Rockall tusk appears to have a separate identity, also tusk on the mid-Atlantic Ridge and Canada. Results from Iceland (Vb) and the Faroe Islands (Vb) in relation to each other and other areas are inconclusive. This issue and recommendations for future work was discussed in the special workshop on population structure of deepwater species (see chapter 4.3.2).

12.3.3 Data available

12.3.3.1 Landings and discards

Landings were available for all relevant fleets. New discard data were not available.

12.3.3.2 Length compositions

Length compositions/mean lengths from 1988 to present based on data from the Norwegian longliners were presented in Bergstad and Hareide (1996) and Helle and Pennington (WD?, 2007). In this period, when the tusk has been fully or heavily exploited, the mean length has varied around 50cm without any clear trend.

Length distributions from Faroese longliners in Vb were presented for the period 1994-2006. No trend in the composition can be seen in this series (Figure 12.3.6).

Length compositions from Spanish experimental longlining in XIIb and VI was presented in a WD18 by Muñoz (2006).

12.3.3.3 Age compositions

No new age compositions were available.

12.3.3.4 Weight at age

No new data were presented.

12.3.3.5 Maturity and natural mortality

No new data were presented.

12.3.3.6 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 data based on private skipper's 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:

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 2000-2006. 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.

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 and Pennington, WD 2004). 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 (2007).

CPUE from a Spanish experimental long line fishery in VI, VII and VII in 2005 was provided, and for Danish trawlers fishing in IVa CPUE was available for the period 1992-2006.

Data from Faroese summer and autumn surveys were available for the period 1994 onwards. CPUE from the Faroese longliners (>100 GRT) for the period 1987-2006 was also available.

12.3.4 Data analyses

No analytical assessments were possible due to lack of age-structured data and/or tuning series.

One source of information on abundance trends was the CPUE series from the Norwegian longliners presented by Helle and Pennington (2007). The number of longliners has declined in recent years, from 72 to 35 in the period 2000-2006. However, the number of fishing days with tusk catch in Division VIa has increased in the same period (Table 12.3.1). The number of hooks set per day and the total set per year has remained rather stable in Subareas IVa, Vb and IV (Table 12.3.2 and 12.3.3).

Tables 12.3.4 and 12.3.5 gives estimates of CPUE based on the Norwegian official logbooks and the reference vessels, and the same results are shown in Figure 12.3.1. In Figure 12.3.2 the data for 2000-2006 are shown together with the data for the period 1971-1994 (considered earlier by WGDEEP and presented in Bergstad and Hareide, 1996). There is a gap in the time series between 1995 and 2000, and due to data limitations it was not possible to estimate CPUE for all years in the early period.

The CPUE varied strongly, but generally declined in the 1970s and 1980s, and the level appears to have remained comparatively low from the early 1990s into the 2000-2006 period. There is an apparent increase in 2006 for all areas except in Division VIb, but this must be interpreted with caution since it is based on few logbooks.

It is interesting that the Spanish CPUE from experimental fisheries (Table 12.3.6 and 12.3.7) show CPUE-estmates very similar to the Norwegian series from logbooks from the commercial vessels.

CPUE of tusk for Danish trawlers in Subareas IVa based on logbook data show a declining trend in for the period 1992-2006 but not a major change in the last 5-7 years (Figure 12.3.3).

The Faroese groundfish survey series from Vb (Table 12.3.8, Figure 12.3.4) show a decreasing trend until 2000 and subsequently an increasing trend. For the longer series from commercial long liners, there is a general declining trend since 1986, perhaps with a levelling off in the last decade (Figure 12.3.5).

Table 12.3.0. Tusk IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV. 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

*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		26	8	2443	1	11		343	1	**3091**
2002	199		21		2438	1	8		294		**2961**
2003	217		19	6	1560		4		191		**1997**
2004	137	+	13	3	1370	+	2		140		**1665**
2005	123	17	11	4	1561	1	2		107		**1826**
2006*	155	8	14	3	1854		5		120		**2159**

[1]) Includes IVb 1988-1993 *Preliminary

Table 12.3.0 (continued).

TUSK IVb

Year	Denmark	France	Norway	Germany	E & W	Scotland	**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	134(1)	-	21	4	3	1	**163**
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**

(1) Includes IVc. *Preliminary

TUSK Vb1

Year	Denmark	Faroes(4)	France	Germany	Norway	E & W	Scotland (1)	Russia	**Total**
1988	+	2,827	81	8	1,143	-			**4,059**
1989	-	1,828	64	2	1,828	-			**3,722**
1990	-	3,065	66	26	2,045	-			**5,202**
1991	-	3,829	19	1	1,321	-			**5,170**
1992	-	2,796	11	2	1,590	-			**4,399**
1993	-	1,647	9	2	1,202	2			**2,862**
1994	-	2,649	8	1 (2)	747	2			**3,407**
1995		3,059	16	1 (2)	270	1			**3,347**
1996		1,636	8	1	1,083				**2,728**
1997		1,849	11	+	869		13		**2,742**
1998		1,272	20	-	753	1	27		**2,073**
1999		1956	27	1	1522		11(3)		**3517**
2000		1150	13	1	1191	1	11(3)		**2367**
2001		1916	14	1	1572	1	20		**3524**
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**

(1)Included in Vb_2 until 1996. (2)Includes Vb_2. (3)Reported as Vb.(4) 2000-2003 Vb1 ans Vb2 combined. *Preliminary

Table 12.3.0 (continued).

TUSK Vb2

Year	Faroe	Norway	E & W	Scotland [1]	Total
1988	545	1,061	-	+	**1,606**
1989	163	1,237	-	+	**1,400**
1990	128	851	-	+	**979**
1991	375	721	-	+	**1,096**
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**

(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	-	1,310	30	-	13		**2,120**
1989	+	6	694	3	2	1,583	3	-	6		**2,297**
1990	-	9	723	+	-	1,506	7	+	11		**2,256**
1991	-	5	514	+	-	998	9	+	17		**1,543**
1992	-	-	532	+	-	1,124	5	-	21		**1,682**
1993	-	-	400	4	3	783	2	+	31		**1,223**
1994	+		345	6	1	865	5	-	40		**1,262**
1995		0	332	+	33	990	1		79		**1,435**
1996		0	368	1	5	890	1		126		**1,391**
1997		0	359	+	3	750	1		137	11	**1,261**
1998			395	+		715	-		163	8	**1,281**
1999			193	+	3	113	1		182	47	**539**
2000			238	+	20	1327	8		231	158	**1982**
2001			173	+	31	1201	8		279	37	**1729**
2002			113		8	636	5		274	64	**1100**
2003			105		4	905	3		104	13	**1134**
2004		1	140		22	470			93	17	**743**
2005		10	204		7	702			96	16	**1035**
2006*		4	239		10	674	16		115	15	**1073**

(1) Not allocated by divisions before 1993. *Preliminary

Table 12.3.0 (continued).

TUSK VIb

Year	Faroes	France	Germany	Ireland	Iceland	Norway	E & W	N.I.	Scot.	Russia	**Total**
1988	217		-	-		601	8	-	34		**860**
1989	41	1	-	-		1,537	2	-	12		**1,593**
1990	6	3	-	-		738	2	+	19		**768**
1991	-	7	+	5		1,068	3	-	25		**1,108**
1992	63	2	+	5		763	3	1	30		**867**
1993	12	3	+	32		899	3	+	54		**1,003**
1994	70	1	+	30		1,673	6	-	66		**1,846**
1995	79	1	+	33		1,415	1		35		**1,564**
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	**2,344**
2001	1	1		31		476	10		157	6	**681**
2002		9		3		515	8		88		**623**
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	**477**

*Preliminary

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*				

*Preliminary

Table 12.3.0 (continued).

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	3	54	177	4		25	**263**
2002	1	31	30	1		3	**66**
2003	1	19		1			**21**
2004	1	19					**20**
2005	4	18				1	**23**
2006*	4	23	63			0	**90**

*Preliminary

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	1	1	-	-		+	6	**8**
2000	3		5	-	-	+	6	**14**
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				2	**3**

*Preliminary

Table 12.3.0 (continued).

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			
2005			
2006*			

*Preliminary

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*						64	**64**

*Preliminary

Table 12.3.0 (continued).

TUSK XIVa

Year	Germany	Norway	**Total**
1988	2		**2**
1989	1		**1**
1990	2		**2**
1991	2		**2**
1992	+		+
1993	+		+
1994	-		+
1995	-		+
1996			+
1997		-	+
1998		-	+
1999		+	+
2000		-	**-**
2001		0	**0**
2002	-	-	-
2003	-	-	-
2004			
2005		5	5
2006*		0	0

*Preliminary

TUSK XIVb

Year	Faroes	Iceland	Norway	E & W	Russia	**Total**
1988			-	-		
1989	19	3	-	-		**22**
1990	13	10	7	-		**30**
1991	-	64	68	1		**133**
1992	-	82	120	+		**202**
1993	-	27	53	+		**80**
1994	-	9	16	+		**25**
1995	-	57	30	+		**87**
1996	-	139	142			**281**
1997	-	10	108			**118**
1998	1	-	14			**15**
1999	-	n.a.	9			**9**
2000			11			**11**
2001	3		69			**72**
2002	4	28	30			**62**
2003			88			**88**
2004			40			**40**
2005	7		36		8	**51**
2006*	3		19		51	**73**

*Preliminary

Table 12.3.0 (continued).

Tusk, total landings by Sub-areas or Division.

Year	III	IVa	IVb	Vb1	Vb2	VIa	VIb	VIIa	VIIb,c	VIIg-k	VIIIa	XII	XIVa	XIVb	All areas
1988	61	4429	0	4059	1606	2120	860		17	5	1	1	2	0	13161
1989	93	6418	4	3722	1400	2297	1593	2	108	86		1	1	22	15747
1990	60	4254	5	5202	979	2256	768	4	155	33		0	2	30	13748
1991	84	4537	2	5170	1096	1543	1108	2	52	14		1	2	133	13744
1992	85	4932	12	4399	992	1682	867	3	218	47		1		202	13440
1993	79	5141	14	2862	577	1223	1003		120	32		12		80	11143
1994	51	3375	7	3407	909	1262	1846		94	31		1		25	11008
1995	42	3348	15	3347	631	1435	1564	1	48	37		18		87	10573
1996	44	3369	163	2728	582	1391	939		58	29		158		281	9742
1997	31	2272	38	2742	577	1261	476	1	75	19		30		118	7640
1998	21	3387	66	2073	637	1281	915	1	33	10	1	1		15	8441
1999	29	2435	34	3517	447	539	953		147	8	0	1		9	8119
2000	36	3259	116	2367	333	1982	2344		164	14		5		11	10631
2001	57	3091	56	3524	469	1729	681	1	263	14		52		72	10009
2002	50	2961	71	2722	281	1100	623		66	5		27		62	7968
2003	51	1997	8	2733	559	1134	561		21	3		83		88	7238
2004	45	1665	23	3536	107	743	627		20	1		16		40	6823
2005	44	1826	7	3272	360	1035	692		23	2		3	5	51	7320
2006*	29	2159	32	3559	317	1073	477		90	3		64		73	7876

*Preliminary

Table 12.3.1. Estimated number of days that the Norwegian long liner fleet (selected using criteria described in the text, Ch 6) operated in Subareas III to XIV (not V) in the period 2000-2006.

Tusk	2000	2001	2002	2003	2004	2005	2006
IVa	18	21	21	16	22	21	39
IVb	1			2			
Vb	11	16	16	17	35	23	14
VIa	12	12	6	10	15	23	19
VIb	4	4	5	3	6	9	6
VIIc	2	1			1	0	
XII	1	2					
XIVb	2	1	+	1	3		

Table 12.3.2. Estimated number of hooks that the Norwegian long liners set per day in Subarea III-IV and VI-XIV 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	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
IIIa	30250	4					33037	27						
IVa	29395	664	30827	744	32199	633	33484	510	30933	439	34039	331	34465	348
IVb	30263	38	31478	23	33867	15	32559	34						
Vb	24409	381	26379	544	25939	475	29906	479	31804	693	29885	374	28469	128
VIa	22808	433	24599	435	21465	185	29517	290	25636	308	24807	369	22692	169
VIb	31023	178	30772	127	31597	149	31325	97	31559	111	35949	137	31255	51
VIIc	29383	81	33108	37					25250	28	33427	7		
XII	13500	4	15389	108			12510	51						
XIVa	28333	6												
XIVb	2815	191	2465	135	13177	162	15480	157	12474	105				

Table 12.3.3. Estimated total number of hooks (in thousands) the Norwegian long liner fleet used in Subareas III-IV and VI-XIV for the years 2000-2006 in the fishery for ling, tusk and blue ling.

All	2000	2001	2002	2003	2004	2005	2006
I	13468	9636	20709	24155	30200	28244	3761
IIa	95960	135173	135375	112970	97530	97401	81706
IIb	5004	19181	3128	4178	13391	17882	5472
IIIa	256			1599			
IVa	41333	45176	40764	30621	29196	27463	46630
IVb	2435	1426	1016	1985			
Va				1540	2997	1689	2049
Vb	19694	28265	24642	25686	47386	27244	13839
VIa	20914	21077	7942	15349	16976	22312	14914
VIb	11694	7698	9416	5448	7532	12005	6199
VIIc	5040	2413			1520	570	
XII	114	3274		1144			
XIVb	1139	655	4269	4358	2816		
All areas	217410	273973	247262	229033	250146	234810	174570

Table 12.3.4. Estimated mean CPUE ([kg/hook]x1000) based on log book data along with its standard error (*se*) and number of catches sampled for tusk.

	2000			2001			2002			2003			2004			2005			2006		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
IVa	32,6	596	1,4	33,2	686	1,1	25,6	615	0,8	27,1	450	0,9	49,3	437	1,8	36,4	329	2,4	40,63	348	3,27
IVb	18,1	17	8	16,5	2	20,8				45,3	59	2,5									
Vb	53,1	375	1,7	50,6	539	1,3	50,1	473	0,9	54,0	478	0,9	59,3	693	1,4	66,6	374	2,3	107,4	128	5,39
VIa	47,6	420	1,6	45,6	398	0,8	45,5	185	1,5	36,4	288	1,1	50,26	307	2,1	59,1	368	2,3	118,7	168	4,71
VIb	89,9	137	2,8	53,5	116	2,7	55,6	149	1,6	44,8	94	2	62,7	111	3,6	72,5	136	3,8	48,63	51	8,54
VIIc	62,7	60	4,3	5	24	6							7,04	23	7,8	15,9	7	14,1			
X				49,2	5	13,1															
XII	51,8	18	7,7	25,9	64	3,7				17,5	9	6,4									
XIVa	63,5	5	14,7																		
XIVb	40,9	84	3,6	48,5	48	4,3	8,8	8	7,1	29,6	33	3,4	17,9	60	4,8						

Table 12.3.5. 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.

	2001			2002			2003			2004			2005			2006		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
IVa							73,73	40	4,52	13,7	83	3,61	21,76	99	3,9	37,53	90	5,72
Vb							60,08	12	8,25	71,63	71	3,9	57,26	84	4,24	80,84	54	7,38
VIa							13,07	45	4,26									
VIb				36,7	29	7,34	31,19	61	3,66							34,01	26	10,64
XII							2,11	6	11,67									
XIVb										13,63	5	14,71	10,11	14	10,38			

Table 12.3.6. Bottom Longline Cooperative Exploratory Survey by Spain. Catches and CPUE (Kg/1000 hooks): Norwegian Automatic System. Preliminary. From WD by Muñoz (2006).

Div.	Catches	CPUE
VIa	18269	61
VIb	6136	55
XIIb	124	3

Table 12.3.7. Bottom Longline Cooperative Exploratory Survey by Spain. Catches and CPUE (Kg/1000 hooks): Manual System. From WD by Muñoz (2006).

Div.	Catches	CPUE
VIb	4984	43
XIIb	1302	17

Table 12.3.8. 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			

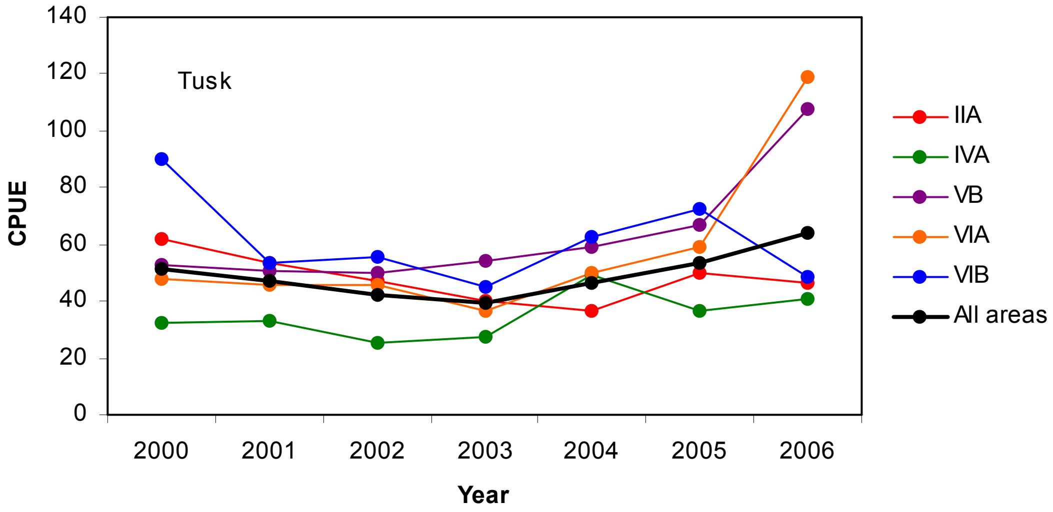
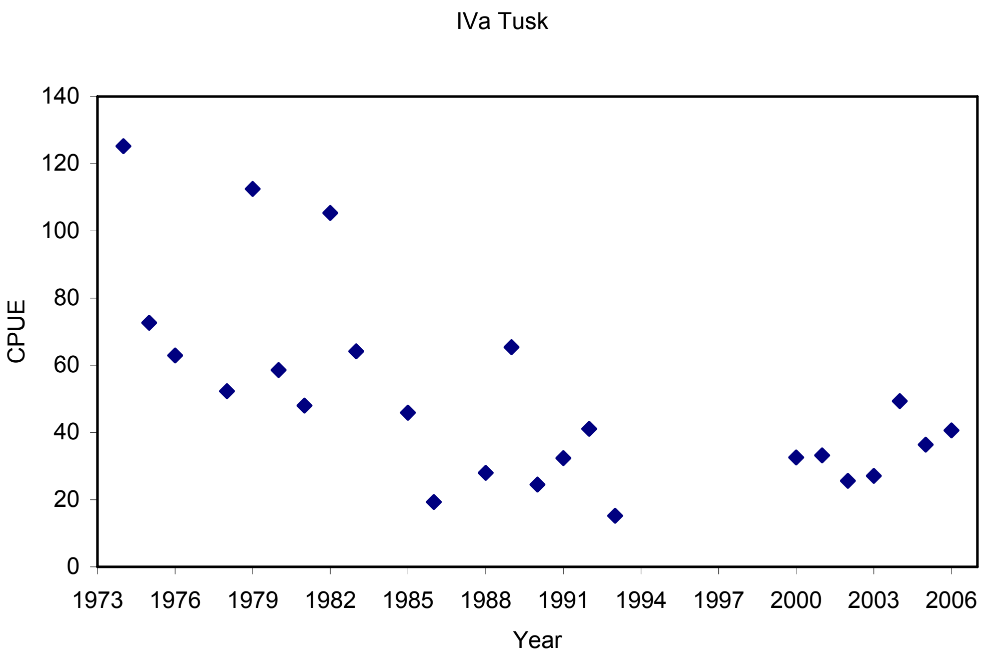
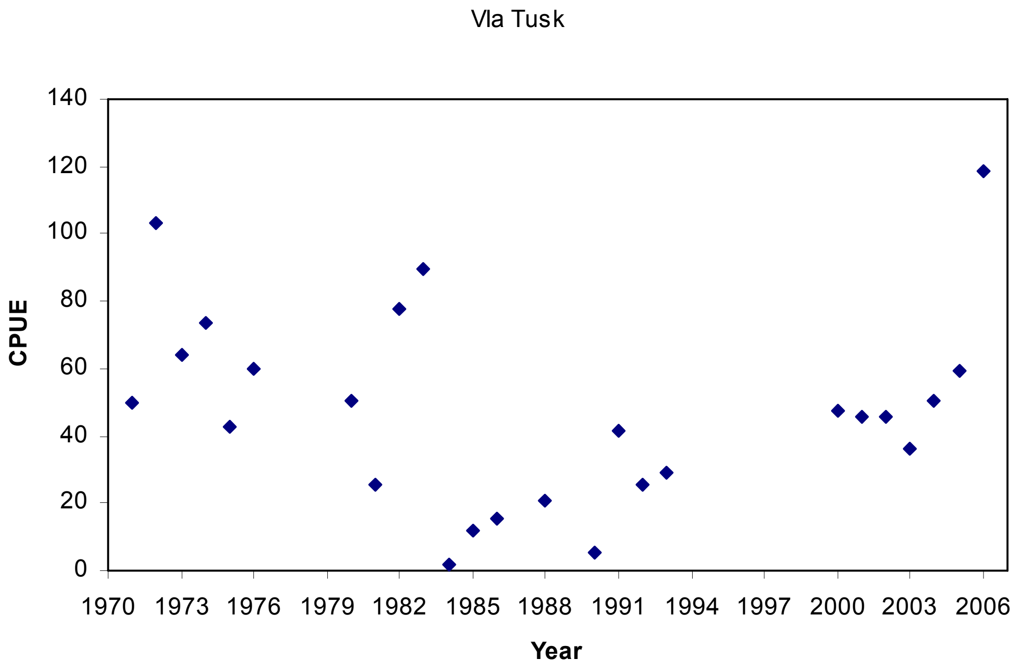
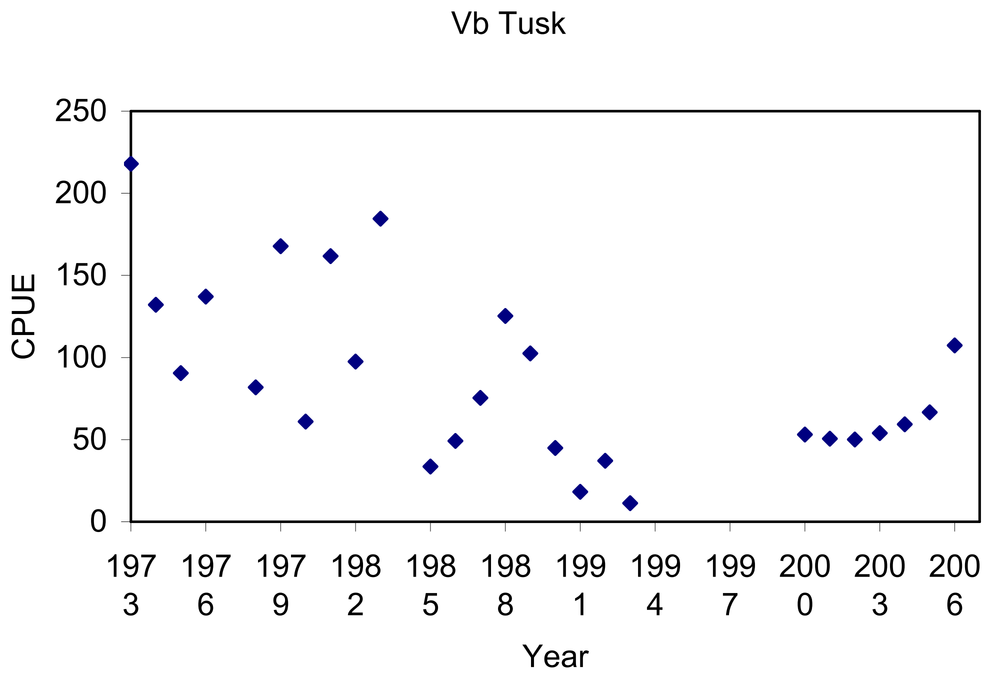


Figure 12.3.1. Estimated mean CPUE([kg/hook]x1000) based on data from the log books for tusk in each ICES subarea and all areas combined for the years 2000-2006.


IVa Tusk
CPUE
140
120
100
80
60
40
20
0
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year


VIa Tusk
CPUE
140
120
100
80
60
40
20
0
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year



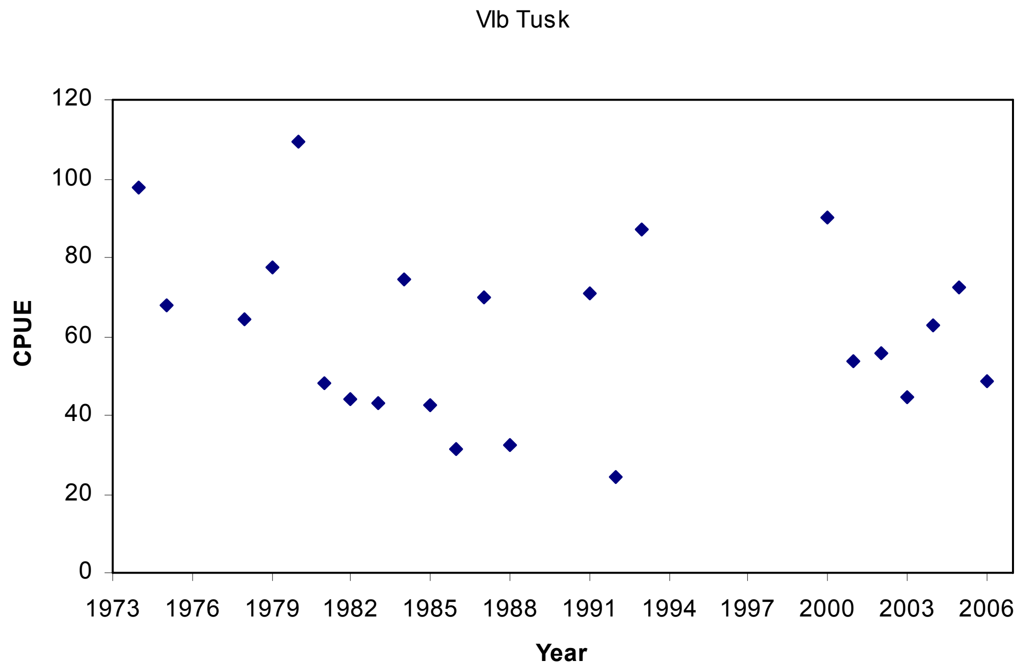


Figure 12.3.2. Estimates of CPUE (kg/1000 hooks) of ling based on skipper's logbooks (pre-2000) and official logbooks (post 2000). Combination of data from Bergstad and Hareide (1996) and WD by Helle and Pennington (2007). Note gap in time series between 1993 and 2000, and the differences in CPUE scale between areas.

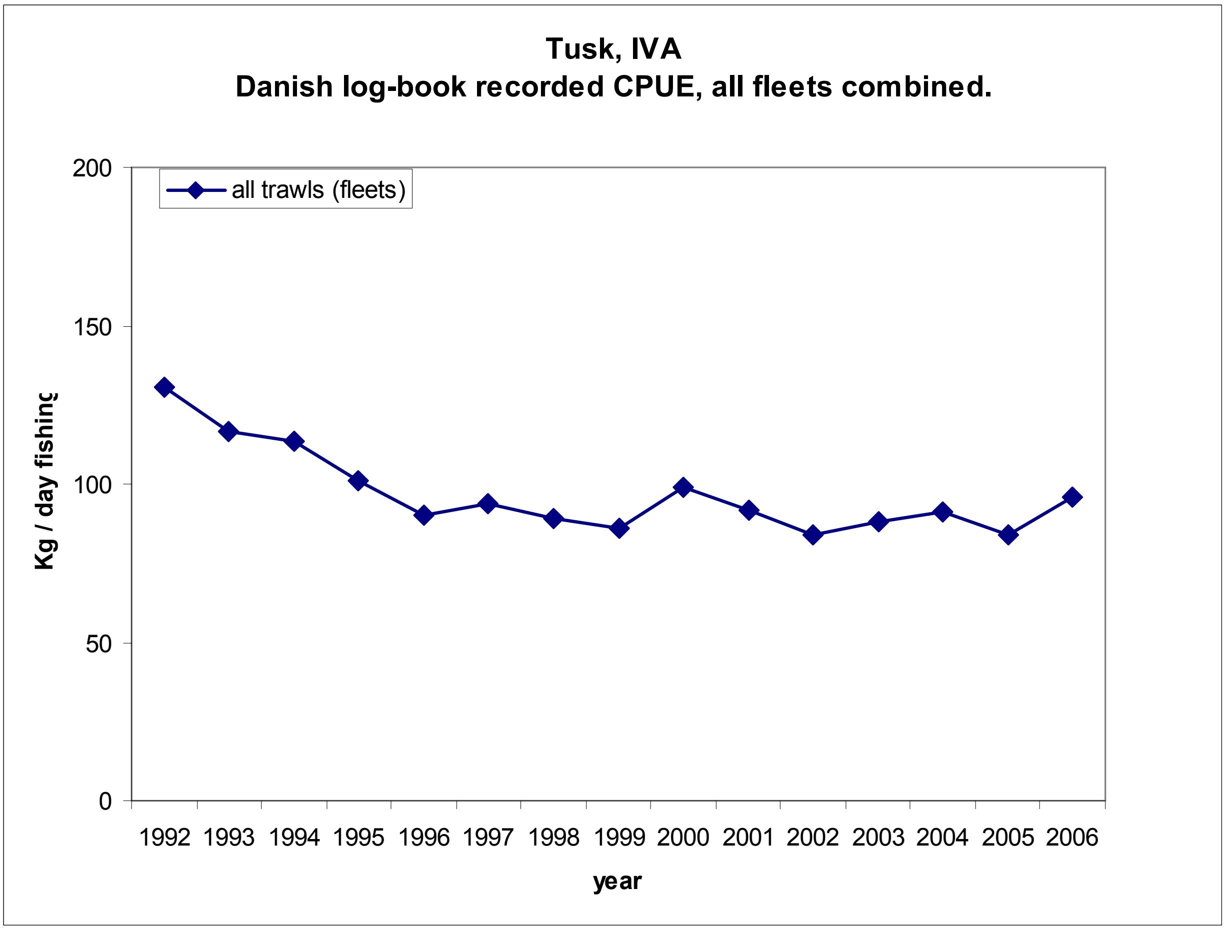


Figure 12.3.3. Tusk in IVa. CPUE of tusk for Danish. Based on logbook data.

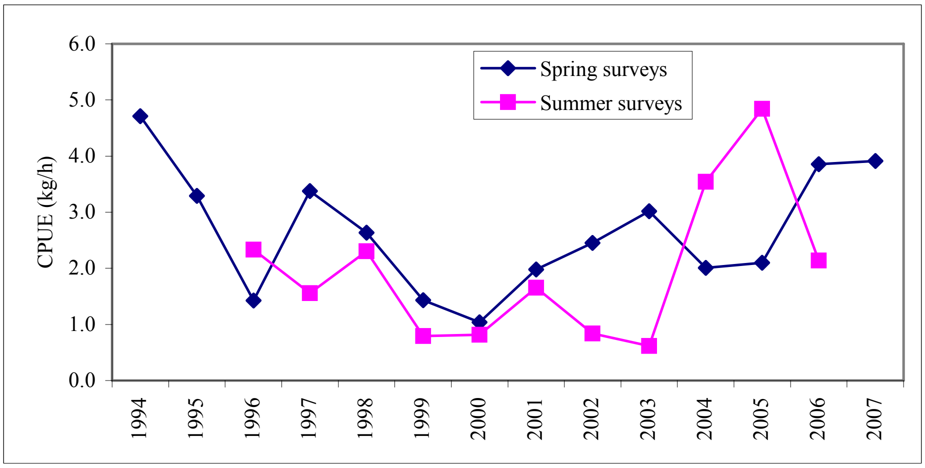


Figure 12.3.4. Tusk in Vb (Faroes). CPUE in spring and autumn bottom trawl survey.

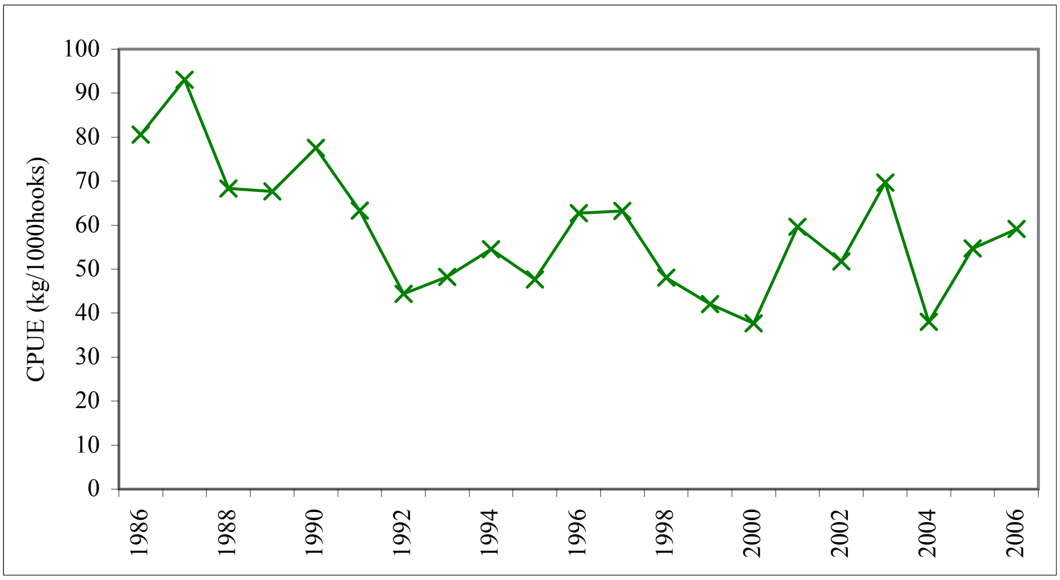


Figure 12.3.5. Tusk in Vb (Faroes). CPUE (kg/1000hooks) from long liners > 100 GRT.

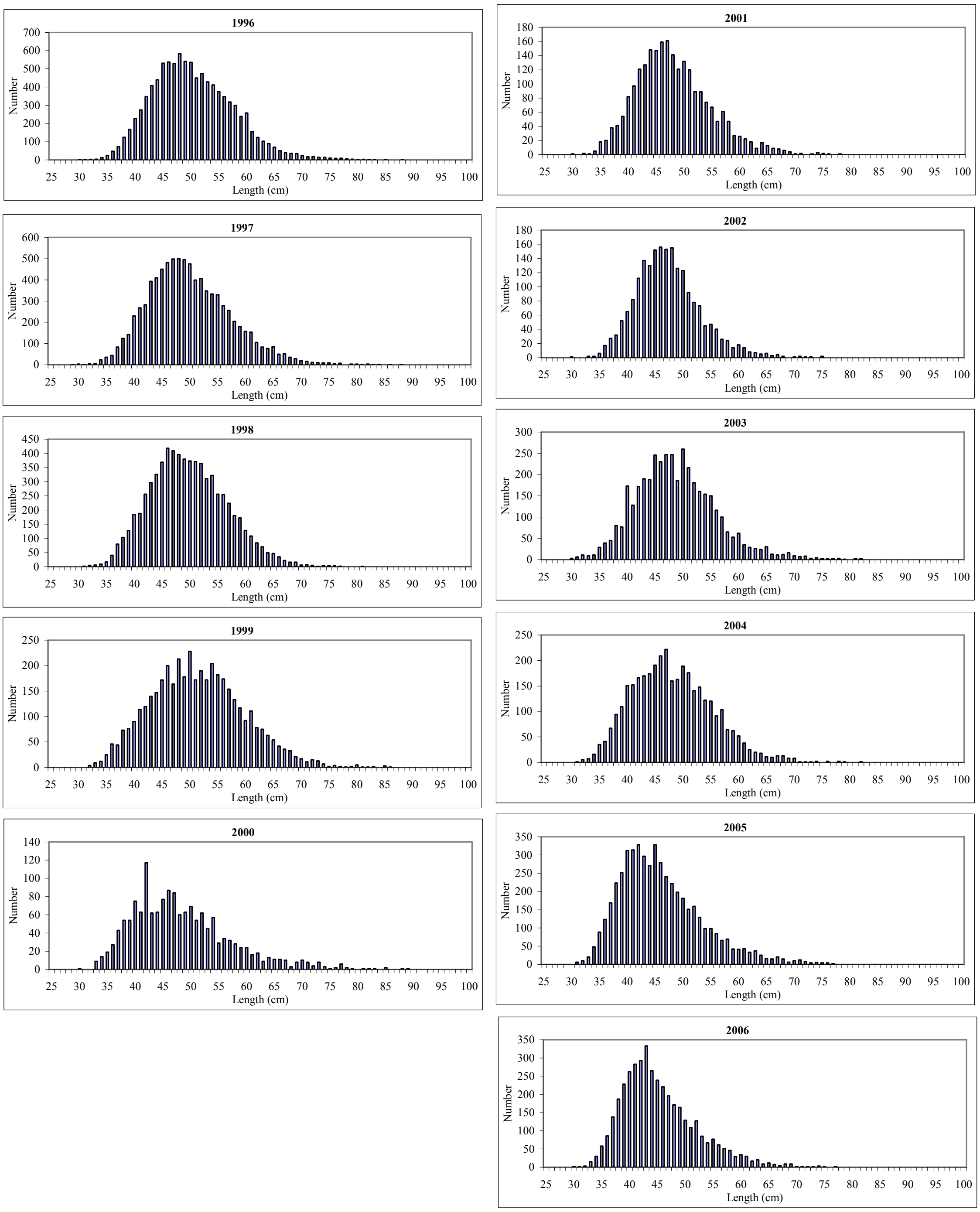


Figure 12.3.6. Tusk in Vb (Faroes). Length distribution in the landings from long liners >100 GRT.

12.4 GREATER SILVER SMELT (*ARGENTINA SILUS*) IN I, II, IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV

12.4.1 The fishery

In Subarea I and II the fishery for greater silver smelt is primarily prosecuted by licenced Norwegian trawlers that have this species as target. In 2004 an apparently exceptional Dutch fishery occurred.

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 aimed fisheries for roundnose grenadier and greater silver smelt. However, there is also a by-catch in the Norwegian and Danish small-mesh bottom trawl fisheries along the Norwegian Deep (primarily in IVa) that land the catch for reduction. There is also an unknown but apparently minor bycatch of *A. silus* in the Danish, Norwegian and Swedish fishery for *Pandalus borealis*. In 2006 the Norwegian landings in area IV increased from 11 tonnes in 2005 to 3 500 t.

In the Faroes (Division Vb) greater silver smelt is usually caught in trawl fishery, either with pelagic- or bottom trawl. Especially two pair of pair-trawlers have had a direct fishery for greater silver smelt, from early summer to autumn, for several years. In some years, three pairs have participated in the fishery and in the most resent years one large single trawler have also fished for greater silver smelt. There are a minor bycatch of greater silver smelt in the pelagic fishery in area Vb.

12.4.1.1 Landings trends

Table 12.4.0 lists the landings data for greater silver smelt (or argentine) *Argentina silus* by ICES Sub-areas/Divisions. Juveniles of the dominant species *Argentina silus* and the much smaller and less abundant *Argentina sphyraena* may be difficult to separate in catches, and the latter species may in some cases have been included in the landing figures (particularly in Subareas III and IV).

Landings by Norway from Sub-areas I and II declined in the 1990s from peak levels of 10 000 to 11 000 t in the 1980s. Landings are stable, but reached high levels in a few years (e.g. 2001 with 14 357 t). It is thought that these fluctuations reflect variation in the market demand rather than changes in abundance of *A. silus*. The landings have increased from about 7 500 t in 2002 to 21 700 in 2006.

Landings in Sub-areas III and IV varied between 1 000 and almost 4 500 t. The Danish quota (part of EU TAC) for 2003 onwards was 1 388 t, and the annual landings are below this level. The Norwegian bycatch in the industrial fishery for Norway pout and blue whiting, based on sampling at fish meal factories, is very variable and annual estimated quantities of 926, 376, 786, and 1348 tonnes occurred the period 2002-2005. There is also an unknown bycatch of *A. silus* in the Danish, Norwegian and Swedish fishery for *Pandalus borealis*. The Norwegian landings in IV was record high in 2006 on 3 500 t.

The landings of *A. silus* in Divisions Vb increased considerably from 1994-1998 as a direct fishery for the species started. Since 1998 when the catches were 18 000 t, the catches have decreased again down to only 5 000 t in 2000. In the last 5 years, landings have been between 6-7 500 tonnes each year. In 2006 the landings increased to 12 500 t. The variations in the catches are largely due to market demand. Greater silver smelt is also taken as by-catch 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.

The previously reported considerable decline in the landings of *A. silus* from Sub-areas VI and VII from a peak in the late 1980s to the mid 1990s has been reversed in recent years and reached an estimated 19 050 t in 2001. The landing figure for 2005 is only 3 800 t, and the landings have been retricted 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 north-west of the Hebrides, from depths ranging from 600-700 m, and west of Ireland (Porcupine Bank) where smelt is a minor by-catch 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 t 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 Sub-area VI a (N). Landings reached over 4700 t in 2000 and an estimated around 7500 t in 2001 and 2002. Preliminary figures for 2003 shows a very low landing of only 95 t. Because of a restrictive quota there was no Irish directed fishery for greater silver smelt. The landing 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 by-catch statistic of greater silver smelt in the commercial blue whiting fishery in Division Vb demonstrates considerable catch decline during recent years. Details on the Russian catch and observations were given in a WD by Vinnichenko (WD9, 2007).

12.4.1.2 ICES advice

ICES advised in 2004: *Greater silver smelt can only sustain low rates of exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data on both target and bycatch fish.*

12.4.1.3 Management

In IIa there is no TAC before 2007. In 2007 was a 12 000 t TAC introduced as a precautionary to reduce an increased fishery. In addition is there a licencing 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). More information about management measures in Faroese waters in section 4.1.6.4.

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	2006/2007
Subarea III, IV	1566	1331	????????
Subarea V,VI, VII	6247*	5310	????????

* of which 4971 was allocated to the Netherlands

12.4.2 Stock identity

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 Sub-area 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 Sub-area VI and the south of Sub-area 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 the winter but in the summer the species is widely distributed (Bergstad, 1993)". No new information was presented to the Working Group.

12.4.3 Data available

12.4.3.1 Landings and discards

Argentina silus can be a very significant discard of the trawl fisheries of the continental slope of Sub-areas VI and VII. (see Ch. 5), particularly at depths 300-700m (e.g. Girard and Biseau, WD 2004). No new information was provided.

12.4.3.2 Length compositions

Length distributions were available for two Faroese surveys in Vb (1994 onwards) (Ofstad, 2006, WD 1). There was no obvious trend in either series. If these lengths are divided into 100 m depth strata it is clear that the length distribution for greater silver smelt in Vb changes with depth (Table 12.4.1). The average length in the catches has decreased in the last 10 years (Figure 12.4.1).

Length frequency distributions from Russian trawl fisheries and research surveys from a number of areas for 2006 were also presented in WD9, Vinnichenko, 2007. In Faroese waters (area Vb), in April, the greater silver smelt were captured in small numbers in fishery for blue whiting conducted by pelagic trawl. Individuals of 30-40 cm in length occurred in catches (Figure 12.4.2), males mainly 32-36 cm long, females – 36-38 cm long.

Figure 12.4.3 presents the comparison between length frequency distributions from the 2001-2006 Spanish bottom trawl surveys on the Porcupine bank (area VII) (Velasco F., *pers. com.*). In the last survey does not appear the 22 cm clear mode of the 2001-2002 surveys but the rest of the length distribution is similar to the 2001 survey although with more abundance of individuals between 28 and 31 cm. In the 2005 length distribution it seems to be a mode at about 16 cm and another at 23 cm and in 2006 it seems to be a mode at about 21 cm and 26 cm.

12.4.3.3 Age compositions

The age distribution of greater silver smelt in the landings in area Vb show a decrease in mean age in the last ten years (Figure 12.4.4). 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.

12.4.3.4 Weight at age

No new data were presented.

12.4.3.5 Maturity and natural mortality

Data on greater silver smelt maturity and diet composition from areas area Vb in April are presented in WD9, Vinnichenko, 2007. Preliminary data on growth and first maturity for greater silver smelt was presented for area Vb (Figure 12.4.5, 12.4.6 and table 12.4.3). These data were sampled from the commercial fleet and a research vessel and the length range were from 10 to 53 cm. The growth data showed that females grow faster than males. Estimated length at maturity indicated that females mature at a smaller length (33 cm) then males (36 cm). Age at first maturity for females was estimated at about 6 years and for males 8 years.

12.4.3.6 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 but a closer evaluation is necessary before accepting these CPUEs as indicators (see Table 12.4.2, Fig. 12.4.7). The figure for 2003 is only based on 2 fishing days and should be regarded as unreliable.

CPUE indices for greater silver smelt were presented from two Faroese surveys for cod, haddock and saithe in Vb (1994 onwards, Figure 12.4.8). The two series do not show any significant trend. The greater silver smelt is not a target species, however, this may not be used as a measurement of stock changes. These are also bottom trawl surveys and it is uncertain if the indices reflect abundance for greater silver smelt which is a benthopelagic species. The distribution of greater silver smelt for the two surveys is showed in Figure 12.4.9.

Logbooks from the one pair of pair trawler (>1000 HP) fishing greater silver smelt in Faroese waters (area Vb) is available to 2003. The reason that the CPUE series stopped in 2003 is that these boats changed ownership, but the greater silver smelt licence did not change accordingly. The data behind the CPUE series contain all hauls where catches of greater silver smelt contribute with more than 50% of total catch in each haul. The series show a relatively stable trend at around two tons per hour for all years (Figure 12.4.10). The pair-trawlers fished greater silver smelt mostly in the area west of the Faroes and on the continental slope north and north-west of the Faroe Bank, at depths around 300-700 meters. There were also some fisheries on the Bill Bailey Bank and Lousy Bank and north of the Faroes.

Spanish research bottom trawl surveys were carried out in Sub-area VII (Porcupine) from 2001 to 2006 (Velasco F., pers. com.). Figure 12.4.11 and 12.4.12 show the greater silver smelt distribution and catch rate, respectively. Blue whiting is the most abundant species in the survey area.

12.4.4 Data analyses

The CPUE series for the Danish fishery in Division IIIa shows no clear pattern. The state of the stock in the Skagerrak-North Sea is not known, and the exploitation rate is uncertain.

The Faroese survey CPUE series (Figure 12.4.8) from Division Vb showed conflicting results, and there were also concerns with regards to their reliability as indices of abundance of this benthopelagic species. There were no obvious trends in the length distribution data. If these lengths are divided into 100 m depth strata it is clear that the length distribution for greater silver smelt in Vb changes with depth. Both length- and age distributions in catches in area Vb have decreased since 1995. 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. Greater silver smelt has seen an unsustainable fishing pressure at other fishing grounds, and it is very important at an early stage to set sustainable reference values for the fishery, so that it prevent the Faroese stock from being over-fished.

Argentina spp. biomass and abundance index Porcupine Survey (area VII) show a decreasing trend in recent years (Figure 12.4.11).

Table 12.4.0. Greater Silver Smelt I, II, IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV. WG estimates of landings.

Greater silver smelt (Argentina silus) I and II

Year	Germany	Netherlan	Norway	Poland	Russia/US	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**

Greater silver smelt (Argentina silus) III and IV

Year	Denmark	Faroes	France	Germany	Netherlan	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**

Table 12.4.0 (continued).

Greater silver smelt (Argentina silus) Vb

Year	Faroes	Russia/US	UK (Scot	UK(EWN	Ireland	France	Netherlan	**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**

Greater silver smelt (Argentina silus) VI and VII

Year	Faroes	France	Germany	Ireland	Netherlan	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*	52											**52**

Table 12.4.0 (continued).

Greater silver smelt (Argentina silus) VIII

Year	Netherlan	TOTAL
2002	191	**191**
2003	37	**37**
2004	23	**23**
2005	202	**202**
2006*		

SPA WG data zero in all years 97-2001

Greater silver smelt (Argentina silus) XII

Year	Faroes	Iceland	Russia	Netherlan	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*					

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			
2006*			

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

Table 12.4.1. Length distribution divided on depth intervals for greater silver smelt in the Faroese spring- and summer surveys (area Vb).

Depth (m)	<100	100-199	200-299	300-399	400-499	>500
Average length (cm)	20	25	30	30	38	40
Number	11	3330	4564	3087	2029	621

Table 12.4.2. Danish CPUE for *Argentina silus* in Division IIIa for 1992 to 2006. Data from logbooks do not represent the entire landings.

Year	Mesh size in Trawl: 70 - 100 mm Kg	days	CPUE	30 - 45 mm Kg	days	CPUE	< 25 mm Kg	days	CPUE	All trawls CPUE
1992	592430	62	9555				77601	10	7760	9306
1993	885880	71	12477	720000	36	20000	77200	4	19300	15163
1994	978300	78	12542	212000	7	30286				14004
1995	647140	67	9659	423848	98	4325	10000	1	10000	6512
1996	1303420	84	15517							15517
1997	808360	69	11715				136000	4	34000	12936
1998	703180	56	12557							12557
1999	885900	65	13629	907900	66	13756	22000	1	22000	13756
2000	767300	89	8621	169000	9	18778	27600	4	6900	9450
2001	788520	103	7656							7656
2002	791000	92	8598							8598
2003	182000	30	6067	669000	80	8363				7736
2004	100000	11	9091	830000	108	7685				7815
2005				454200	67	6779				6779
2006				324000	51	6353				6353

Table 12.4.3. Data on growth, length- and age at first maturity of greater argentine in area Vb.

	Growth				Length at first maturity		Age at first maturity	
	L_{inf}	K	t_0	N	L_{50}	N	A_{50}	N
Female	46.8	0.15	- 1.7	450	32.8	1280	5.7	450
Male	42.8	0.17	- 1.3	310	35.6	1135	7.8	310

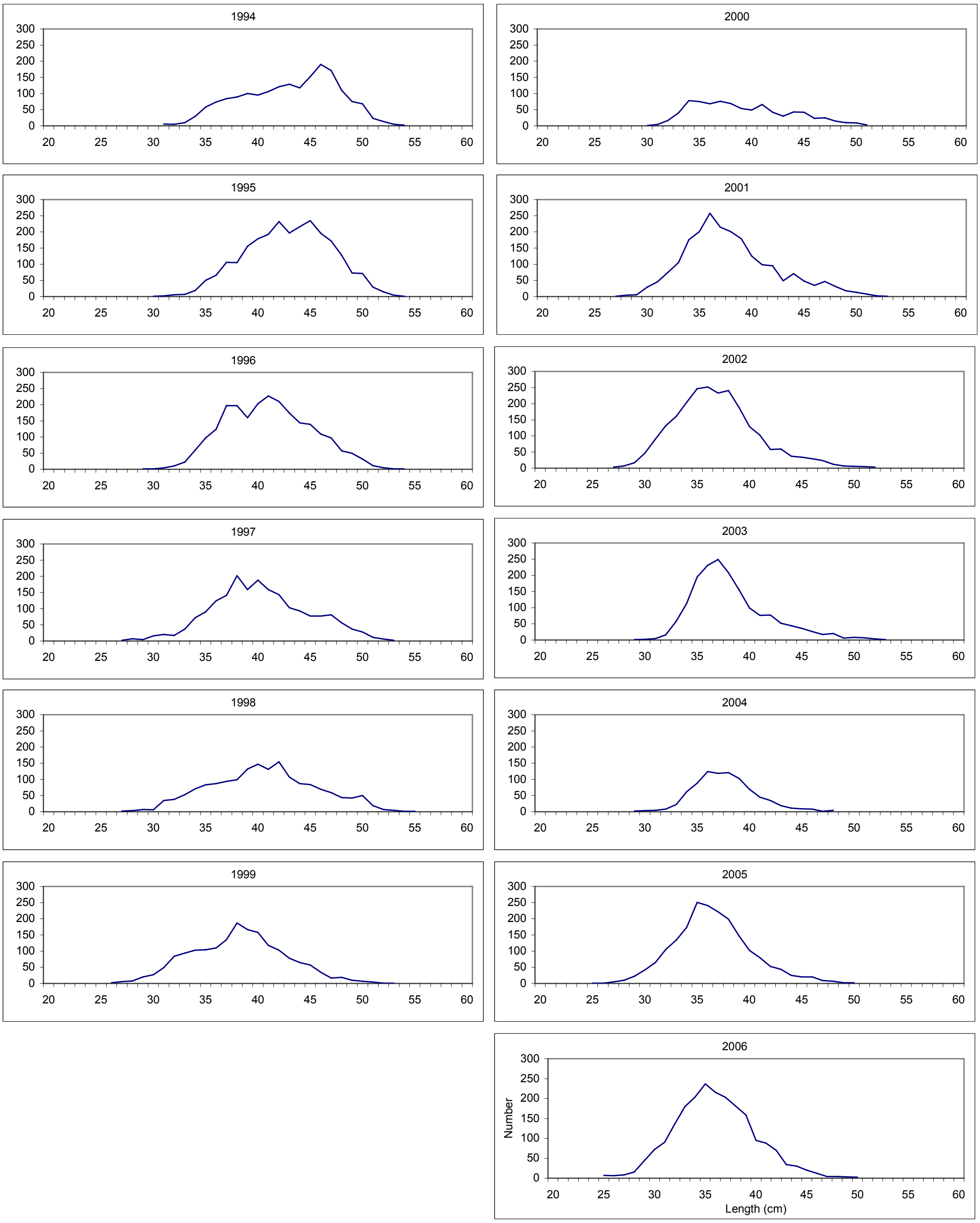


Figure 12.4.1. Length distribution of greater silver smelt in Faroese landings (area Vb) in the period 1994 to 2006.

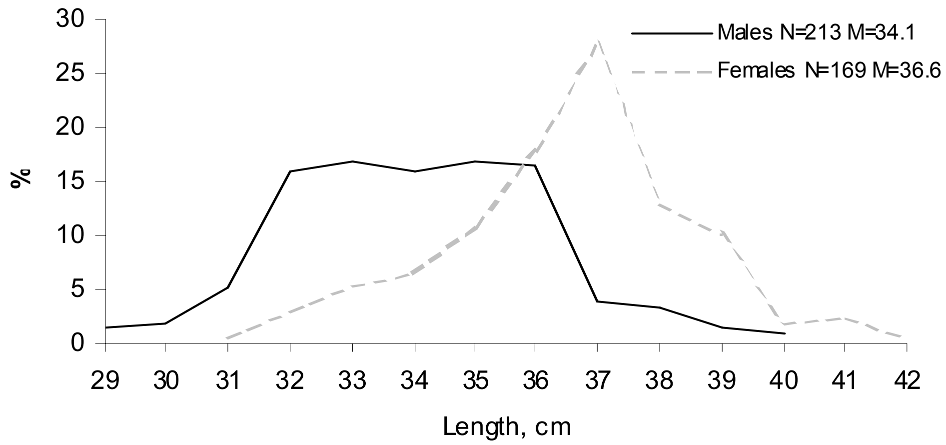


Figure 12.4.2. Length composition of greater silver smelt as bycatch from Russian blue whiting fishery in Faroese zone (Div. Vb) in April 2006.

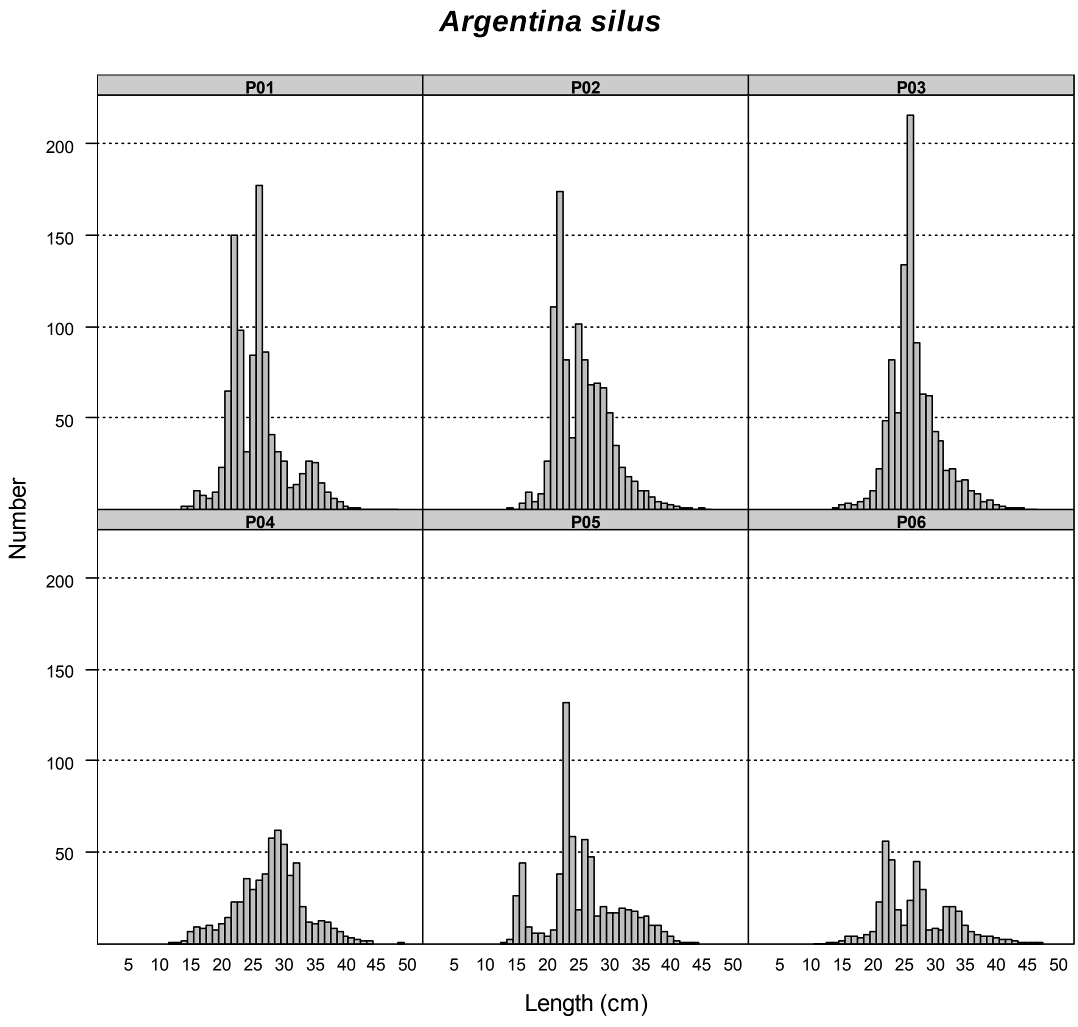


Figure 12.4.3. Mean stratified length distributions of *Argentina* spp. in Porcupine surveys (2001-2006) (F. Velasco, *pers. com.*).

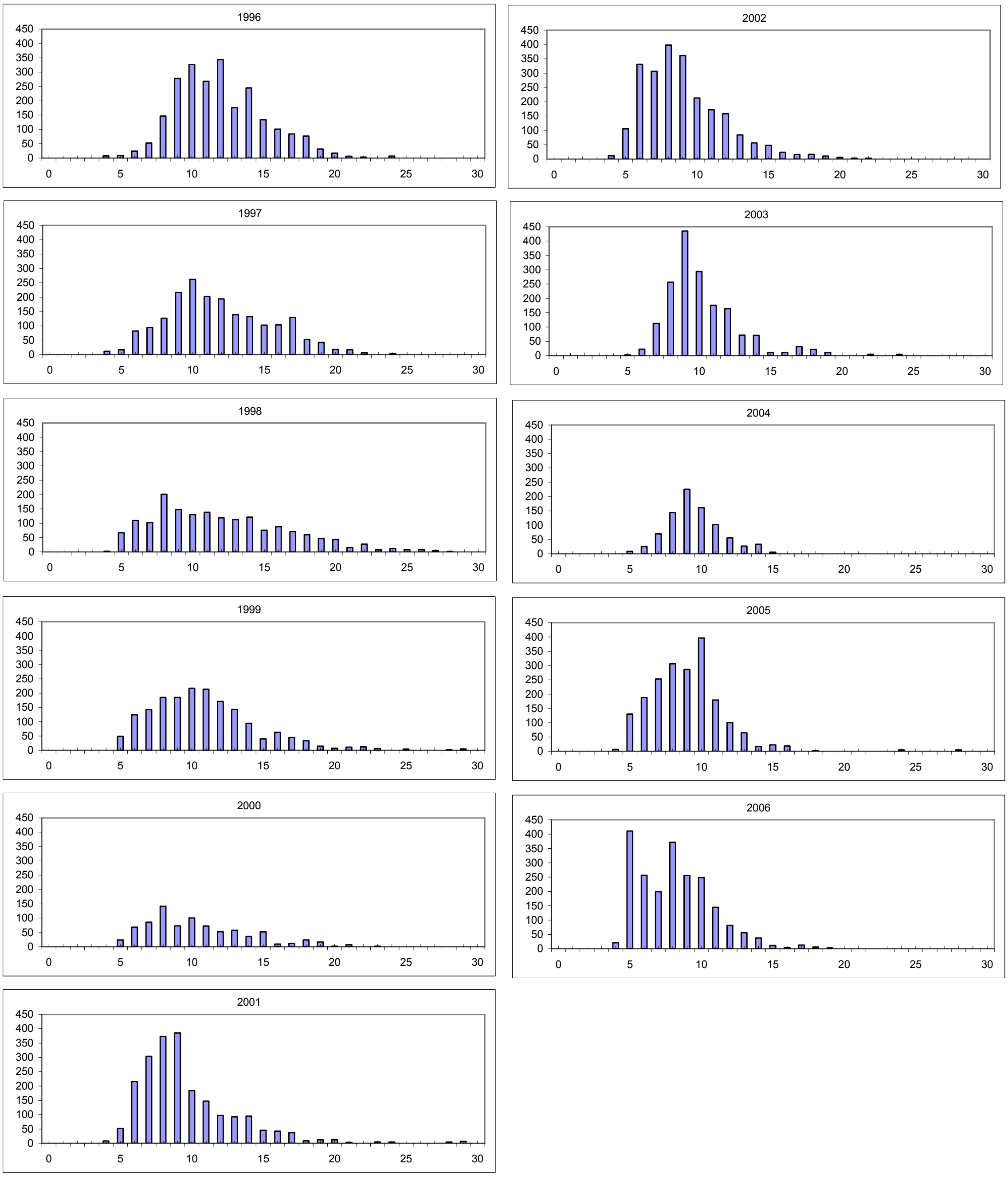


Figure 12.4.4. Age distribution of greater silver smelt in Faroese landings (area Vb) in the period 1994 to 2006 (age (year) on x-axis and number on y-axis).

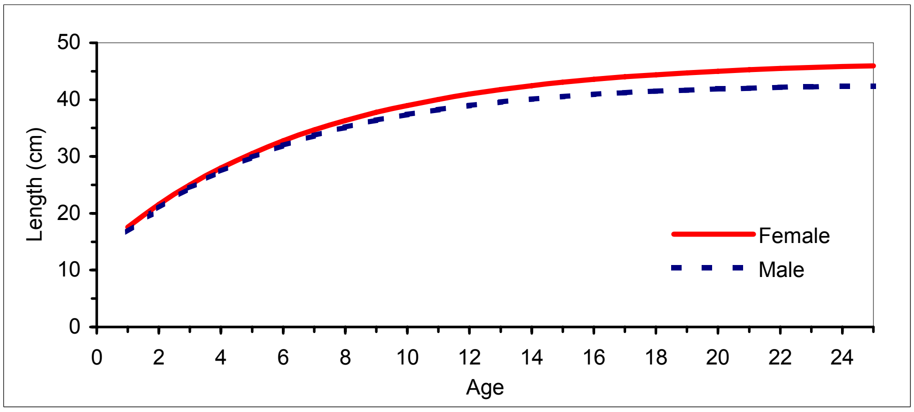


Figure 12.4.5. Growth of greater argentine in area Vb.

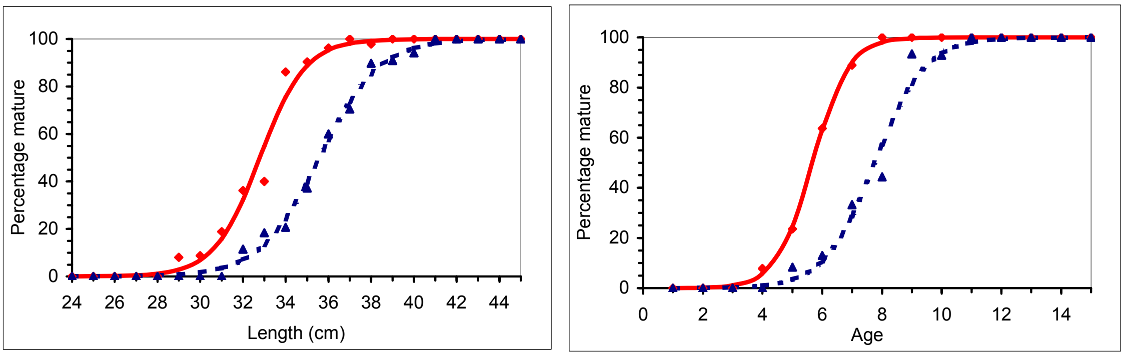


Figure 12.4.6. Length- and age at first maturity of greater argentine in area Vb.

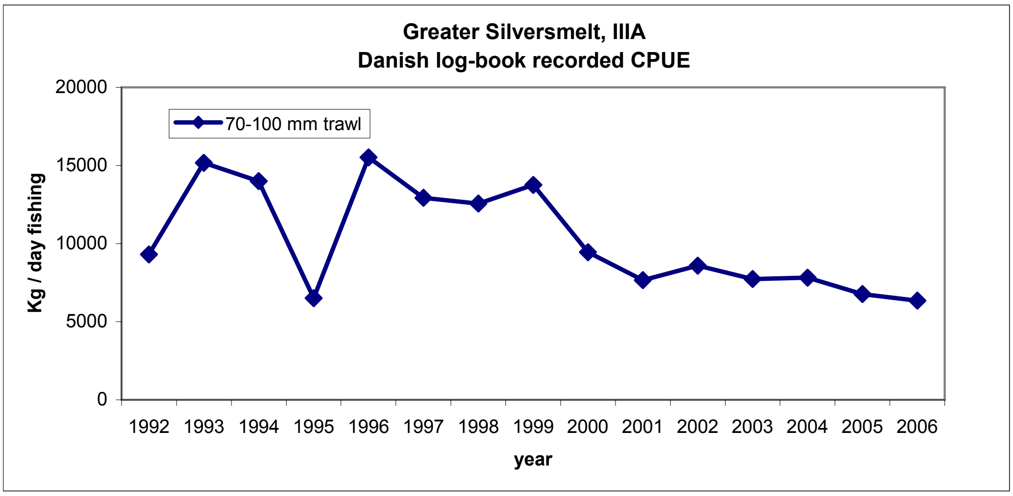


Figure 12.4.7. CPUE from Danish trawl fisheries in Division IIIa for 1992-2006.

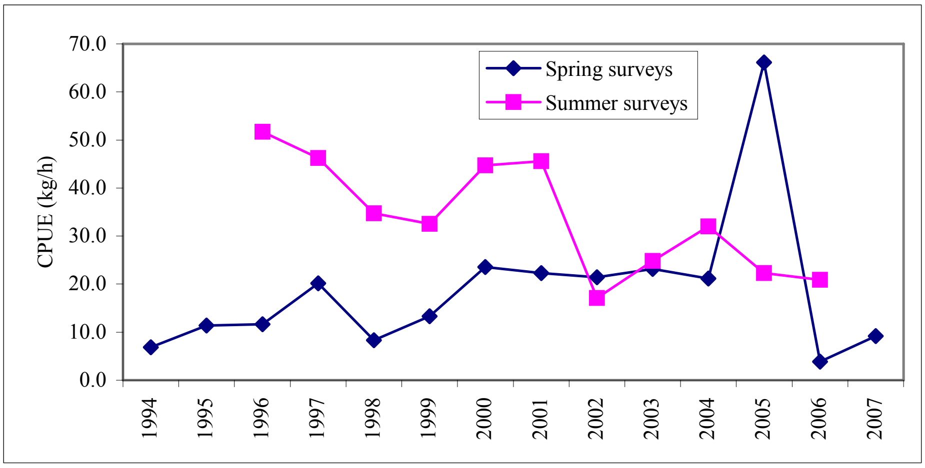


Figure 12.4.8. CPUE from Faroese surveys in Vb.

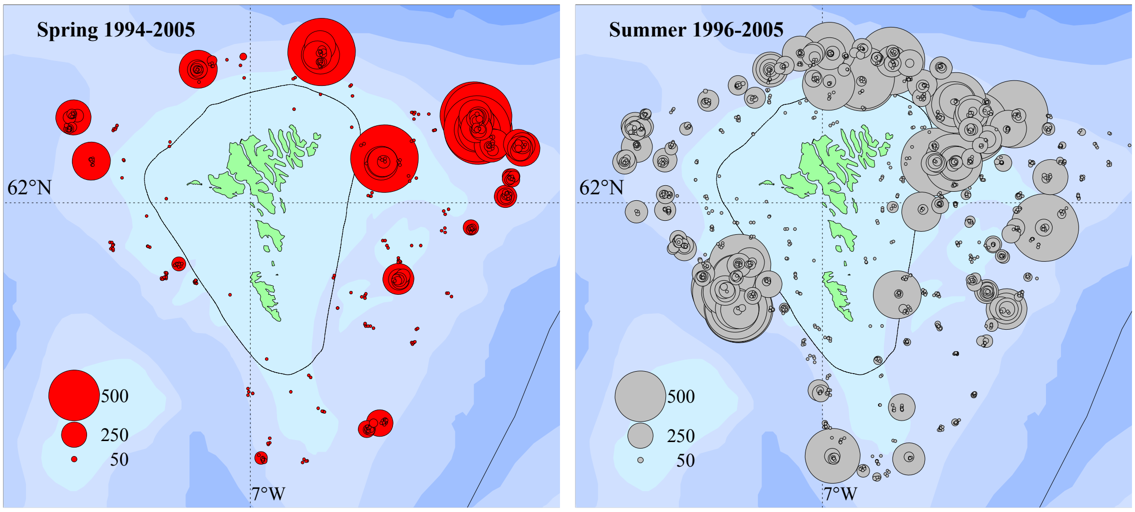


Figure 12.4.9. Distribution of greater silver smelt (kg/h) on the Faroe plateau (area Vb) from spring- (1994-2005) and summer survey for cod, haddock and saithe (1996-2005).

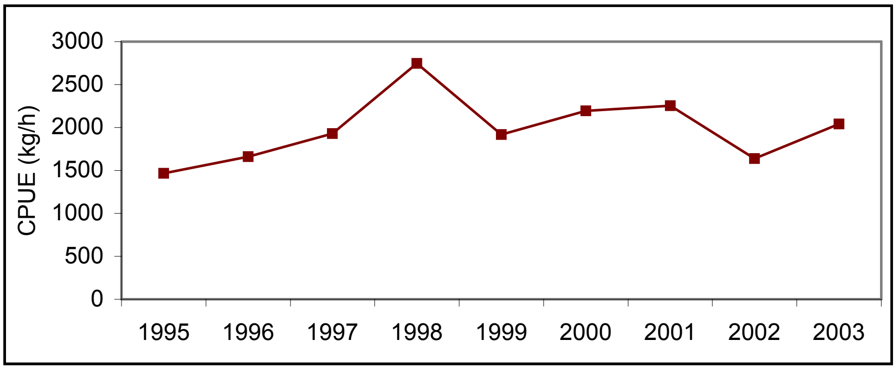


Figure 12.4.10. Catch per unit effort (kg/h) for a pair of Faroese pair-trawlers (area Vb) in the period 1995 to 2003. Only hauls where greater silver smelt is more that 50% of the total catch are used.

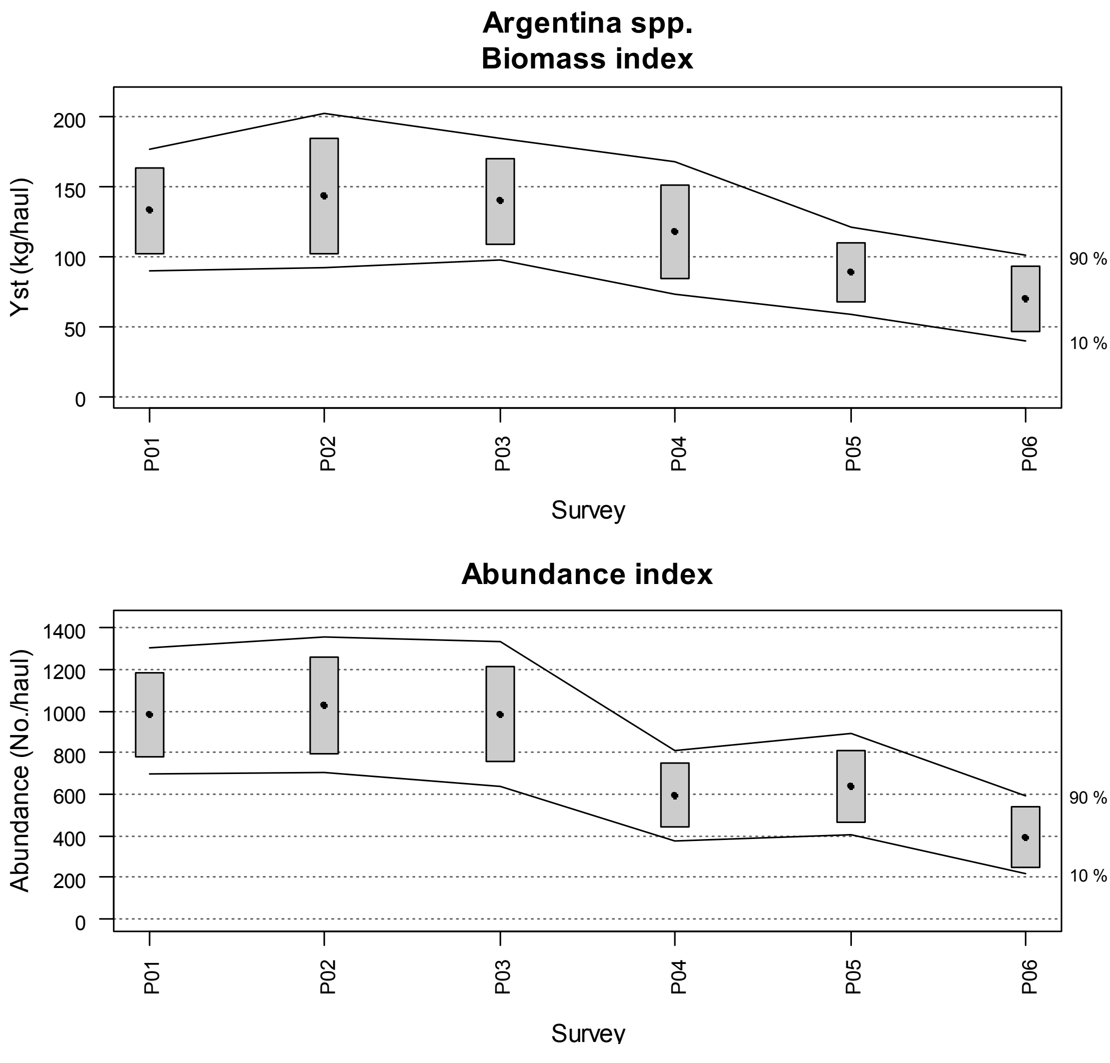


Figure 12.4.11. Changes in *Argentina* spp. biomass and abundance index during Porcupine Survey time series (2001-2006). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000).

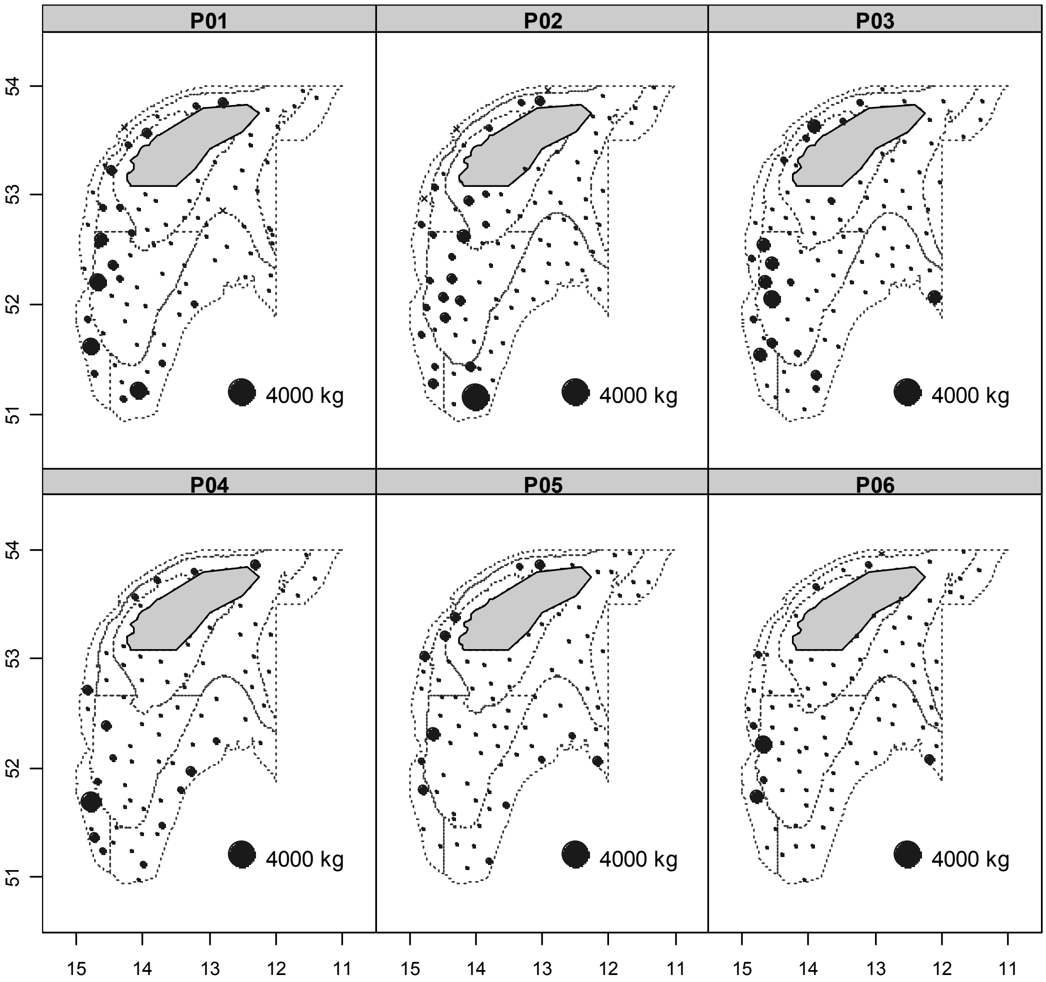


Figure 12.4.12. Geographic distribution of Argentina spp. catches (kg/30 min haul) in Porcupine surveys between 2001 and 2006 (F. Velasco, *pers. com.*).

12.5 ORANGE ROUGHY (*HOPLOSTETHUS ATLANTICUS*) IN I, II, IIIa, IV, V, VI, VII, VIII, IX, X, XII, XIV

12.5.1 The fishery

Small fisheries have existed in sub-areas Va, Vb, VIII, and X, and a relatively modestly sized one in XII. Most started in the early 1990s, the exception being sub-area X which started in 1996. There has been no real fishery in IX, just a few tonnes caught over a few years The main fishery for Orange Roughy was conducted in areas VI and VII on the peak fisheries.

12.5.1.1 Landing trends

Table 12.5.1 shows the landings data for orange roughy for the ICES area as reported to ICES or as reported to the Working Group. Fig. 12.5.1 and 12.5.2 shows the landings by statistical rectangle per quarter for 2005 and 2006. Most landings were taken from France and Ireland in area VI and VII. See sections 8.3 and 8.4 for a more detailed description of the landings in these areas.

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 420t, but since 1997 they have been trivial except for 2000.

In Subarea VIII, there have been small landings by France since the early 1990's. In Sub-areas VIII and IX, Spain has recorded small landings in some years.

In Sub-area 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 Sub-area XII, the Faroes dominated the fishery throughout the 1990's, 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.

12.5.1.2 ICES advice

The advice statement from 2006 was:

"Orange roughy can only sustain very low rates of exploitation. Currently, it is not possible to manage a sustainable fishery for this species. Hence, ICES recommends no fishery for this species. Bycatches in mixed fisheries should be limited as far as possible".

12.5.1.3 Management measures

The overall TAC for EC vessels in I, II, III, IV, V, VI, VII, VIII, IX, X, XII, XIV for 2007 is 288 tons and for 2008 is 194 tons. The TAC applies to Community waters and international waters.

In addition to a TAC, a number of Orange Roughy protection areas have been introduced from which EU vessels have no permission to land or retain any catches of Orange Roughy. These areas are defined as the following sea areas:

(a) that sea area enclosed by rhumb lines sequentially joining the following positions:

57° 00′ N, 11° 00′ W,57° 00′ N, 8° 30′ W,56° 23′ N, 8° 30′ W,55° 00′ N, 9° 38′ W, 55° 00′ N, 11° 00′ W and 57° 00′ N, 11° 00′ W;

(b) that sea area enclosed by rhumb lines sequentially joining the following positions: 55° 30′ N, 15° 49′ W,

53° 30′ N, 14° 11′ W, 50° 30′ N, 14° 11′ W, 50° 30′ N, 15° 49′ W;

(c) that sea area enclosed by rhumb lines sequentially joining the following positions: 55° 00′ N, 13° 51′ W, 55° 00′ N, 10° 37′ W, 54° 15′ N, 10° 37′ W, 53° 30′ N, 11° 50′ W, 53° 30′ N, 13° 51′ W.

12.5.2 Stock identity

The fishing grounds so far discovered in the North Atlantic have appeared to support relatively small aggregations of fish, usually associated with seamounts and other topographical features. It would appear that the aggregations fished on the Hebrides Terrace Seamount constituted a separate stock. Further south, it seems likely that the separate aggregations are separate stock units too, though it is not clear. The probability of finding, in the northern Atlantic, stocks comparable in size to the stocks exploited in the south Pacific seems low. A genetics project is now underway, to study the genetic structure of orange roughy in the north Atlantic.

12.5.3 Data available

12.5.3.1 Landings and discards

Landings are in Table 12.5.1.

12.5.3.2 Length composition

Details on length composition for Orange Roughy in area VI and VII are given in section 8.4. The relationship between standard individual size (Ls in cm) and weight (W in g) has also been derived in sub-area X, based on the Azorean exploratory cruise (Anom. 2002):

$W = 0.08\ Ls^{2.74}$ (females)

$W = 0.10\ Ls^{2.76}$ (males)

12.5.3.3 Age composition

No data.

12.5.3.4 Weight at age

No data.

12.5.4 Maturity and natural mortality

No specific data for this sub-area.

12.5.5 Catch, effort and research vessel data

For Division Vb, French CPUE were presented to WGDEEP in 2002 (Anon. 2002). These data are not informative of stock abundance as they represent very small catches.

For Subarea XII there are CPUE data are available from observed fishing trips as part of the Irish Sea Fisheries Board Deepwater Programme (BIM, WD, 2002a). These data are presented by ICES Division in Table 12.5.2. Irish CPUE are available from Sub-area XIIb for 2002 only. No other CPUE data are available for other areas.

12.5.6 Data analysis

No new data analysis has been carried out during WGDEEP 2007. For details on previous data analysis refer to WGDEEP 2006.

Table 12.5.1. Working Group estimates of landings of orange roughy, *Hoplostethus atlanticus,* for all sub-areas excluding VI and VII.

Orange roughy 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

*Preliminary.

Orange roughy 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

*Preliminary.

Table 12.5.1 (continued). Orange roughy in Sub-area VIII

Year	France	Spain VIII & 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

Orange roughy in Sub-area IX

Year	Spain	Total
1988	-	0
1989	-	0
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

*Preliminary. Continued …

Table 12.5.1 (continued). Orange roughy in Sub-area X

Year	Faroes	France	Norway	E & W	Portugal	Ireland	Total
1988	-		-	-	-		0
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

*Preliminary.

Orange roughy in Sub-area XII

Year	Faroes	France	Iceland	Spain	E & W	Ireland	New Zealand	Russia	Total
1988	-	-	-	-	-			-	0
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

*Preliminary.

Table 12.5.1 (continued). Orange roughy total international landings in the ICES Area, excluding VI and VII.

Year	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	**148**
Total	**1681**	**1001**	**480**	**3**	**1825**	**5224**	**10214**

Table 12.5.2. CPUE from observed trips on Irish trawlers in 2002, from data made available by BIM. Catch in kg, effort in hours, CPUE in kg per hour and kg per haul. Hauls with zero catches are removed for ease of comparison between years, as zero haul data unavailable for 2001 (this applies to other sub-areas VI and VII which had data for both years).

Year	ICES	Effort	Catch	CPUE kg per hour	No. hauls	Kg per haul
2002	XIIb	29.5	5440	184.4	20	272

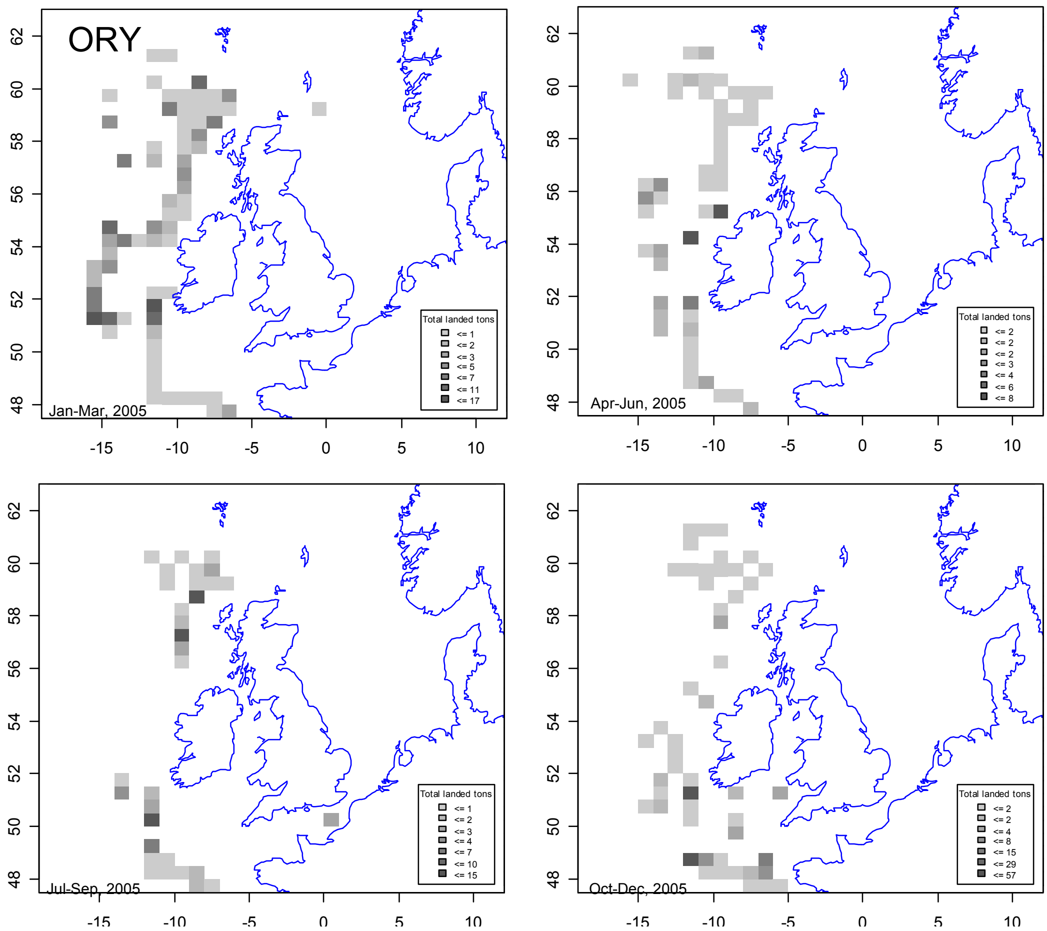


Figure 12.5.1) Distribution of aggregated orange roughy landings by statistical rectangle per quarter for 2005.

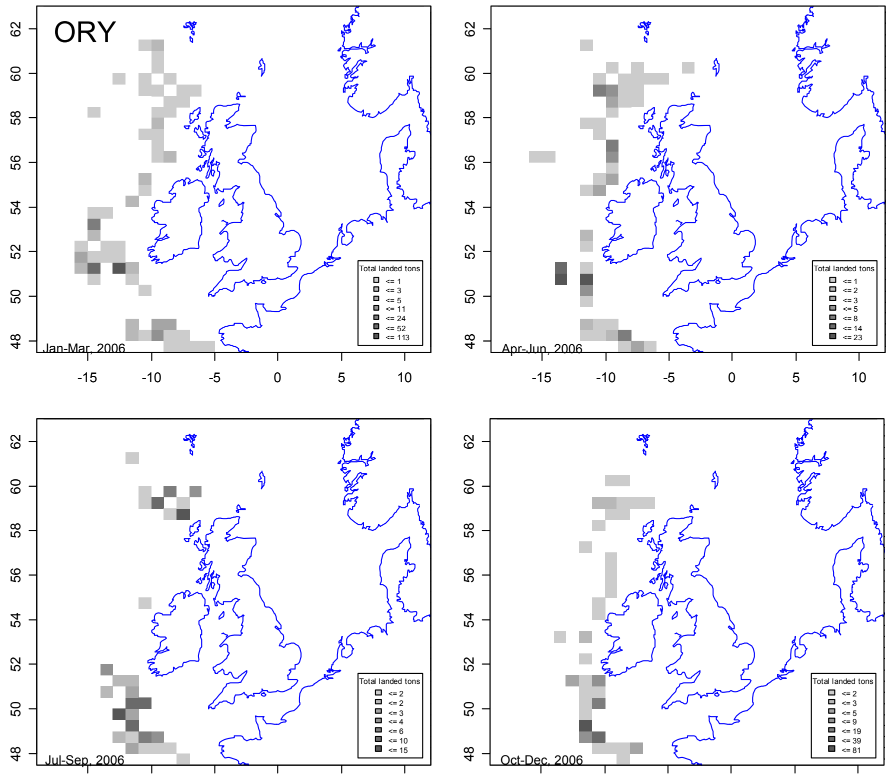


Figure 12.5.2) Distribution of aggregated orange roughy landings by statistical rectangle per quarter for 2006.

12.6 ROUNDNOSE GRENADIER (*CORYPHAENOIDES RUPESTRIS*) IN I, II, IV, Va2, VIII, IX, Xa, XIVa, XIVb2

12.6.1 The fishery

Similar to previous years, the main fisheries in ICES areas in 2006 were located to the west of British Isles (current management areas Vb, VI and VII), in Skagerrak (division IIIa) and offshore along the western slope of the Hatton Bank (ICES Subarea XIIb). In other areas catches of roundnose grenadier were insignificant.

12.6.1.1 Landings trends

Landing statistics by nations in the period 1988-2006 are presented in Table 12.6.1.

In the Subareas I and II, the total catch of roundnose grenadier in 2006 amounted 12 t only. During 1988-2006 catches varied from 0 to 106 t (Fig. 12.6.1). France substantially contributed to the total catch in 1990-1992, when roundnose grenadier was taken as by-catch in the fisheries for saithe *Pollachius virens* and other gadids. In 1997-1998, when total catch exceeded 100 t, the major contribution was made by Norway. Roundnose grenadier was partly taken in mixed deepwater fisheries; directed local fisheries in Norwegian fjords for this species also exist.

In the Subarea IV, the total catch of roundnose grenadier in 2006 comprised 4 t which was taken by Germany fleet as by-catch in the fishery for saithe. During 1988-2006 catches in this area varied between 1 and 525 t (Fig. 12.6.2). The main contribution to the total catch in 1989-1994 (167-521 t) was made by French fleet that conducted directed fishery in division IVa off Shetland Islands. Roundnose grenadier is caught as incidental by-catch in this area by Scottish vessels in insignificant amount as well. In 2004, the major part of the total catch (371 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 Icelandic waters (Division Va) in 2006 amounted 62 t. Similar to previous years, the major contribution to the total catch was made by Iceland. During 1988-2005, the catches within Icelandic waters varied 2 to 398 t (Fig. 12.6.3). Maximum catches were registered in 1992-1997 when 198-398 t were caught annually as by-catch in mixed deepwater fisheries. In recent years, roundnose grenadier is taken in Icelandic waters as by-catch in trawl fisheries for Greenland halibut and redfish.

Roundnose grenadier catches in Subareas VIII and IX during 1988-2006 were minor and amounted 0 to 20 t annually (Fig. 12.6.4). The main contribution to the total catch in 1998 and 1999 (19 and 7 t respectively) was made by Spain. In other years, France as occasional by-catch took the majority of catches in mixed deepwater fisheries.

Total catch in Subarea XIV in 1998-2006 amounted 15-395 t (Fig. 12.6.5). There is no directed fishery for roundnose grenadier in Greenland waters (Division XIVa and Subdivision XIVb2). The majority of catches in these areas is taken as by-catch by Greenland, Norway and Russia during Greenland halibut bottom trawl fisheries. Recently (prior to 2005), Germany also considerably contributed to roundnose grenadier by-catch in Greenland waters, especially in 1998 and 1999, when 116 and 105 t were caught respectively.

There was directed fishery for this species by Russian fleet in 1997 at Reykjanes ridge (Subdivision XIVb1) when 336 t of roundnose grenadier was taken (Tab. 12.6.1). Spanish fleet operated in this area in 2002 and 2003 fishing for blue ling. By-catch of roundnose grenadier comprised 235 and 272 t respectively.

12.6.1.2 ICES advice

ACFM advice applicable to 2003 and 2004 was: *"In all other areas, the expansion of fisheries should not be allowed until reliable assessments indicate that increased harvests are sustainable."*

12.6.1.3 Management

There is TAC-based species-specific management of the roundnose grenadier fisheries in Subareas I, II, IV, VIII, IX, XIV and Division Va for European Community vessels (Tab. 10.2.2). In the international waters there are NEAFC regulation of efforts in the fisheries for deepwater species.

12.6.2 Stock identity

No any new data on stock identity of roundnose grenadier were reported. As it came from discussion in SGDEEP94, roundnose grenadier in Subareas II and IIIa and the eastern part of IV along the Norwegian coast (Norwegian Deep) may represent separate stock(s) due to physical boundaries to dispersion. For other populations the stock structure remains unclear. However, WGDEEP05 recommended considering roundnose grenadier stocks in Subareas VIII and IX as separate unit.

12.6.3 Data available

12.6.3.1 Landings and discards

Landings are given in Table 13.6.0. No any discard data are available.

12.6.3.2 Length compositions

No data on length compositions were available.

12.6.3.3 Age compositions

No data on age compositions were presented.

12.6.3.4 Weight at age

No weight at age data were available.

12.6.3.5 Maturity and natural mortality

Data on maturity and natural mortality are unavailable.

12.6.3.6 Catch, effort and research vessel data

There were no effort and research vessel data presented.

12.6.4 Data analyses

No stock assessments are possible for roundnose grenadier in other areas (Subareas I, II, IV, VIII, IX, XIV and Division Va) due to the lack of relevant data.

Table 12.6.1. Roundnose grenadier I, II, IV, Va, VIII, IX, XIV. WG estimates of landings.

ROUNDNOSE GRENADIER (*Coryphaenoides rupestris*) I and II

Year	Faroes	Denmark	France	Germany	Norway	Russia/USSR	Germany	UK (E+W)	UK (Scot)	TOTAL
1988										0
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*					10	2				12

* Preliminary data

Table 12.6.1. (continued).

ROUNDNOSE GRENADIER (*Coryphaenoides rupestris*) IV

Year	France	Germany	Norway	UK (Scot)	Denmark	TOTAL
1988		1				1
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*			4			4

* Preliminary data

Table 12.6.1. (continued).

ROUNDNOSE GRENADIER (*Coryphaenoides rupestris*) Va

Year	Faroes	Iceland**	Germany	Russia	UK (E+W)	TOTAL
1988		2				2
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		57				57
2004		181				181
2005		76				76
2006*		62				62

** includes other grenadiers from 1988 to 1996

Table 12.6.1. (continued).

ROUNDNOSE GRENADIER (*Coryphaenoides rupestris*) VIII and IX

Year	France	Spain	TOTAL
1988			0
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*			

* Preliminary data

Table 12.6.1. (continued).

ROUNDNOSE GRENADIER (*Coryphaenoides rupestris*) X

Year	Faroes	France	Russia	UK (E+W)	Total
1988					0
1989					0
1990					0
1991					0
1992					0
1993					0
1994					0
1995					0
1996	3				3
1997	1				1
1998	1				1
1999	3	3			6
2000				74	74
2001					0
2002					0
2003		1			1
2004	1				1
2005			799		799
2006*					

Table 12.6.1. (continued).

ROUNDNOSE GRENADIER (*Coryphaenoides rupestris*) XIV

Year	Faroes	Germany	Greenland	Iceland**	Norway	UK (E+ W)	UK (Scot)	Russia	Spain	TOTAL
1988		45	7							52
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			336		395
1998	1	116	3		6					126
1999		105	0		19					124
2000		41	11		5			5		62
2001		11	5		7	2	72	69		166
2002		25	5		15	1	1	4	235	286
2003			15		5	1			272	293
2004		27	3					20		50
2005			7		6	1				14
2006*		35	0		18					53

* Preliminary data

** includes other grenadiers from 1988 to 1996

Table 12.6.1. (continued).

ROUNDNOSE GRENADIER (Coryphaenoides rupestris)

All sea areas

Year	I+II	IV	Va	VIII +IX	X	XIV	Unallocated	Total
1988	0	1	2	0	0	52	0	55
1989	22	170	4	0	0	45	0	241
1990	49	372	7	5	0	47	0	480
1991	72	525	48	1	0	29	0	675
1992	52	426	210	12	0	31	0	731
1993	15	283	276	18	0	26	0	618
1994	15	212	210	5	0	15	0	457
1995	7	84	398	0	0	27	0	516
1996	2	71	140	1	3	25	0	242
1997	106	11	198	0	1	395	0	711
1998	100	35	120	20	1	126	0	402
1999	46	61	129	16	6	124	0	382
2000	0	2	54	5	74	62	0	197
2001	2	19	40	7	0	166	208	442
2002	12	38	60	3	0	286	504	903
2003	4	17	57	2	1	293	952	1 326
2004	27	377	181	2	1	50	0	638
2005	13	20	76	7	799	14	0	929
2006*	12	6	62	0	0	53	0	133

* Preliminary data

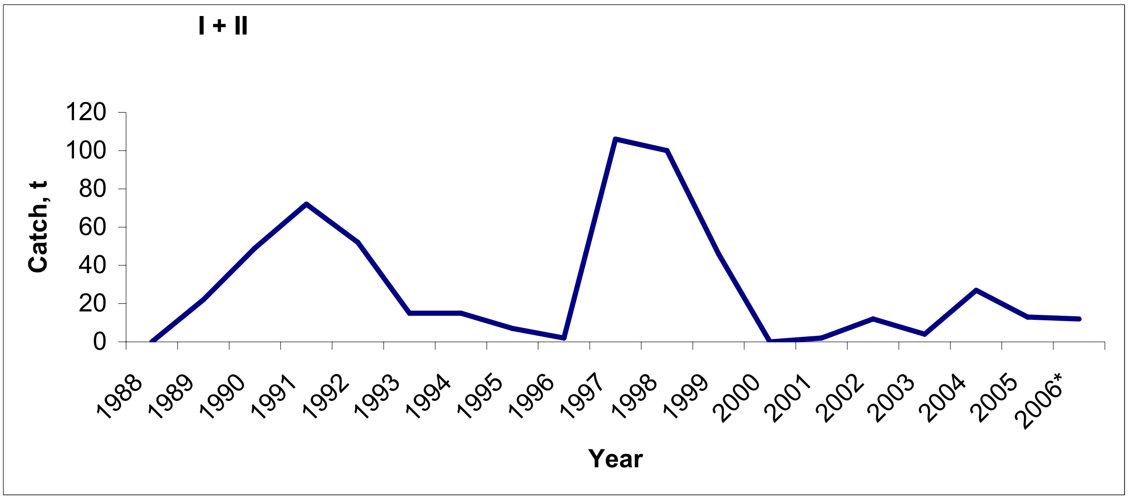


Figure 12.6.1. Roundnose grenadier catches in Subareas I and II, 1988-2006 (data for 2006 is preliminary).

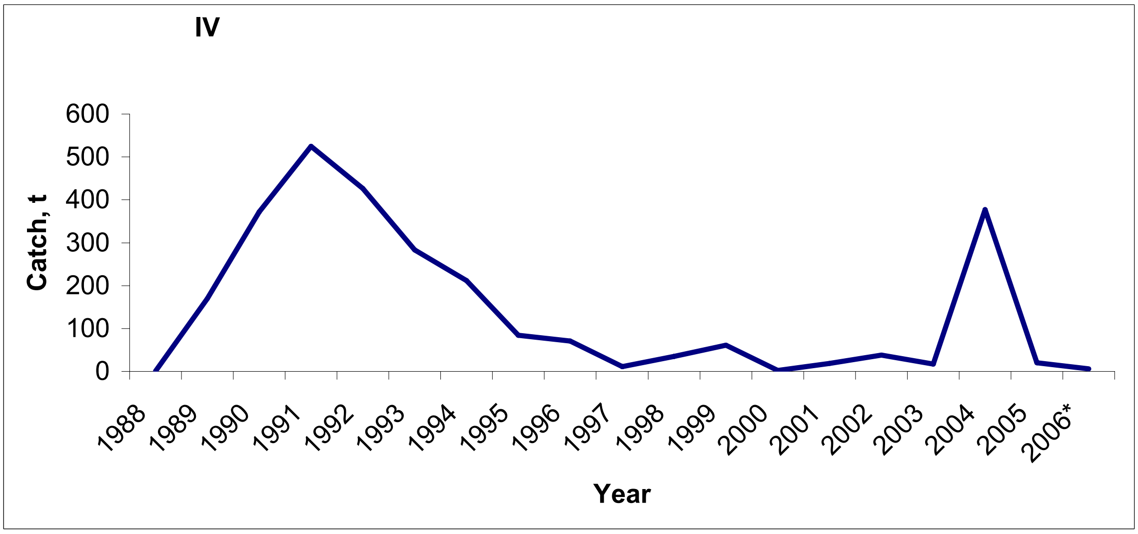


Figure 12.6.2. Roundnose grenadier catches in Subarea IV, 1988-2006 (data for 2006 is preliminary).

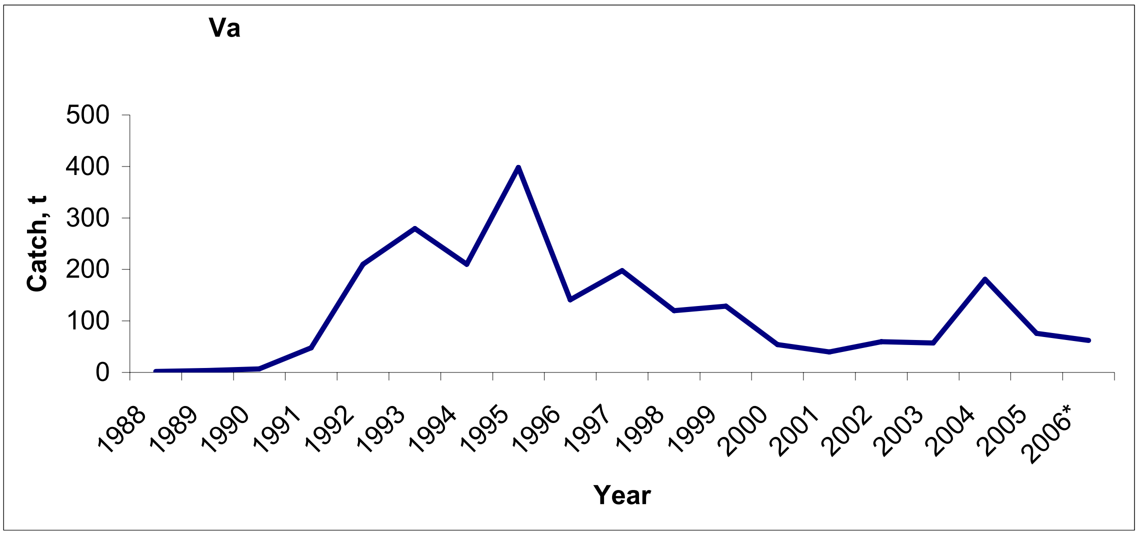


Figure 12.6.3. Roundnose grenadier catches in Division Va, 1988-2006 (data for 2006 is preliminary).

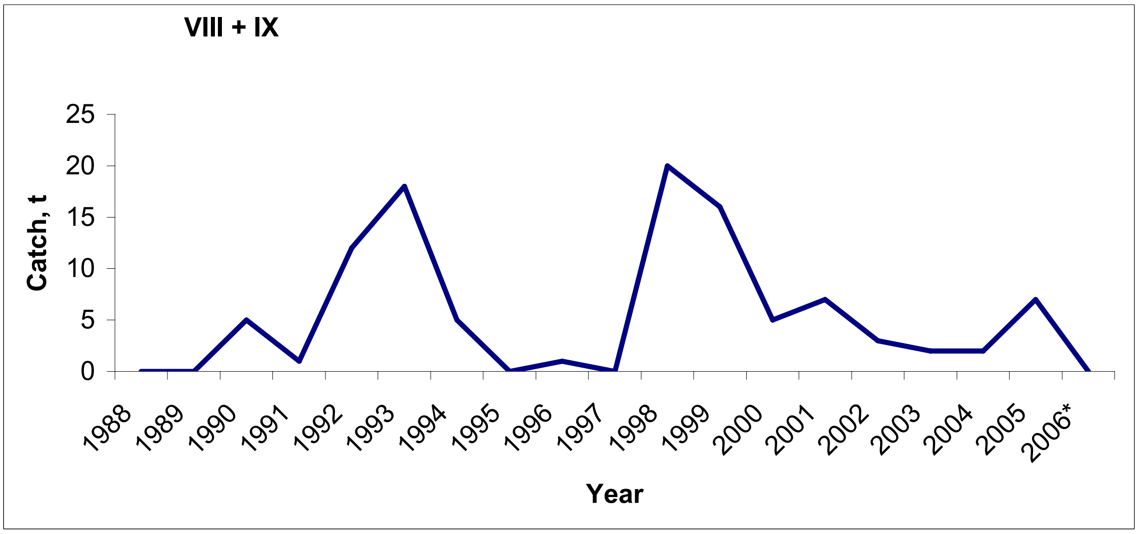


Figure 12.6.4. Roundnose grenadier catches in Subareas VIII and IX, 1988-2006 (data for 2006 is preliminary).

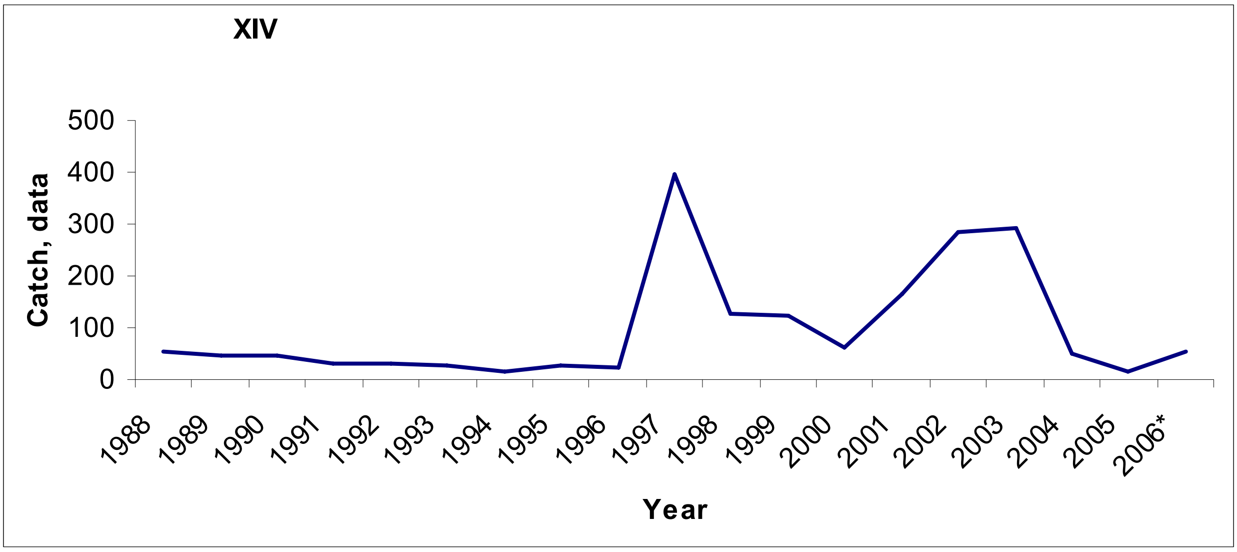


Figure 12.6.5. Roundnose grenadier catches in Subarea XIV, 1988-2006 (data for 2006 is preliminary).

12.7 BLACK SCABBARDFISH (*APHANOPUS CARBO*) IN I, II, IIIa, IV, Va, X, XIV

12.7.1 The fishery

The fisheries were already described in last report (ICES, 2006). No new information was available.

12.7.1.1 Landings trends

Landings are presented in Tables 12.7.1-12.7.6.

Landings from subarea X have fluctuated greatly over the years and are mainly assigned to Portugal.

In subarea XIV the landings are almost null in more recent years.

12.7.1.2 ICES advice

The advice stated in 2006 was: Any measure taken to manage this species in these areas should take into account the advice given for other species taken in the same mixed fishery. Fisheries on black scabbard should 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 shown that it is sustainable.

12.7.1.3 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 2005/06 and 2007/08by subareas are next presented

	2005/06	2007/08
I, II, III & IV	30	15
V, VI, VII, XII	3 042	3 042
VII, IX & X	4000	4000

12.7.2 Stock identity

Black scabbardfish has a wide distribution in the NE Atlantic at depths between 200-1600m but there is very little objective information available on the stock structure of this species. Distribution of the species has led to hypothesis of a single stock but this remains uncertain. It is hypothesized that the species life cycle is not completed in just one area and also that either small or large scale migrations seem to occur seasonally.

12.7.3 Data available

Landing data was available for all fleets, excluding Spain. Length frequency distributions, CPUE and discard data were not available.

12.7.3.1 Landings and discards

No new information was available.

12.7.3.2 Length compositions

No new information was available.

12.7.3.3 Age compositions

No new information was available.

12.7.3.4 Weight at age

No new information was available.

12.7.3.5 Maturity and natural mortality

No new information was available.

12.7.3.6 Catch, effort and research vessel data

No new information was available.

Table 12.7.1. Black scabbardfish in Sub-areas II

Year	France	Faroes II a	Total
1988			0
1989	0		0
1990	1		1
1991	0		0
1992	0		0
1993	0		0
1994	0		0
1995	1		1
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	27	0
2006			0

Table 12.7.2. Black scabbardfish in Sub-area IV

Year	France	Scotland IVa	Scotland IVb	Scotland IVc	Germany IVa	E&W&NI IVa	Total
1988		-			-	-	0
1989	3	-			-	-	3
1990	70	-			-	-	70
1991	107	-			-	-	107
1992	219	-			-	-	219
1993	34	-			-	-	34
1994	45	-			3	-	45
1995	6	2			-	-	8
1996	6	1			-	-	7
1997	0	2			-	-	2
1998	2	9			-	-	11
1999	4	3			-	-	7
2000	2	3			-	-	5
2001	1	10			-	1	11
2002	0	24			-		24
2003	0	4			-		4
2004	5	0			-		5
2005	2	0			-		2
2006	13	0	0	0	-		13

Table 12.7.3. Black scabbardfish in Division Va

Year	Iceland	Total
1988	-	0
1989	-	0
1990	-	0
1991	-	0
1992	-	0
1993	0	0
1994	1	1
1995	+	0
1996	0	0
1997	1	1
1998	0	0
1999	9	9
2000	10	10
2001	5	5
2002	13	13
2003	14	14
2004	19	19
2005	19	19
2006	23	23

Table 12.7.4. Black scabbardfish in Sub-area X

Year	Faroes	Portugal	France	Ireland	Total
1988	-	-			0
1989	-	-	0		0
1990	-	-	0		0
1991	-	166	0		166
1992	370	-	0		370
1993	-	2	0		2
1994	-	-	0		0
1995	-	3	0		3
1996	11	0	0		11
1997	3	0	0		3
1998	31	68	0		99
1999	-	46	66		112
2000	-	112	1		113
2001	-	16	0		16
2002	2	0	0		2
2003		91	0		91
2004	111	2	0		113
2005	56	323	0	0	379
2006	10	55			65

Table 12.7.5. Black scabbardfish in Sub-area XIV

Year	Faroes XIVb	Spain	Total
1988	-	-	0
1989	-	-	0
1990	-	-	0
1991	-	-	0
1992	-	-	0
1993	-	-	0
1994	-	-	0
1995	-	-	0
1996	-	-	0
1997	-	-	0
1998	2	-	2
1999	-	-	0
2000	-	90	90
2001	-	0	0
2002		8	8
2003		2	2
2004		0	0
2005	0	0	0
2006	-		0

Table 12.7.6. Black Scabbardfish (*Aphanopus carbo*) Combined areas

	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	9	112	0	127
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	137
2005	0	2	19	379	0	401
2006	0	13	23	65	0	102

12.8 GREATER FORKBEARD (*PHYCIS BLENNOIDES*) IN ALL ECO-REGIONS

12.8.1 The fishery

Greater forkbeard may be considered as a by-catch species in the traditional demersal trawl and longline mixed fisheries targeting species such as hake, megrim, monkfish, ling, blue ling.

Since 1988, on average the 80% of landings came from the Subareas VI and VII. Spanish, French and UK trawlers and long liners are the main fleets involved in this fishery. The Irish deepwater fishery around Porcupine Bank is based on the flat grounds and targets orange roughy, black scabbard, roundnose grenadier and deepwater siki sharks. The Russian fishery in the North-East Atlantic targeting roundnose grenadier, tusk and ling fish small quantities of greater forkbeard as by-catch of the trawler fleet in Hatton and Rockall Banks.

In last 18 years the rest of landings (11%) come from Subareas VIII and IX (mainly from VIII) by the trawler and longliner Spanish 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. In this subarea also operates the Portuguese artisanal longline vessels landing on average 45 tonnes of *P. blennoides* in last 10 years, but landings of this specie strongly declines since 2000. However the morst important landings of this fleet are recorded for *Phycis phycis* and *Phycis spp* (239 tons in 2006).

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 (up to 15) 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 3% and can be considered as by-catch.

The historical series of landing In Subarea XII is very incomplete. The longest series belongs to the French fleet which usually lands less than 4 tonnes by year. Spanish fleet landed 34 tons in 2004 but the landings in 2005 only reached less than 3 tons. In this subarea Norway greater forkbeard landings mainly come from a Norway commercial longline targeting Greenland Halibut at Hatton Bank. Not landings are reported for Norway, UK and Spain in 2006.

12.8.1.1 Landing trends

The Table 12.8.1 describes the greater forkbeard (*P. blennoides*) landings by subarea and country. The trend in VI and VII subdivision shows an important increase in landings from 1994 to 2000. In this year the total landings reported reached a peak of 4919 tons. Since 2001 a continuous and notable decrease is observed and in 2006 only 2094 ton are recorded. That is a value similar to the landings recorded in years from 1988 to 1993 (Figure 12.8.1).

Landings by subarea and gear of Spanish fleet from 2003 to 2006 are shown in Table 12.8.2. In this period the 66 % of total landings of *Phycis spp* of Spain comes from bottom trawler and longliner fleet (65% and 29% respectively) operating mainly in Subareas VII and VIII.

In subdivision VIII and IX the historical series of landings since 1993 remains always above 300 tons, but in 2006 reached only 289 tons, one of the lowest values of the series. An exception of this period can be observed in 1999 in which the highest value is reached (664 tons).

Although In the subarea X landings of greater forkbeard show ups and downs (is not a target species of the Portuguese demersal fleet), a continuous decrease can be observed since 2000.

Even though the maximum landings in all divisions are reached between 2000 and 2003 the overall trend shows a decrease in landings since 2004.

In Subareas I & II, the landings registered mainly by Norway have declined since 1993. 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 reported 315 tons of landings. However a strongly decrease in Norwegian landings is observed since 2003.

12.8.1.2 ICES advice

The landings of greater forkbeard are mainly bycatch from traditional demersal trawl and longline fisheries targeting species such as hake, megrim, monkfish, ling, blue ling, etc. Fluctuations in landings are probably the result of changing effort on different target species and/or market prices and are not necessary linked with changes in the resource abundance. The species should not be managed in a single-species context and any advice should take into account advice on other species/fisheries.

12.8.1.3 Management

The Council Regulation (EC) No 2015/2006 maintained for *Phycis blennoides* the same TAC for 2007 and 2008 that in two previous years. In the next table a summary of *P. blennoides* international TAC by subareas and also landings in 2006 are shown. Due to in some cases international landings are not available by species, these summary table could include significant landings of *Phycis spp.* Landings reported in all subareas except X and XII are above the TAC.

Phycis Blennoides SUBAREA	TAC 2007-2008	landings 2006
I, II, III, IV	36	188
V, VI, VII	2028	2052
VIII, IX	267	279
X, XII	63	10
Total	2394	2529

12.8.2 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 began of the 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 Subareas VI, VII and XII (Hatton Bank).
- • Greater forkbeard in Subareas VIII and IX.
- • Greater forkbeard in Subarea X (Azorean region)

12.8.3 Data available

No new data were presented.

12.8.3.1 Landings and discards

Historical series of landings data available to the Working Group have been described in text and tables of section 12.8.1.1.

12.8.3.2 Length compositions

The Figure 12.8.2 presents the comparison between length frequency distributions from 2001-2006 Spanish bottom trawl surveys in Porcupine (Velasco F., *pers. com.*). Length distribution shows a mode of small individuals, 12-14 cm, and another most abundant mode between 28 and 30 cm in the first two surveys. In 2003, there is a decrease these small ones (ranged 12-18 cm) and a notable increase of sizes from 22 to 32 cm which established a clear mode of 26-27 cm. In 2004 and 2005 the importance of this class size disappears and these two years show modes in 30 and 38 cm and in 35 and 45 cm respectively. In 2006 two modes can be observed one in 29 cm and other in 50 cm. Since 2001, mean catch length from these surveys is: 37.7, 34.6, 30.4, 34.8, 39.8 and 41,3 cm.

12.8.3.3 Age compositions

No data on age composition are available.

12.8.3.4 Weight at age

No weight at age data are available.

12.8.3.5 Maturity and natural mortality

No data on maturity and natural mortality are available.

12.8.3.6 Catch, effort and research vesssel data

Data of abundance of Greater forkbeard are provided from 2001 to 2006 for Spanish bottom trawl surveys in Porcupine (Velasco F., *pers. com.*). Biomass index in the period ranks from 10,0 kg/haul in 2002 to 26,02 kg/haul in 2005. The Abundance index reaches the maximun in 2003 with 99,4 individuals/haul and the minimun in 2001 with 29,6 individuals/haul (Figure 12.8.3). A geographic representation of *Phycis blennoides* catches in Porcupine bank is shown in Figures 12.8.4 and 5. Notice the notable abundance in 2003 in all geographic area covered by the survey coincides with an importan increase of sizes from 22 to 32 cm in this year (figure 12.8.2).

A historical data series of Effort (days at sea) and LPUEs of *Phycis spp.* of commercial Baka trawler and long liner Basque fleet in VI, VII and VIII subareas is shown in table 12.8.4. The higher effort in Baka trawlers is reached in 1996 in subarea VIII, and in long liners in the same subarea but in 2001. On average, by far the best LPUE of historical series in both fleets happens in subarea VI. However landings and LPUE of long liners show an important decrease from 2004 to 2005.

England and Wales effort data of Greater Forkbeard by gear in all ICES Subareas are presented in table 12.8.4. From 2000 to 2005 the 95% of total days at sea of netter, liner and trawler fleets are been carried out in in Subareas V, VI and VII. Historically most of the effort in these Subareas belongs to trawlers (69%) and netter fleets (23%), but the amount of days at sea has been decreased continuously since 2000. In the case of trawler fleet the effort in 2005 has been reduced in a 55 % compared with that in 2005, 59% in the case of liners and 50% in the netter fleet.

12.8.4 Data analyses

Due to the lack of suitable data in all ICES Subareas no data analysis were carried out by the Working Group.

Table 12.8.1. Working Group estimates of greater forkbeard (*Phycis blennoides*) landings (tonnes).

GREATER FORKBEARD (*Phycis blennoides*) I and II

Year	Norway	France	Russia	UK (Scot)	Germany	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**

GREATER FORKBEARD (*Phycis blennoides*) III and IV

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	3		0	7		**11**
2001	5		1	19	2	**26**
2002	2	561	1	21	0	**585**
2003	1	225	0	7		**233**
2004	1	138		3		**142**
2005	0	81	0	1		**82**
2006	1	134	3			**139**

(1) Includes Moridae, in 2005 only data from January to June

Table 12.8.1 (continued).

GREATER FORKBEARD (*Phycis blennoides*) Vb

Year	France	Norway	UK (Scot)[1]	UK (EWNI)	Faroe Islands	**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	7	92	1	0		**100**
2002	10	133	5	0		**148**
2003	11	55	7	0		**73**
2004	8	37	2	2		**48**
2005	4	39		0,3		**43**
2006	8	26			6	**39**

(1) Includes Moridae, in 2005 only data from January to June

Table 12.8.1 continued

GREATER FORKBEARD (*Phycis blennoides*) VI and VII

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	317	686	183	824	929	518	1			**3458**
2000	623	743	380	1613	731	820	8	2		**4919**
2001	626	663	536	1332	538	640	10	4		**4349**
2002	548	481	300	1049	421	545	9	0		**3352**
2003	439	319	492	1100	245	661	1	1		**3257**
2004	281	183	165	1131	288	397		1		**2447**
2005	598	237	128	941	179	164		5		**2252**
2006	626	82	162	1074	148			2	0	**2094**

(1) *Phycis spp*.

(2) Includes Moridae, in 2005 only data from January to June

Table 12.8.1 (continued).

GREATER FORKBEARD (*Phycis blennoides*) VIII and IX

Year	France	Portugal (1)	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	655		**664**
1999	7	10	361		**378**
2000	31	6	374		**411**
2001	33	8	454		**494**
2002	63	8	418		**489**
2003	23	11	388		**422**
2004	6	10	444		**461**
2005	30	14	312	0	**355**
2006	27	10	252		**289**

(1) *Phycis spp*.

GREATER FORKBEARD (*Phycis blennoides*) X

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**

(1) from 1988 to 2005 *Phycis spp*.

Table 12.8.1 (continued).

GREATER FORKBEARD (*Phycis blennoides*) XII

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		**6**
2003	3		8	0		**11**
2004	3		6		34	**43**
2005	1	0	0	0	3	**3**
2006*	0					**0**

(1) Includes Moridae, in 2005 only data from January to June

(2) *Phycis spp* .

* Preliminary data

GREATER FORKBEARD (*Phycis blennoides*) All ICES Sub-areas

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	81	1	**2128**
1993	1	34	27	1462	395	115	1	**2035**
1994	0	12	4	1571	320	135	3	**2045**
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	664	38	1	**3763**
1999	0	31	34	3458	378	41	0	**3941**
2000	0	11	32	4919	411	94	6	**5472**
2001	8	26	100	4349	494	83	8	**5068**
2002	318	585	148	3352	489	57	6	**4955**
2003	155	233	73	3257	422	45	11	**4196**
2004	75	142	48	2447	461	37	43	**3253**
2005	51	82	43	2252	355	22	3	**2809**
2006	49	139	39	2094	289	15	0	**2626**

Table 12.8.2. ***Phycis spp*** **Spanish landings (tons) by Subarea and gear in the period 2003-2005**

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	375	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	26	0	0
Others	0	0	0	18	0	0	0	0	0	40	0	0

*** Preliminary**

Table 12.8.3. ***Phycis spp*** **landings (tons), effective effort (fishing days = trips*(days/trip)) and LPUE (landings in kg/day) of different fleets landing in the Basque Country (Spain) ports in 1996-2006.**

1996-2000 Effort and landings of Baka otter trawl from Ondarroa in Divisions VIIIa,b,d, Subarea VI-VII

(a)	BAKA trawl-ON-VIII			BAKA trawl-ON-VII			BAKA trawl-ON-VI		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
1996	4,8	4378	1,1	63,2	1170	54,0	45,7	695	65,7
1997	6,2	4286	1,5	15,4	540	28,5	36,2	710	51,0
1998	6,2	3002	2,0	52,6	1196	44,0	54,1	750	72,2
1999	5,3	2337	2,3	40,0	1384	28,9	140,7	855	164,7
2000	8,6	2227	3,8	65,7	1850	35,5	190,8	763	250,0
2001	7,7	2707	2,8	59,4	1531	38,8	183,7	1171	156,9
2002	165,4	3617	45,7	23,6	1055	22,4	5,0	1592	3,1
2003	24,2	3363	7,2	15,3	1060	14,4	65,1	827	78,8
2004	20,0	4232	1,6	29,9	1074	1,4	52,8	510	1,5
2005	23,4	3697	6,3	28,1	663	42,4	49,9	484	103,1
2006	15,8	3275	4,8	3,9	501	7,9	37,1	449	82,7

2001-2006 Effort and landings of Baka otter trawl from all ports in Divisions VIIIa-d, Subareas VI-VII

(b)	BOTTOM LONG LIGNER VIII			BOTTOM LONG LIGNER VII			BOTTOM LONG LIGNER VI		
Year	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)	Landings (t)	Effort (days)	LPUE (kg/days)
2001	22,3	5593	4,0	0,4	358	1,1	152,4	818	186,2
2002	87,2	2606	33,5	20,1	401	50,2	11,6	454	25,5
2003	14,2	6586	2,2	16,7	800	20,9	64,1	139	463,1
2004	6,9	4428	1,6	1,5	491	3,0	0,8	197	3,8
2005	53,3	3997	13,3	1,3	443	3,0	1,2	143	8,5
2006	22,5	4046	5,6	89,8	386	232,7	0,0	0	0,0

Table 12.8.4. Fishing effort for Greater forkbeard from England and Wales fleets, by ICES sub-area and gear. Effort in days at sea.

Subareas	gear	2000	2001	2002	2003	2004	2005
I II III IV	Lines	3	24	0	5	0	0
	Netter	23	278	317	257	211	162
	Trawl	526	980	817	309	182	69
V VI VII	Lines	1155	1243	1259	1062	999	272
	Netter	3678	2434	3110	3180	3552	1508
	Trawl	11723	11520	9716	7703	7424	5286
VIII IX	Lines	0	0	0	23	6	2
	Netter	0	0	0	0	177	51
	Trawl	0	0	0	0	0	1
X XII	Lines	0	0	0	0	0	0
	Netter	0	8	24	0	1	0
	Trawl	4	43	14	0	0	5

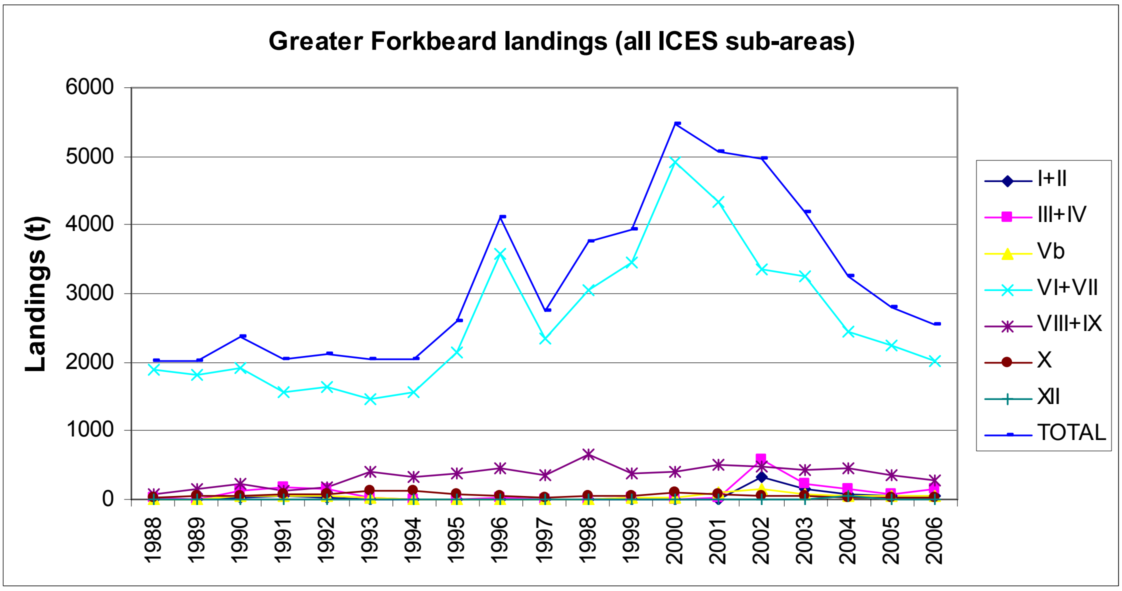


Figure 12.8.1. Time series of landings of Greater forkbeard landing by ICES Sub-areas,1988-2006.

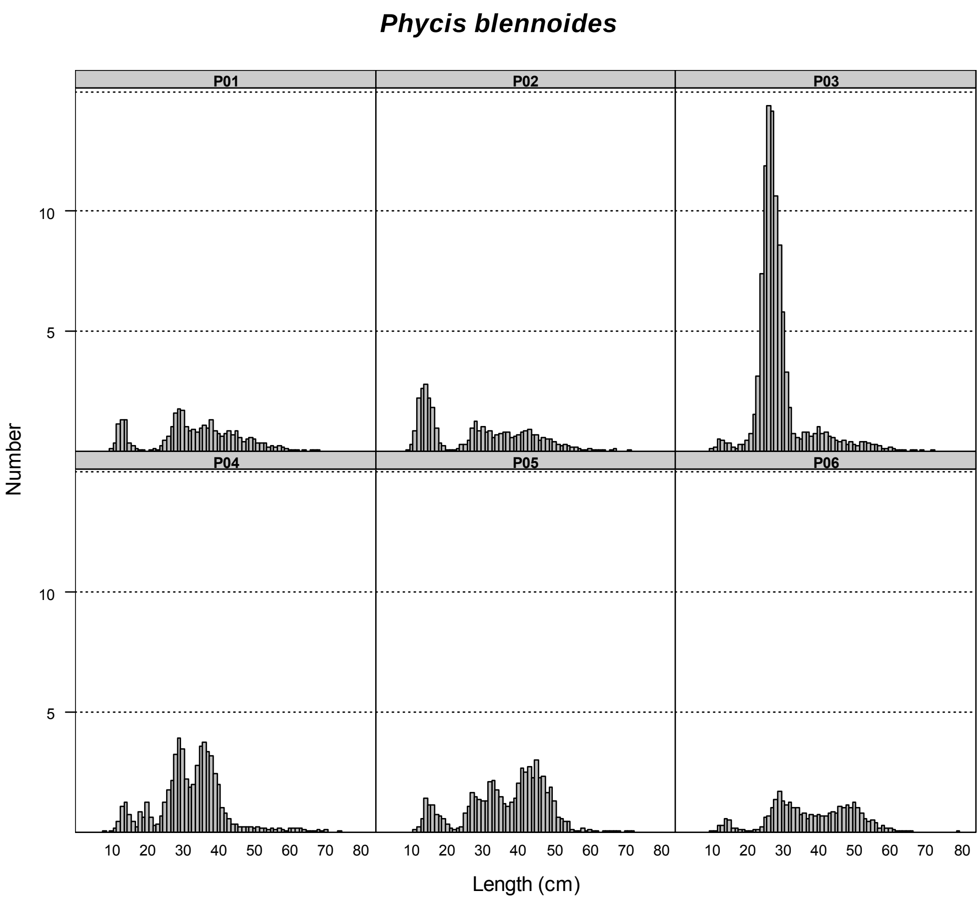
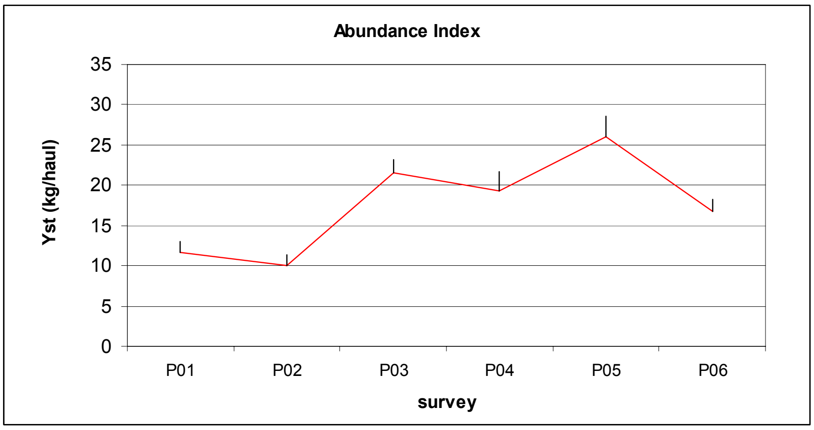


Figure 12.8.2. Mean stratified length distributions of *Phycis blennoides* in Porcupine surveys (2001-2006) (F. Velasco, *pers. com.*)



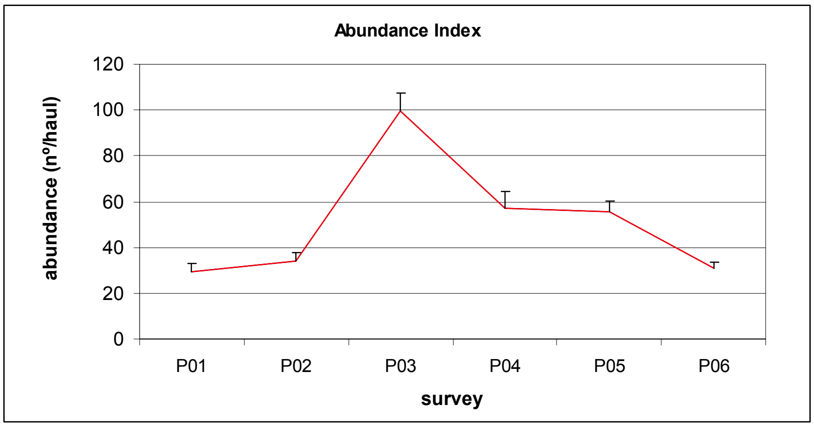


Figure 12.8.3. Changes in *Phycis blennoides.* biomass and abundance index during Porcupine Survey time series (2001-2005). (F. Velasco, pers. com.)

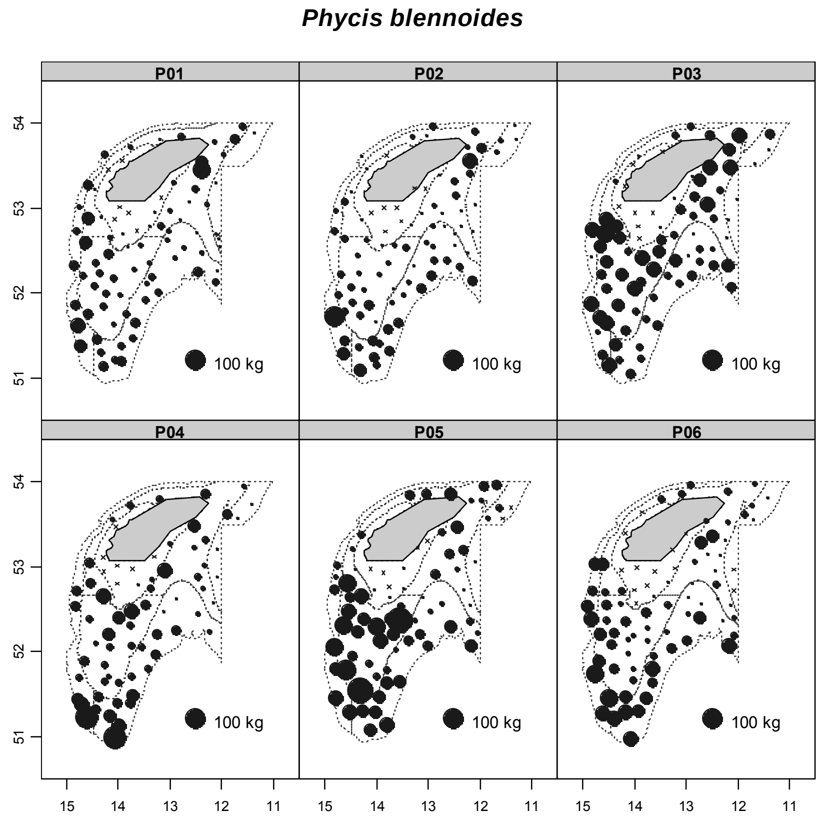


Figure 12.8.4. Geographic distribution of *Phycis blennoides* catches (kg/30 min haul) in Porcupine surveys between 2001 and 2005 (F. Velasco, pers. com.).

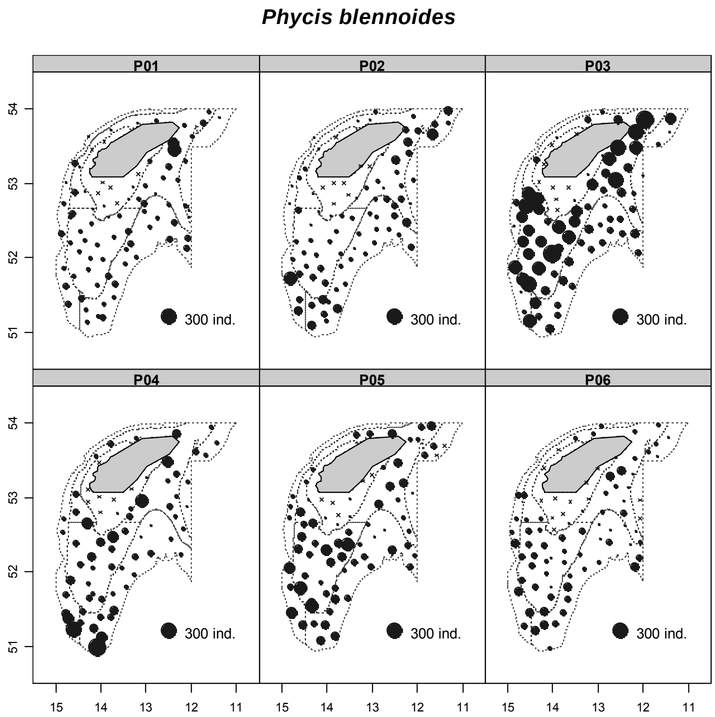


Figure 12.8.5. Geographic distribution of *Phycis blennoides* catches (n/30 min haul) in Porcupine surveys between 2001 and 2005 (F. Velasco, pers. com.)

12.9 ALFONSINOS/GOLDEN EYE PERCH (*BERYX SPP.*) IN ALL ECO-REGIONS

12.9.1 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 unknown. Detailed landings data by species are available only for the Portuguese longline fishery in area Xa, where the landings of *B. decadactylus* averaged 20% 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 long liners are the main fleets involved in this fishery.

From 1988 to 1993 almost only the Azores (ICES area Xa) was involved on the fishery (representing 94% of the landings), duplicating the landings at the final of this period. Former USSR 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 18% of the total catch from 1996 to 2006 and areas VIII+IX, which catches averaged 32% of the total from 1996 to 2006. 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 15) 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* represents 5 to 10% of the deep water species caught in the region.

12.9.1.1 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 table 12.9.1 and figure 12.9.2. Data from Russia is not official and was revised before the meeting. 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 due to 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 by-catch of demersal fisheries targeting other species.

The general trend of the total landings follows the Azorean trend (increase until 1996 and decrease thereafter) but is very affected by the Russian catches during the period 1994-2000. Landings increase from 225t in 1998 to 729t in 1993 mainly due to the contribution of the Azores. From 1994 to 2000 the total landings fluctuate considerably due to the catches of the Russian trawlers fishery from the Xb ICES area, with a peak in 1994 (837t) and 1996 (960t). In 2001 the total landings become at the same level of 1993 but with a decrease trend from 614t in 2001 to 351t in 2006.

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

(186 t), but decreased in the following years. The 2006 catch (76 t) was at the same level of 2005 (70 t).

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 200t, mainly due to the Spanish landings, with a drop in 2003 (109t) and 2006 (84t). Most of these landings can be regarded as by-catches 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 185 t in 1987 to 644 t in 1994, the highest value in the catch series, and then decreased to 175 t in 1999. In the following years they fluctuate between 139 and 243 t. During the last four years the landings fluctuated around 200 t. Landings of *B.. splendens* by former USSR trawlers were estimated to be around 3028t during 1994–2000. From 2000 no catches were reported by Russia for the Subarea X.

Detailed information by species is available only for Area X (Azores area). Both species, *B. splendens* and *B. decadactylus* present a decreasing trend in their landings, which is partly explained by a change in target species in the fishery. The landings series in the period 1988-2006 for both species separately is presented in table 12.9.2 and in Figure 12.9.2.

12.9.1.2 ICES advice

Due to their spatial distribution associated with seamounts and their aggregation behaviour, alfonsinos are easily overexploited; they can only sustain low rates of exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data on both target and bycatch fish.

12.9.1.3 Management

No update.

12.9.2 Stock identity

The Alfonsinos *Beryx spp*. are deepwater species that occur throughout the world's tropical and temperate waters, in depths from 25 to 1300 meters. The 2004 report of the WGDEEP 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. Since very little is known about stock structure of those species, the WG does not pre-suppose the existence of different stocks of *B. splendens* and *B. decadactylus* in the north Atlantic.

12.9.3 Data available

Historical landings series are available for *Beryx spp* by subarea and fishing country since 1988. Disaggregated landing data by species are available only for the Portuguese longline fishery around the Azores, in division Xa and Russian trawl fishery in division Xb.

Information on discard, length composition and abundance indexes exist from the discard trips carried out in Irish waters in 2004 and by the Spanish trawler surveys in Porcupine since 2001.

For the Azores longline fishery detailed information is available for both *Beryx* species for length composition of the catches, nominal and standardized cpue's, biological data on reproduction, sex ratio and weight-length relationships.

Detailed information is also available from the annual deep-water species bottom longline surveys from the Azorean, including biological data and abundance index in number "Relative Population Number" (RPN), for both *Beryx* species.

No information about age compositions, weight at age and natural mortality was available during the WGDEEP meeting for the all ICES areas.

12.9.3.1 Landings and discards

Tables 12.9.0a-h describe the alfonsinos landings by subarea and country. No information about discards of *Beryx* species was available during the WGDEEP meeting.

12.9.3.2 Length compositions

Size data are available for the golden eye perch (*B. decadactylus*) and for alfonsino (*B. splendens*) from the Portuguese bottom longline fleet in divison Xa (Azores) for the years 1998 to 2005. The size distributions of the landings (catch at size) for both species is presented in figure 12.9.3 for golden eye perch and in figure 12.9.4 for alfonsino (ICES, 2006)

Mean annual length composition (1995-2005) from spring bottom longline surveys in Azores (ICES division Xa) for *B. decadactylus* are presented in figure 12.9.5 and in figure 12.9.6 for *B. splendens* (ICES, 2006).

12.9.3.3 Age compositions

No information about age compositions of *Beryx* species was available during the WGDEEP meeting

12.9.3.4 Weight at age

No information about weight at age of *Beryx* species was available during the WGDEEP meeting

12.9.3.5 Maturity and natural mortality

Information on the sex ratio and stage of maturity is available for both *Beryx* species from the Azores fisheries in division Xa (ICES, 2006). No new information was presented to the working group this year.

12.9.3.6 Catch, effort and research vessel data

Fishery standardized indices of abundance in weight are available for both species (ICES, 2006) and are presented in figure 12.9.7. for *Beryx decadactylus and* figure 12.9.8 *Beryx splendens.*

Annual bottom longline survey abundance index in number “Relative Population Number” (RPN) is also available for the golden eye perch (*Beryx decadactylus*) (figure 12.9.9) the alfonsino (*Beryx splendens*) (figure 12.9.10) (ICES, 2006).

12.9.4 Data analyses

Detailed information by species is available only for Area X (Azores). Both species, *B. splendens* and *B. decadactylus* present a decreasing trend in their landings, which is partly explained by changes in the fishing pattern and in the target species in the fishery that have been observed in recent years.

12.9.4.1 Beryx decadactylus

The size distribution of *B. decadactylus* landings shows a stability of the sizes caught along the period (Figure 12.9.3)

The standardized fishery CPUE in weight, presents an overall slow decreasing trend but with fluctuations around its mean (Figure 12.9.7). The observed tendencies in the CPUE series could be explained by the fact that the golden eye perch is not a target species of the fishery and its catches can be considered as a by catch of the deep water demersal fishery, where changes in the fishing pattern and in target species have been observed in recent years.

The distribution area of the resource may be broader than the survey's coverage area and depths, and caution must be taken when relating the surveys information to the stock status (ICES, 2006).

12.9.4.2 Beryx splendens

Alfonsino size frequencies show some interannual variability with a general stability of the sizes caught along the analyzed period (Figure 12.9.4).

The standardized fishery CPUE in presents an overall slow decreasing trend but with fluctuations around its mean (Figure 12.9.8). The trends in the standardized CPUE observed could be explained by the fact that the alfonsino is not a target species of the fishery and that its catches could be considered as a by catch in the demersal fishery.

Caution must be taken when relating the surveys information to stock status, since the distribution in depth and area of the resource may be much broader than the survey's coverage.

Due to the lack of suitable data for *Beryx* spp. in most ICES Subareas, no further analyses were carried out by the Working Group.

Table 12.9.0a. ALFONSINOS (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

*Preliminary

Table 12.9.0b. 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

*Preliminary

Table 12.9.0c. ALFONSINOS (Beryx spp.) VI and VII

	France	E & W	Spain	Ireland	TOTAL
1988					
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	4		25
1998	10	0	71		81
1999	55	0	20		75
2000	31	2	100		133
2001	58	13	115		186
2002	34	15	45		94
2003	18	5	55	4	82
2004	13	3	46		62
2005	15	0	55	0	70
2006*	27	0	49	0	76

*Preliminary

Table 12.9.0d. 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	259		269
1999	11	29	161		201
2000	6	40	117	4	167
2001	7	43	179	0	229
2002	12	60	151	14	237
2003	9	0	100	0	109
2004	14	53	202	0	280
2005	9	45	202	0	191
2006	9	20	51	3	84

*Preliminary

Table 12.9.0e. 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*	191	0	0		0	191.4606

*Preliminary

** Not oficial data from ICES area Xb

Table 12.9.0f. ALFONSINOS (Beryx spp.) XII

Year	Faroes	TOTAL
1988		0
1989		0
1990		0
1991		0
1992		0
1993		0
1994		0
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

*Preliminary

Table 12.9.0f. 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*		

Table 12.9.0g. ALFONSINOS (Beryx spp.). All areas.

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			76	84	191	0		351
*Preliminary								

Table 12.9.0h. Landings (tonnes) of Beryx spp. (split by species) in Azorean waters (Portuguese EEZ in Subarea X)

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	191

Table 12.9.1. Reported landings for the Alfonsinos, (*Beryx* spp), by ICES Subareas/Divisions.

Year	IV	Vb	VI+VII	VIII+IX	X	XII	**TOTAL**
1988				0	225		**225**
1989			12	0	260		**272**
1990	1	5	8	1	338		**353**
1991			0	0	371		**371**
1992	2	4	3	1	450		**460**
1993			1	0	728		**729**
1994			5	2	1481		**1488**
1995		1	3	82	729	2	**817**
1996			178	88	1510		**1776**
1997			25	135	384		**544**
1998			81	269	229		**579**
1999			75	201	725		**1001**
2000			133	167	484		**784**
2001			186	229	199		**614**
2002			94	237	243		**574**
2003			82	109	172		**363**
2004			62	280	139		**481**
2005			70	191	157		**418**
2006*			76	84	191		**351**

Table 12.9.2. Reported landings of *Beryx splendens* and *B. decadactylus* in Azores (ICES area X).

Year	*B. splendens*	*B. decadactylus*
1988	122	103
1989	113	147
1990	137	201
1991	203	168
1992	274	176
1993	316	217
1994	410	234
1995	335	194
1996	379	171
1997	268	111
1998	161	68
1999	119	56
2000	168	35
2001	182	17
2002	223	20
2003	150	22
2004	110	29
2005	134	23
2006	152	40

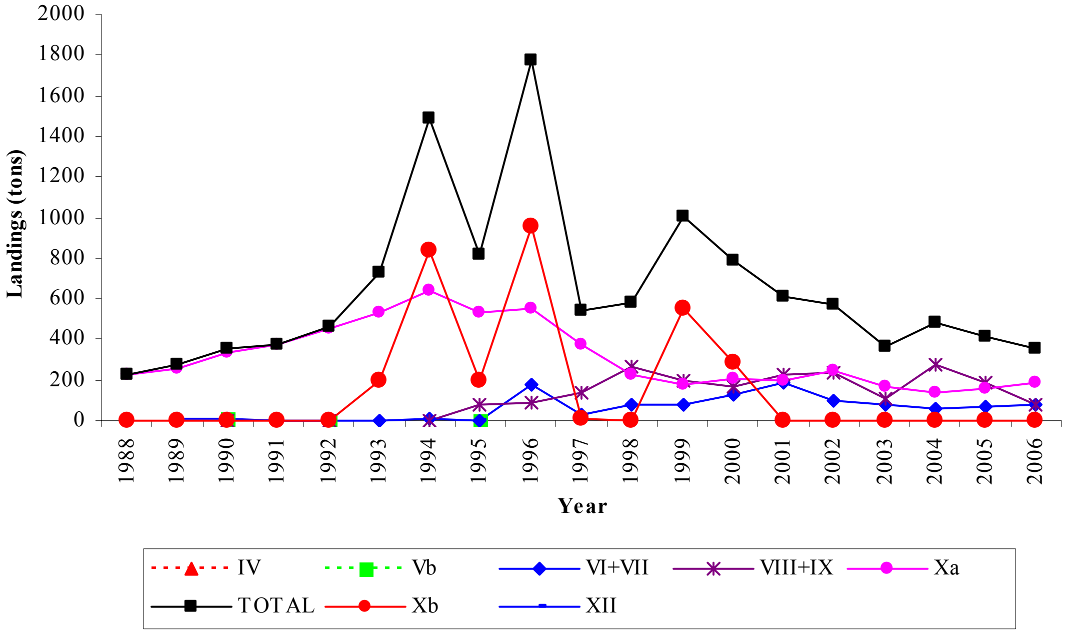


Figure 12.9.1. Reported landings for the Alfonsinos, (*Beryx* spp), by ICES Subareas/Divisions

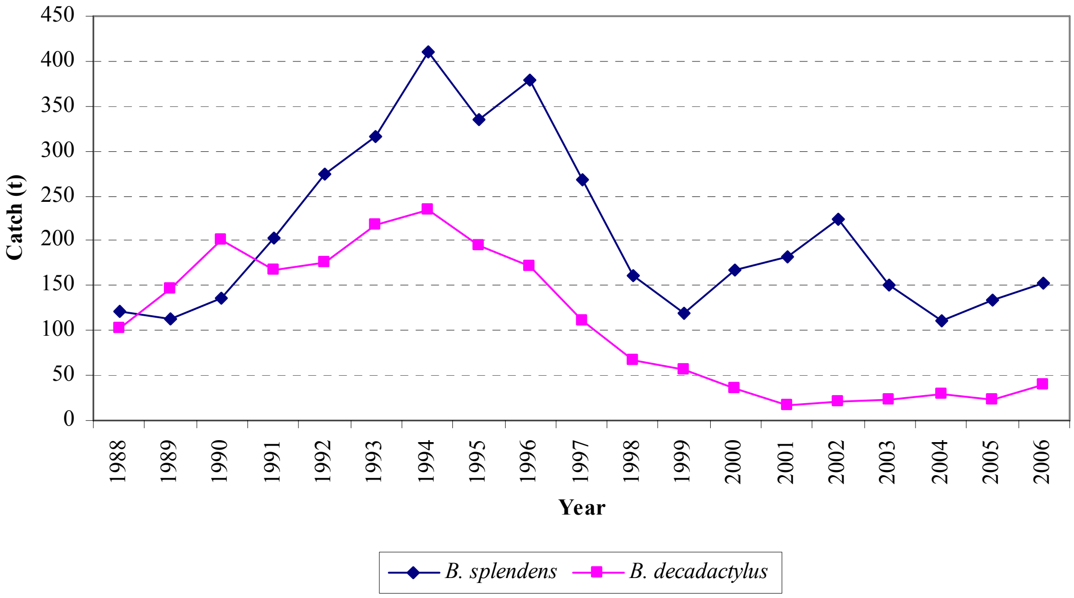


Figure 12.9.2. Landings of *Beryx splendens* and *B. decadactylus in Azores* (ICES Subarea X).

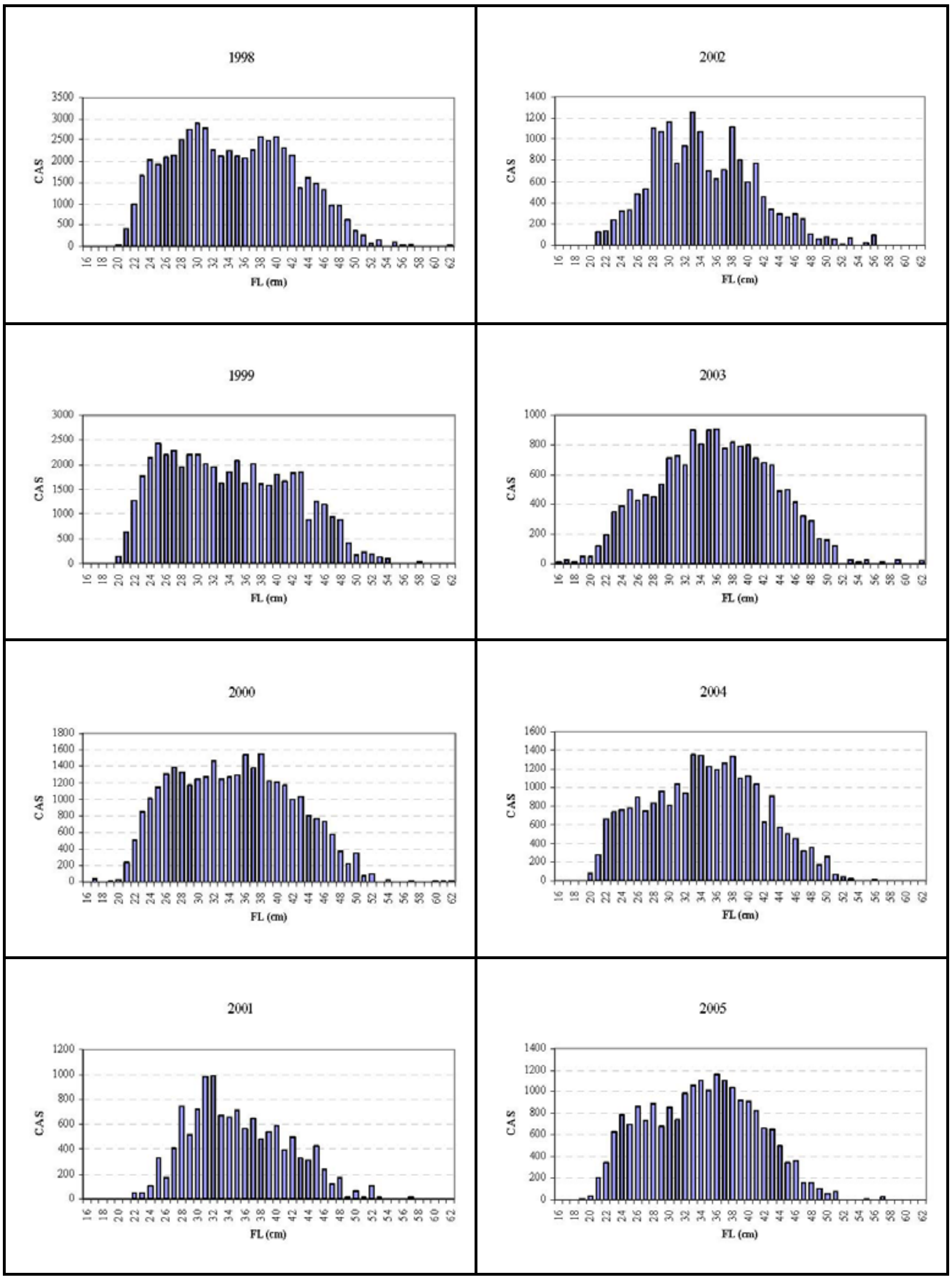


Figure 12.9.3. Size frequencies of the catches of the Golden eye perch (*Beryx decadactylus*) from the Azores longline fishery, from 1998 to 2005 (ICES Subarea X).

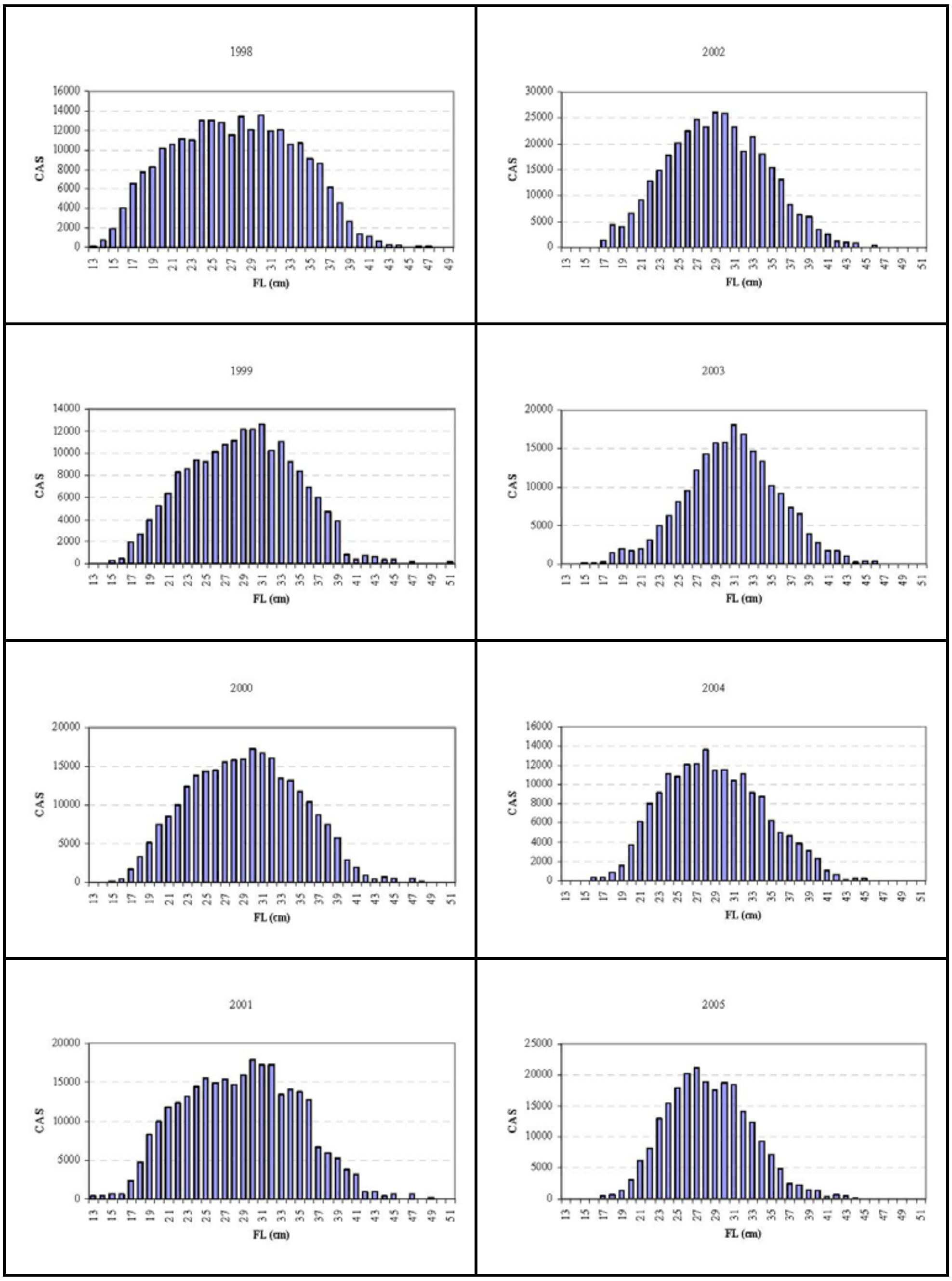


Figure 12.9.4. Size frequencies of the catches of alfonsino (*Beryx splendens*) from the Azores longline fishery, from 1998 to 2005 (ICES Subarea X).

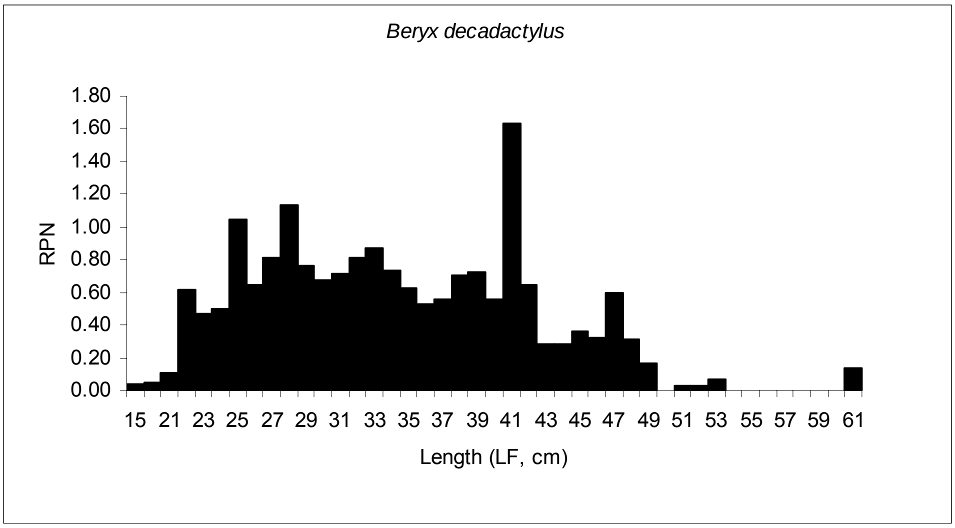


Figure 12.9.5. Mean annual length composition (1995-2005) from spring bottom longline surveys in Azores (ICES subarea X) for *Beryx decadactylus.*

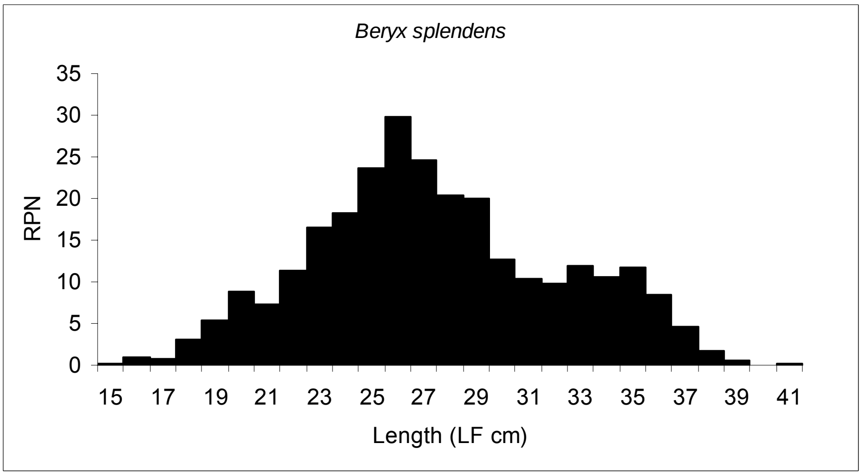


Figure 12.9.6. Mean annual length composition (1995-2005) from spring bottom longline surveys in Azores (Ices area X) for *Beryx splendens.*

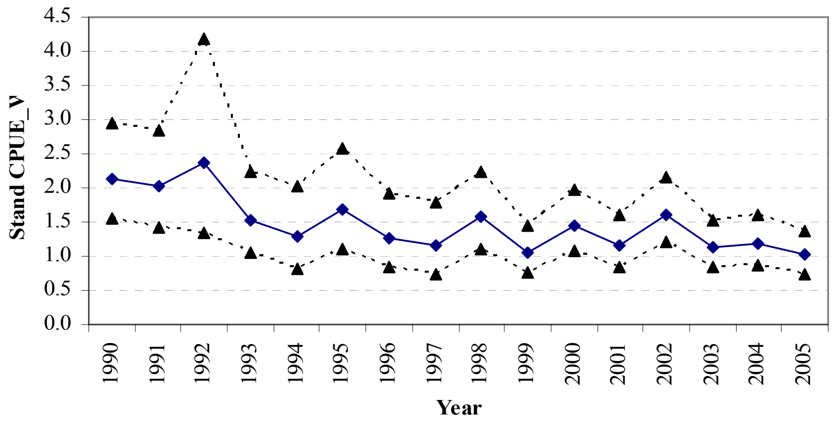


Figure 12.9.7. Annual standardized CPUE in biomass (kg per 1000 hooks) and upper and lower 95% confidence intervals for *B. decadactylus* from the Azores longline fishery (ICES X)

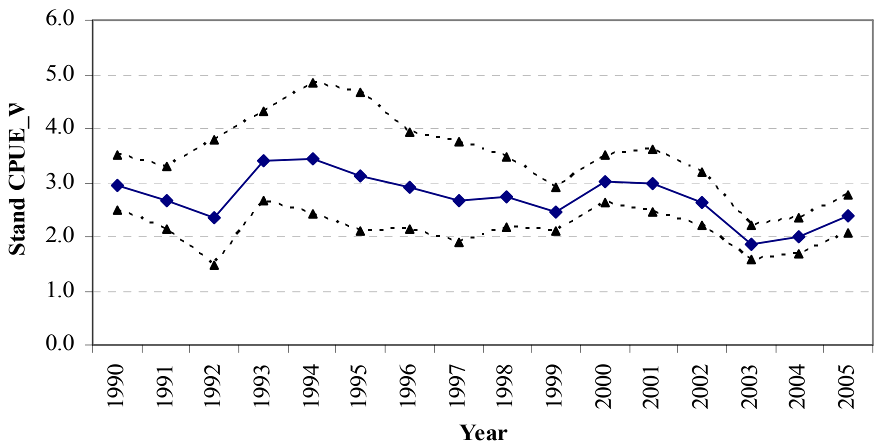


Figure 12.9.8. Annual standardized CPUE in biomass (kg per 1000 hooks) and upper and lower 95% confidence intervals for the Alfonsino (*B. splendens)* from the Azores longline fishery (ICES Subarea X).

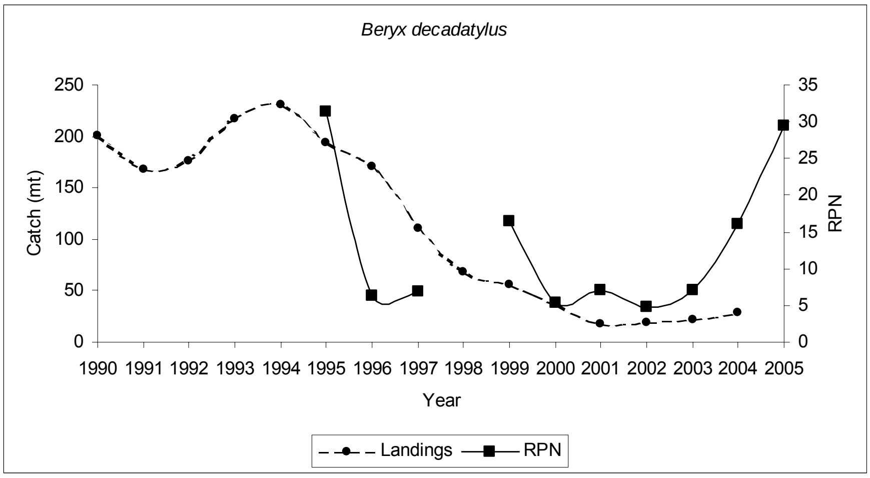


Figure 12.9.9. Annual bottom longline survey abundance index in number "Relative Population Number" (RPN) available for the golden eye perch (*B. decadactylus*) from the Azorean deep-water species surveys (ICES Subarea X). Annual landing are also presented in the graph for trend illustration.

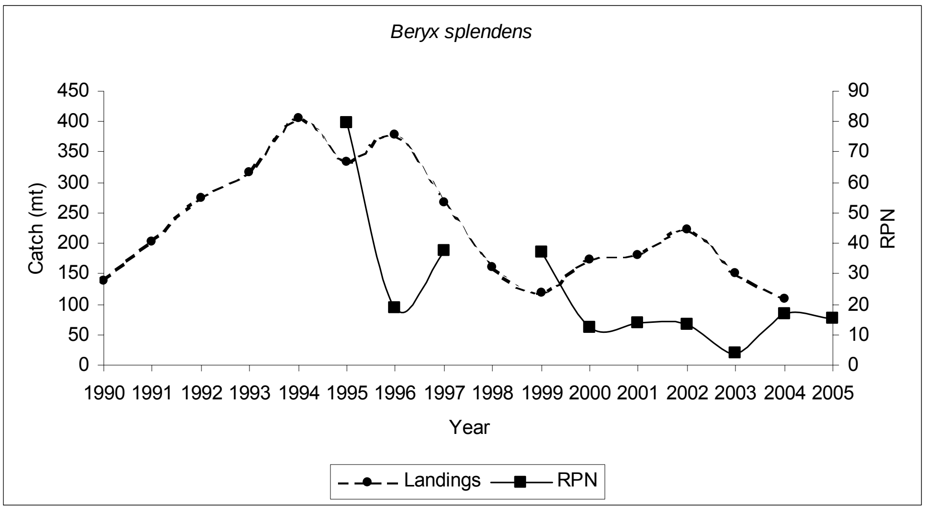


Figure 12.9.10. Annual bottom longline survey abundance index in number "Relative Population Number" (RPN) available for the Alfonsino (*Beryx splendens*) from the Azorean deep-water species surveys (ICES Subarea X). Annual landing are also presented in the graph for trend illustration.

12.10 OTHER SPECIES

12.10.1 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 deepwater red crab (*Chaceon affinis*)

Roughhead grenadiers are predominantly taken as bycatch in trawl and longline fisheries targeting Greenland halibut in sub-areas I and II. Mora, rabbitfish, smoothheads, bluemouth and deep-water cardinal fish are taken as bycatch in mixed-species demersal trawl fisheries in sub-areas 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 is needed on levels of discarding. A small bycatch of rabbitfish is taken in the Roundnose grenadier fishery in sub-area III.

Mora, wreckfish, bluemouth and silver scabbardfish are caught in targeted and mixed species longline fisheries in sub-areas VIII, IX and X.

Deep-water red crab are caught in directed tangle net and trap fisheries and as a bycatch in net fisheries for deep-water sharks, principally in sub-areas VI and VII but increasingly in other areas including sub-area IX.

12.10.1.1 Landings trends

Reported landings of roughhead grenadier increased dramatically from 185 tonnes in 2004 to 5151 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 recorded as "*Macrourus berglax* and other grenadiers". It is therefore possible that these landings were not actually *M. berglax*. 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 also possible that the high landings of roughhead may result from misreporting of other species eg. roundnose grenadier. Landings data from the Spanish Hatton Bank fishery in 2006 were not available to the working group in 2007 so it has not been possible to confirm whether this trend has continued.

Reported landings of Mora decreased between 2002 and 2005 both in the trawl fisheries in sub-areas VI, VII and XII and in the longline fisheries in sub-areas VIII, IX and X. Preliminary data from 2006 indicates that this trend has not continued, with 2006 landings similar to pre-2002 levels. 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 is incomplete and it is impossible to tell whether this trend has been continued.

Landings of smoothheads showed a general increasing trend from the mid 1980s to 2002 as a result of increasing retention in the fisheries, however, more recent landings show 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.

Bluemouth landings in sub-areas 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 sub-area 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 sub-areas VIII and IX have been increasing since 2002.

Silver scabbardfish landings in sub-area 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 sub areas VIII and IX declined from a peak of over 5000 tonnes in 1995 to 526 tonnes in 2005.

The largest catches of deepwater Cardinal fish came from sub-areas VI and VII where landings 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 sub-areas V, VI and VII in 1995. This has recently been an increase in catches in other areas, including sub-area IX. Landings have fluctuated with an increasing trend. 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 gill-netting in sub-areas VI and VII.

12.10.1.2 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."

12.10.1.3 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 deepwater fishing effort.

12.10.2 Stock identity

No new information has been made available to the Working Group on the stock identity of these species.

12.10.3 Data available

12.10.3.1 Landings and discards

Landings for all of these species are presented in table 12.10.1 to 12.10.8

No new information on discarding of any of these species was made available to the working group.

12.10.3.2 Length compositions

New length data was provided to the Working Group in the form of working documents from Russia, and Spain and survey data from Spain. This adds to data included in previous reports.

Length composition of catches and discards of Baird's smoothhead sampled by observers on Spanish trawlers fishing at Hatton Banks are presented in figures 12.10.1 and 12.10.2

Length compositions of bluemouth taken in Spanish surveys on the Porcupine Bank between 2001 and 2006 and from Russian trawl fisheries on the Rockall Bank in 2006 are shown in figures 12.10.3 and 12.10.4.

Length compositions of roughhead grenadier taken in Russian trawl surveys in East Greenland 2006 are presented in Figure 12.10.5.

12.10.3.3 Age compositions

No new data on age compositions of any of these species were presented to WGDEEP in 2007.

12.10.3.4 Weight at age

No new data on weight at age for any of these species were presented to WGDEEP in 2007.

12.10.3.5 Maturity and natural mortality

New information was presented to the working group on maturities of bluemouth and roughhead grenadier in Russian surveys on Rockall bank and East Greenland (Figures 12.10.8 and 12.10.9).

12.10.3.6 Catch, effort and research vessel data

Variation in abundance indices of bluemouth in the Spanish Porcupine Bank Survey from 2001to 2006 is shown in figures 12.10.6 and 12.10.7. CPUE has remained more or less stable for through this period.

12.10.4 Data analyses

The data available to the working group on the species considered here were not considered sufficient to attempt any assessments.

Table 12.10.1 Working group estimates of landings of roughhead grenadier. Data fro 2006 are provisional.

Year	I and II	III and IV	Va	Vb	VI and 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	8	93	3		19	5	**213**

Table 12.10.2 Working group estimates of landings of *Mora moro* and Moridae. Data fro 2006 are provisional.

Year	Vb	VI and VII	VIII and 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	5	111	51	127			294

* source of data 1988 to 1994 unknown, may be unreliable

Table 12.10.3 Working group estimates of landings of rabbitfish (*Chimaera monstrosa* and *Hydrolagus* spp.) Data from 2006 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	17		62	325	10		5	**447**

Table 12.10.4 Working group estimates of landings of Wreckfish. Data fro 2006 are provisional

Year	VI and VII	VIII and 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		331	497	**828**

Table 12.10.5 Working group estimates of landings of bluemouth Data fro 2006 are provisional

Year	III and IV	Vb	VI	VII	VIII and 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	10		483	**572**
1997	1		78	10	1	410	**500**
1998			53	92	3	381	**529**
1999	8	64	194	160	29	340	**795**
2000		16	213	119	33	452	**833**
2001			177	102	34	301	**614**
2002			81	115	18	280	**494**
2003			184	213	124	338	**859**
2004	2	3	142	291	135	282	**855**
2005			103	204	206	190	**703**
2005			59	160	287	209	**715**

Table 12.10.6 Working group estimates of landings of silver scabbardfish Data fro 2006 are provisional

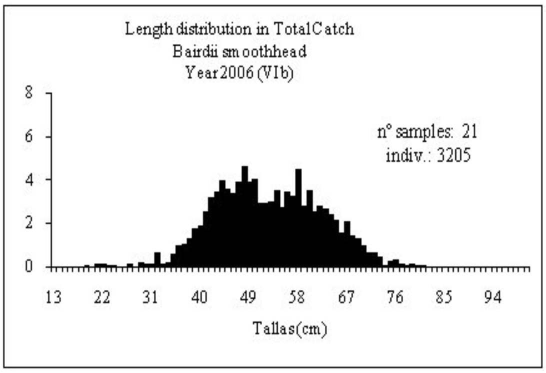
	VI and VII	VIII and IX	X	XII	TOTAL
1988		2666	70		**2736**
1989		1385	91	102	**1578**
1990		584	120	20	**724**
1991		808	166		**974**
1992		1374	2160		**3534**
1993	2	2397	1722	19	**4140**
1994		1054	373		**1427**
1995		5672	789		**6461**
1996		1237	815		**2052**
1997		1725	1115		**2840**
1998		966	1186		**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	341	624	35		**1000**

Table 12.10.7 Working group estimates of landings of deepwater cardinal fish. Data fro 2006 are provisional

Year	Vb	VI	VII	VIII and 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		30	383	12	10		**435**

Table 12.10.8 Working group estimates of landings of deep-water red crab. Data fro 2006 are provisional

	IV and V	VI	VII	VIII and 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	311		**220**



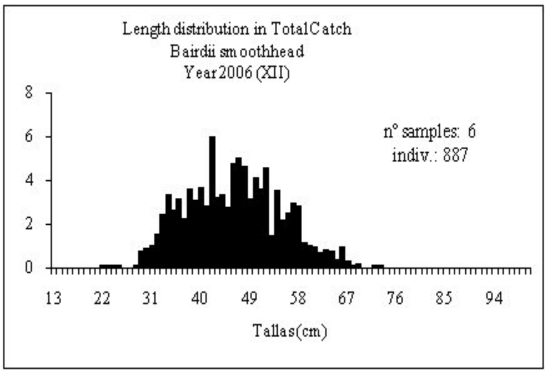
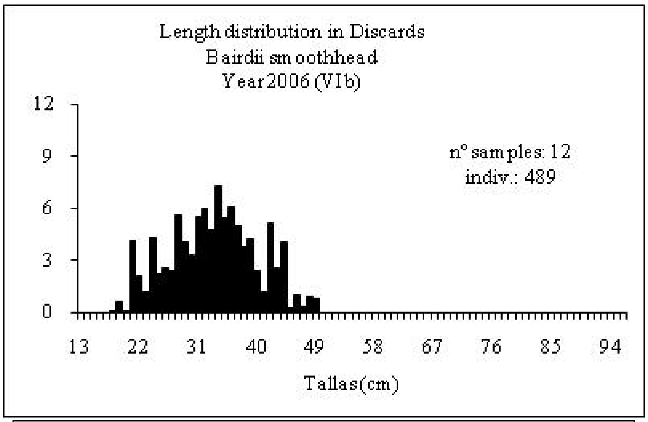


Figure 12.10.1 Length composition of *Alepocephalus bairdii* from Spanish observer data from Hatton Bank.



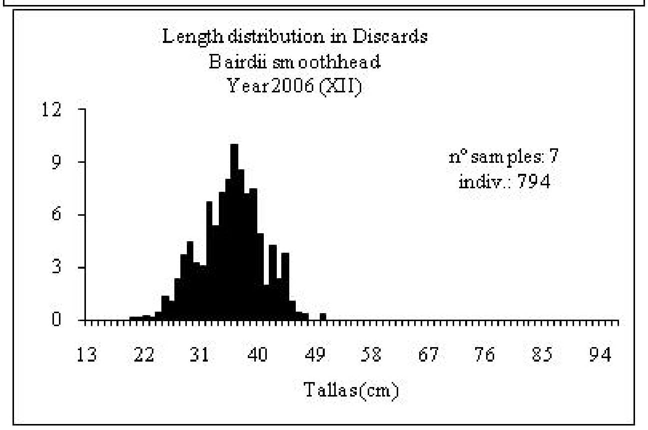


Figure 12.10.2 Length distribution of discarded Baird's smoothhead from Spanish observer data from hatton Bank.

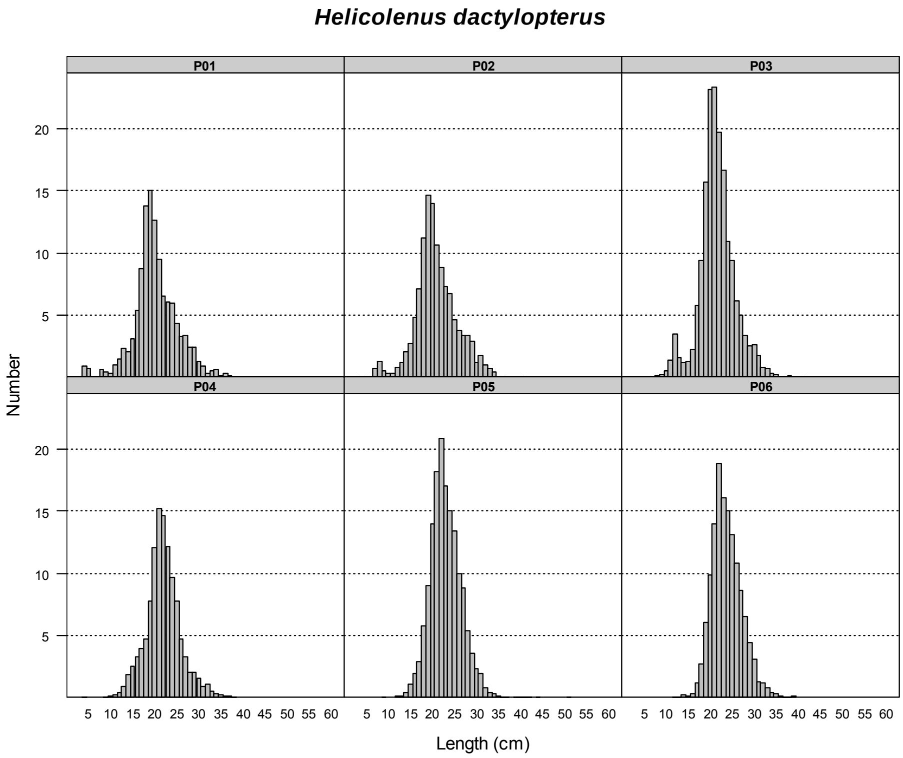
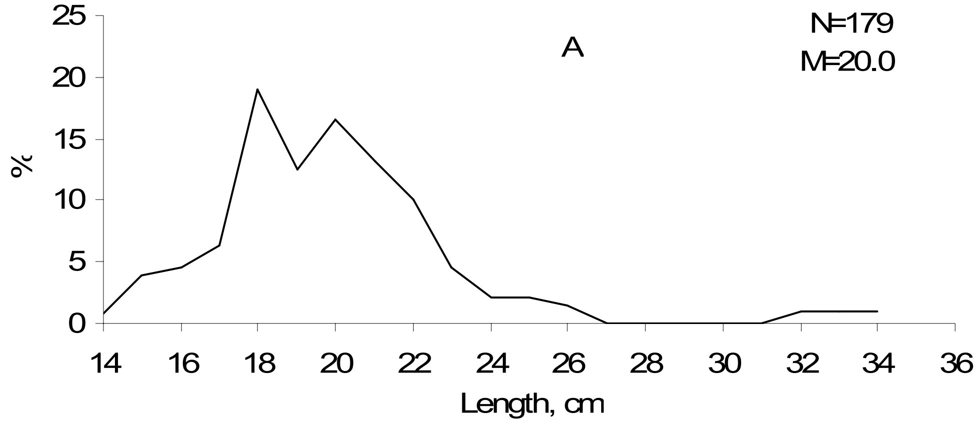


Figure 12.10.3 Length distributions ofBluemouth in the Spanish Porcupine Bank survey



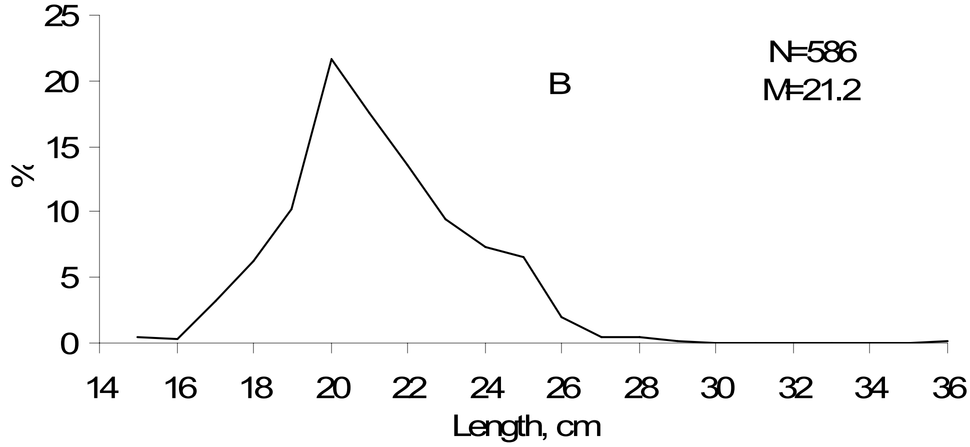


Figure 12.10.4 Length composition of bluemouth in Russian surveys on the Rockall Bank in April-July (A) and August (B) 2006

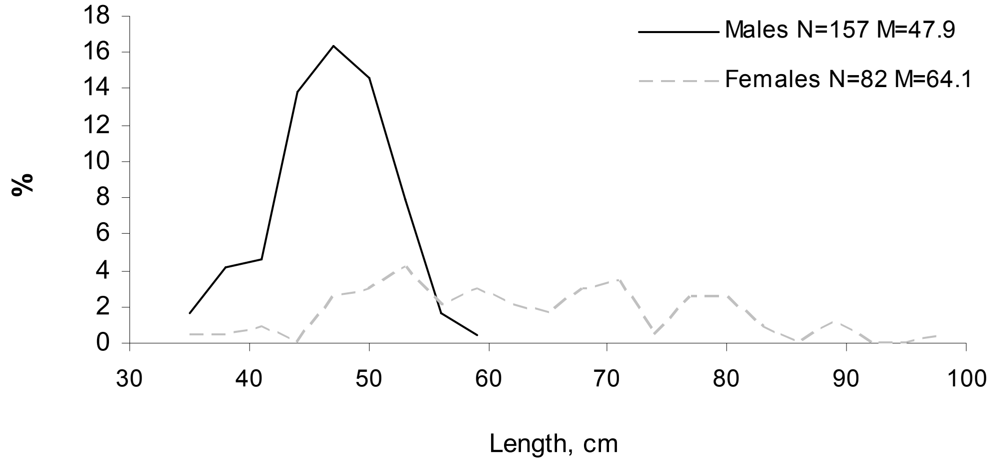


Figure 12.10.5. Length composition of roughhead grenadier in catches of Russian trawlers at East Greenland

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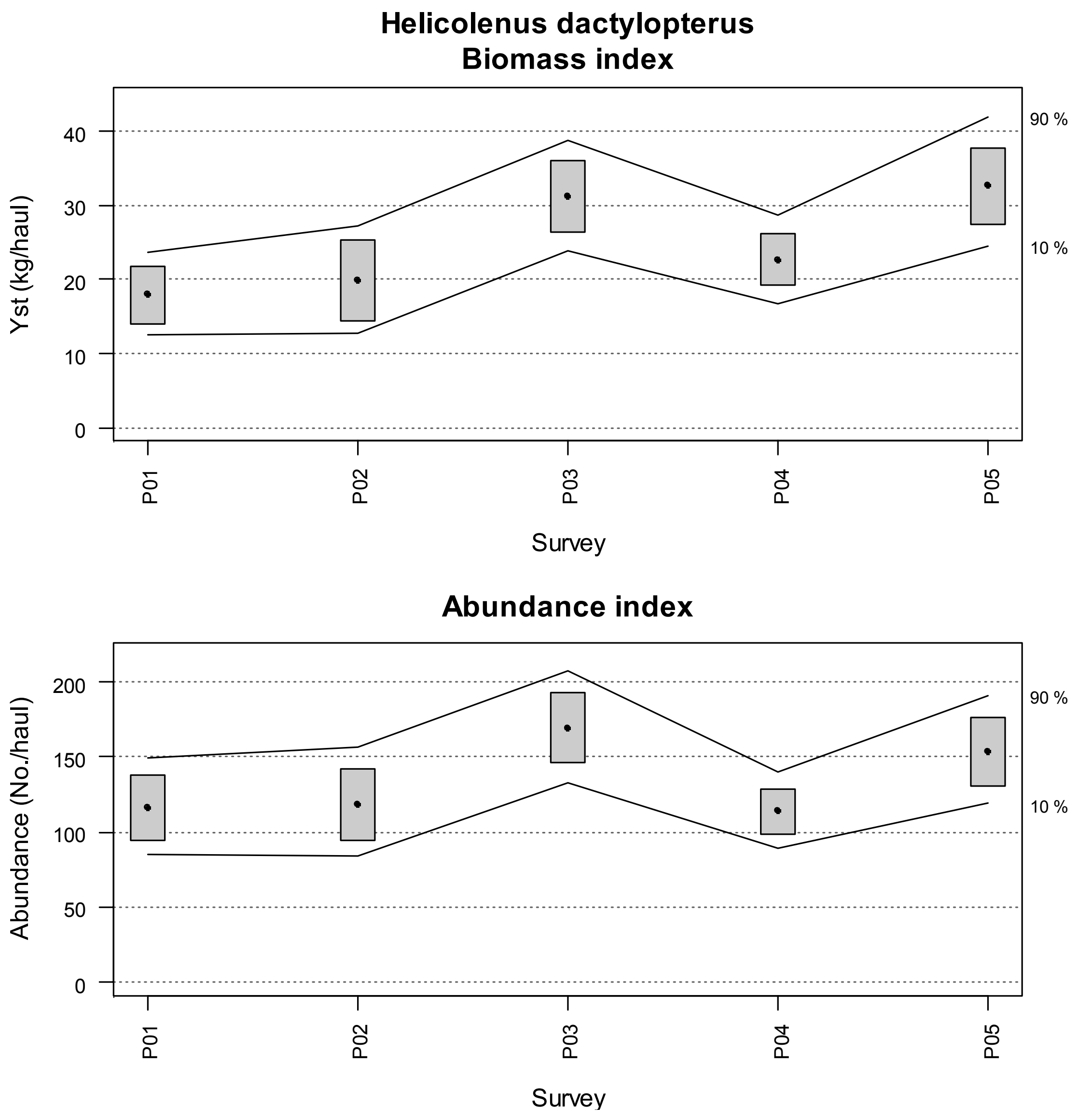


Figure 12.10.6 Abundance indices of Bluemouth form the Spanish Porcupine Bank Survey.

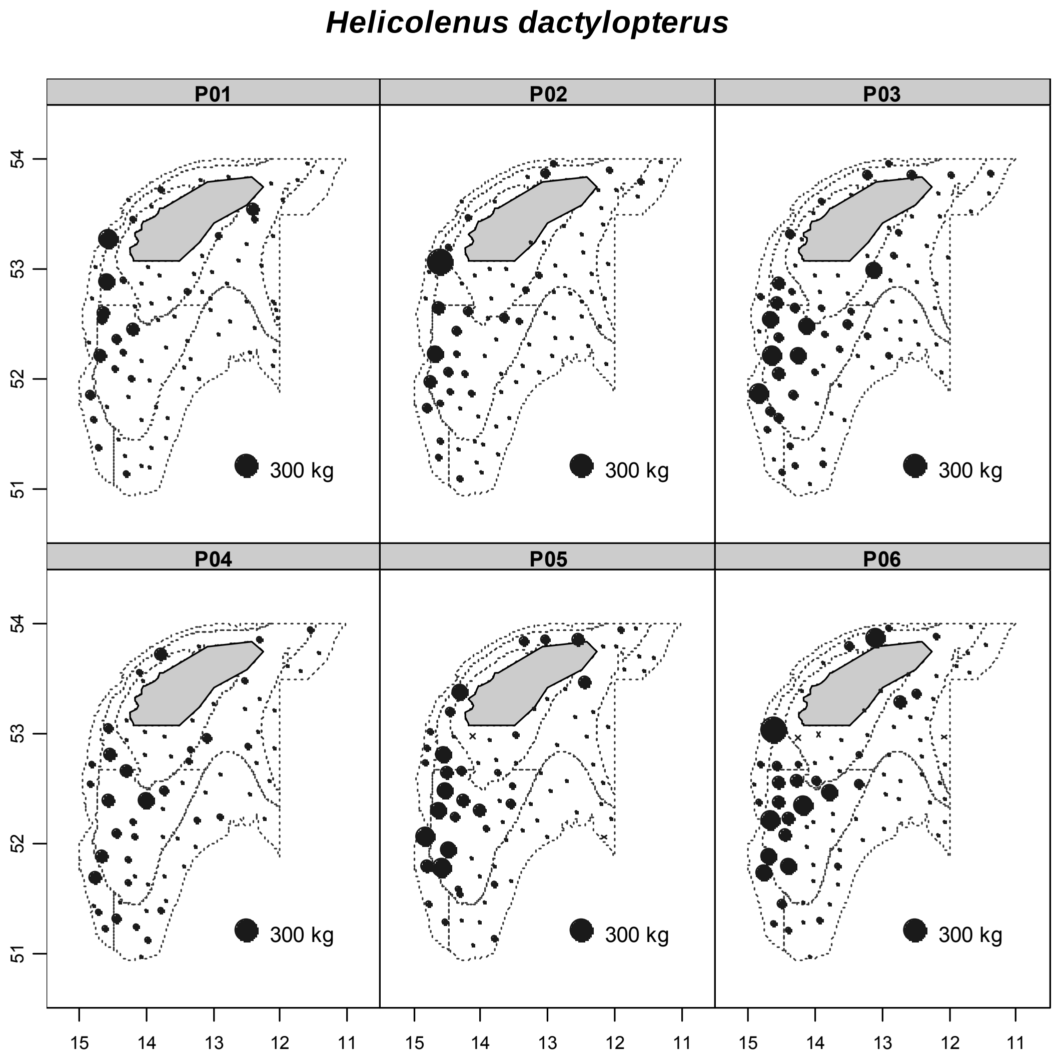
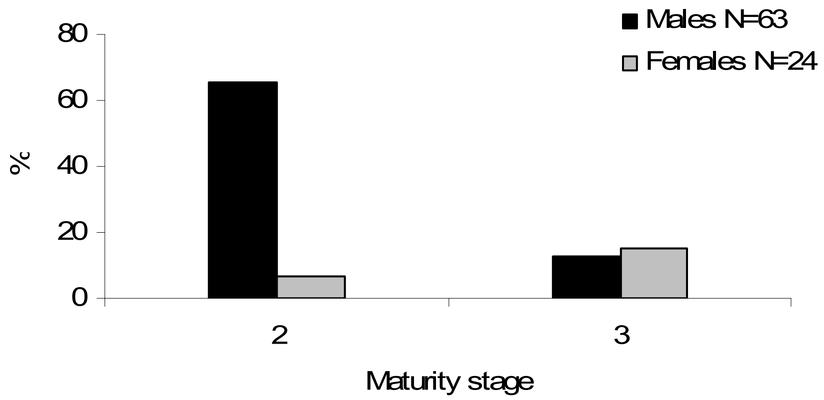


Figure 12.10.7. Spatial distribution of bluemouth catches in Spanish Porcupine Bank survey



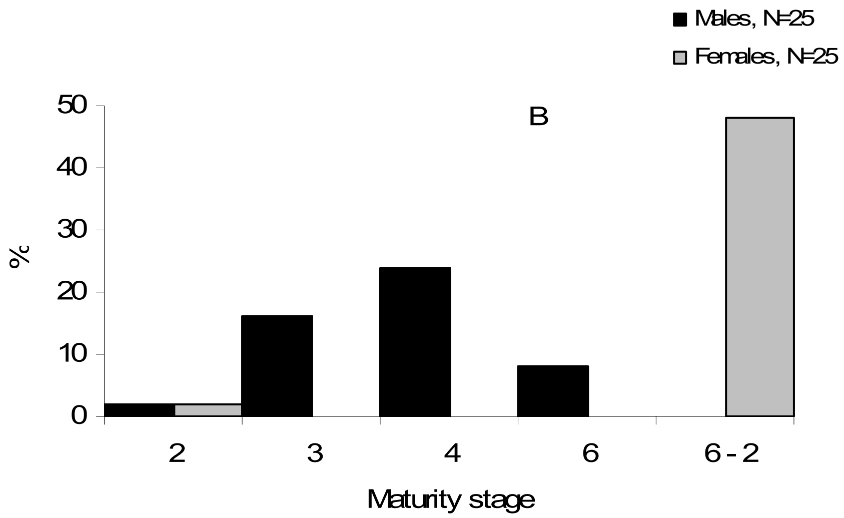


Figure 12.10.8 Maturity of bluemouth in Russian surveys on the Rockall Bank in April-July (A) and August-September (B) 2006

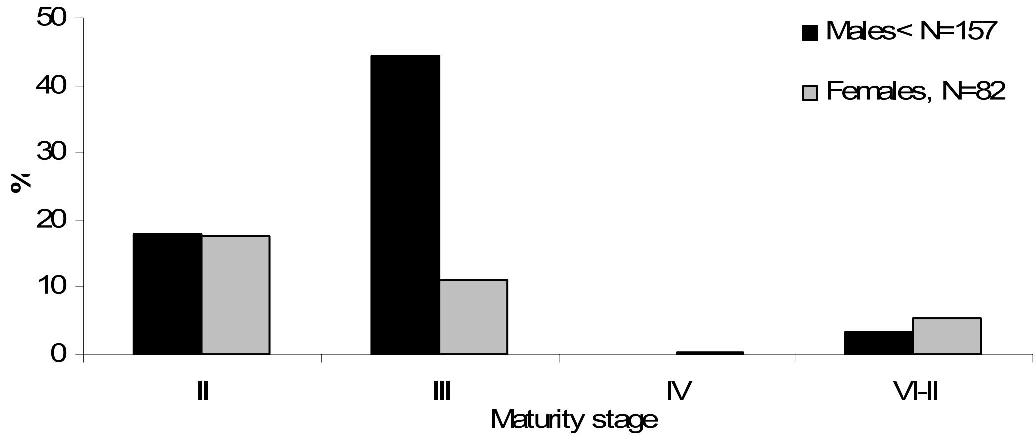
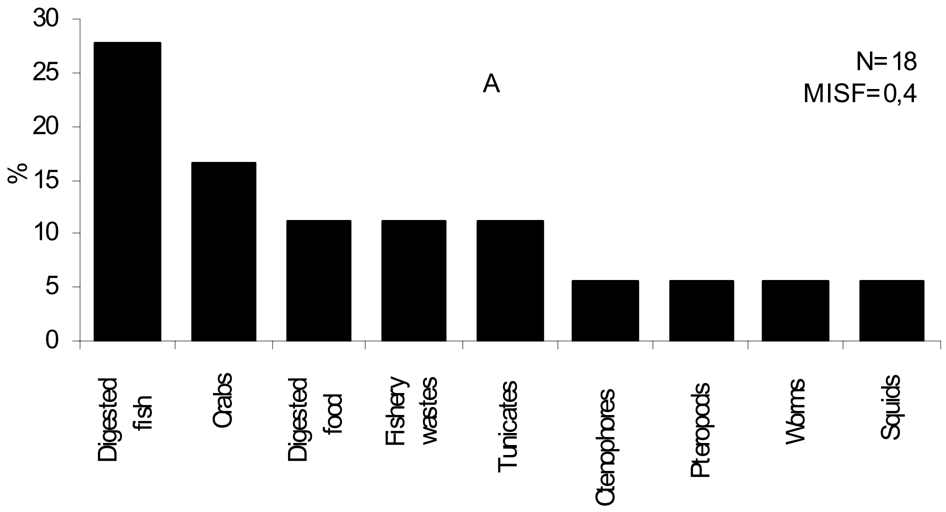


Fig 12.10.9 Maturity of roughhead grenadier in Russian surveys on the Rockall Bank in April-July (A) and August-September (B) 2006



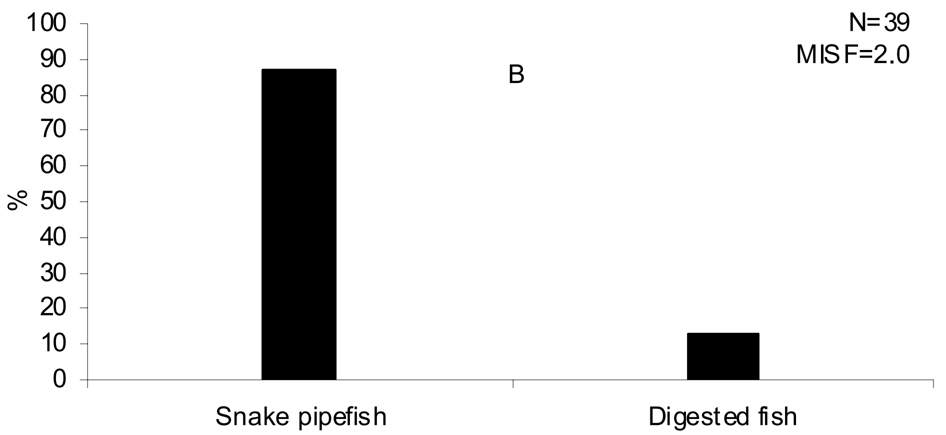


Fig. 12.10.10 Feeding of bluemouth sampled on Russian Surveys on the Rockall Bank in April-July (A) and August-September (B) 2006

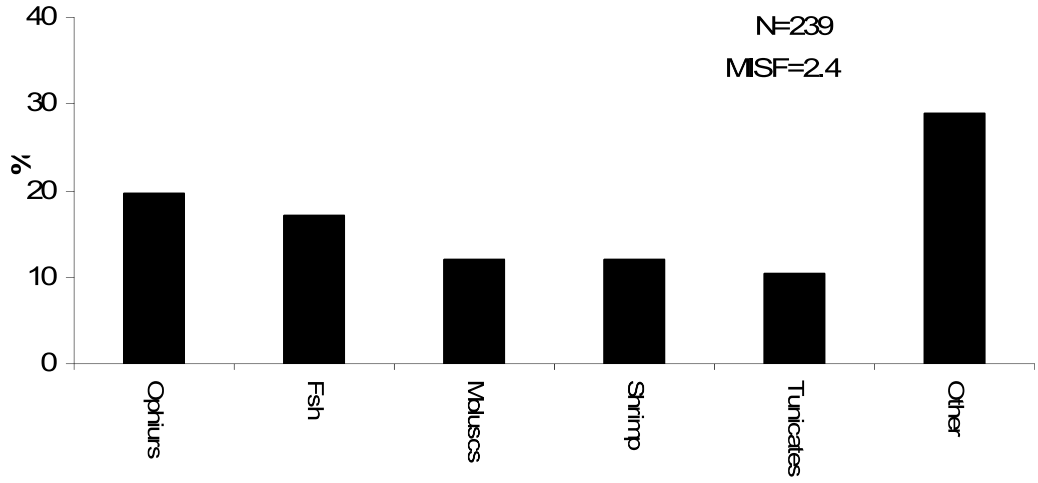


Figure 12.10.11 Feeding of roughhead grenadier in samples on the Russian survey near the eastern Greenland in August 2006

13 Stocks and Fisheries outside ICES ECO-REGIONS: the Tusk (*Brosme brosme*) Fishery in Canadian waters

13.1 The fisheries

Tusk (*Brosme brosme*), or cusk as they are called in Canada, are caught by a number of gear types in Atlantic Canada however there is no directed fishery. Although considered a deep-water species, commercial catches are mostly from waters of less than 500m in depth due to the distribution of effort. The majority of landings are reported from the cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) longline fishery (Table 13.1) in Northwest Atlantic Fisheries Organization (NAFO) divisions 4X and 5Z (Figure 13.1). Catches by otter trawlers are low due to the behaviour of tusk and their preference for rocky or hard bottom, which is avoided by this sector. Tusk landings in the groundfish fisheries have been reported since the 1960s but the quality of the data in earlier years is questionable and the resolution is low. Prior to 1999 there was no catch limit on tusk and it has been suggested that other species, such as cod, were landed as tusk when quotas were exceeded. Tusk were also landed in combination with white hake (*Urophycis tenuis*) and pollock (*Pollachius virens*) as ‘shack’. The proportion of shack landings that were tusk cannot be determined.

Prior to 1999, tusk caught in the lobster (*Homarus americanus*) fishery could be landed in unlimited quantities. Unfortunately, reporting at that time was minimal thus there are no historical estimates of tusk landed although anecdotal reports suggest catches off south-western Nova Scotia may have been substantial. Currently tusk caught in the invertebrate fisheries cannot be legally landed. These discards, which are unlikely to survive when returned to the water, are not reported. The data collection phase of a science project to estimates these discards has just been completed.

13.2 Landings trends

Tusk landings in Atlantic Canada have decreased and have been at an historical low since 1994. The CPUE of tusk in the 4X groundfish longline fishery declined in the early 1990s. The current catch rates are at around 40% of the historical level, though misreporting of other species as tusk may have exaggerated this trend. The decline appears to have stopped. The proportion of 5-minute square units in 4X in which tusk landings were reported and the proportion of trips that report tusk were used as indices of area occupied. These indices suggested that there has been little change in the proportion of the 4X area occupied by tusk since 1991 or in the proportion of 4X longline trips with tusk since 1977, and that tusk are still caught throughout the traditionally fished area despite the decline in landings and CPUE. However, there are anecdotal reports from members of the fishing industry that tusk are no longer a significant proportion of the catch in some locations where, in the past, they were abundant.

13.3 Management measures

Tusk in Canadian waters are managed as a single stock. They can only be legally landed in the groundfish fisheries. A by-catch cap of 1000t for fixed gear in NAFO divisions 4VWX was first implemented in 1999. In 2003 this cap was reduced to 750t for 4VWX5Z, where it has remained since. There are no minimum size limits. Cusk are currently being considered for legal protection under Canada’s Species at Risk Act but there is some debate over their status.

Table 13.1. Reported landings (metric tonnes) of tusk by gear type from NAFO divisions 4VWX5Z

	Longline	Bottom Trawl	Gillnet	Other	Total
1986	1657	34	21	287	2000
1987	3386	95	118	137	3736
1988	2666	74	41	51	2832
1989	3044	45	77	127	3294
1990	3210	42	52	143	3447
1991	4028	73	40	151	4293
1992	4693	46	93	196	5028
1993	2693	55	57	77	2882
1994	1427	56	49	42	1574
1995	1828	40	25	38	1931
1996	1293	17	27	31	1368
1997	1688	25	23	34	1770
1998	1508	56	21	15	1600
1999	976	35	16	5	1032
2000	1020	28	16	9	1073
2001	1397	37	16	5	1454
2002	1218	35	13	3	1270
2003	1037	27	13	4	1080
2004	873	31	7	2	878
2005	859	22	6	2	887
2006	804	17	5	4	830

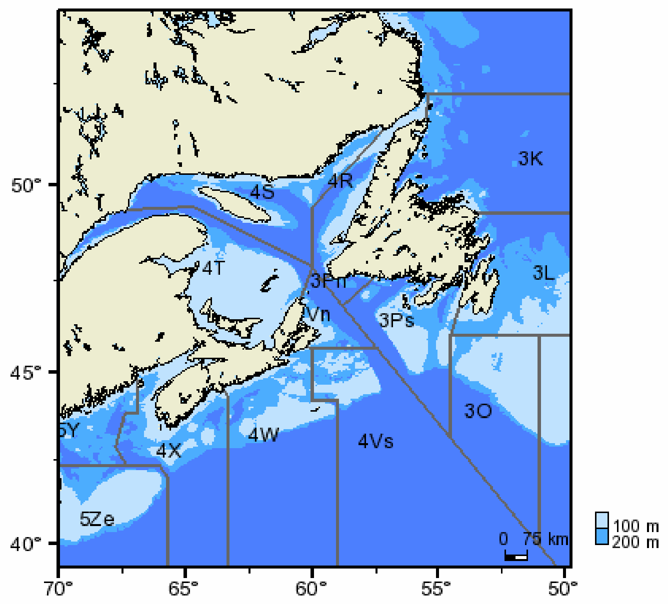


Figure 13.1. NAFO divisions from which tusk are landed

14 Impact of Area Closures

No more data than those used to substantiate ACFM/ACE response to the NEAFC request on the impact of area closures (ICES advice 2006, book 9, p. 17) could be used by the WG (see Section 15).

Progress on this issue is closely linked to advances in identifying and mapping out deep-water fisheries (see Section 16).

15 NEAFC Request concerning the quality of VMS, Catch and Effort Data

15.1 Background

For several years, WGDEEP has repeatedly stressed that a number of tasks requested by ICES clients could not be fulfilled satisfactorily due to a lack of fine-scale data on the spatial distribution of fishing effort. Such data are held by national and international bodies responsible for fisheries management, but these have until recently not been made accessible to ICES.

In the course of 2006, after WGDEEP06 had met, the NEAFC submitted a set of raw VMS data (2001-2005) to ICES, with copies to the chairs of WGDEEP and WGDEC. These data were evaluated by CEFAS and IFREMER, which produced a WD (WD3). This document provided the main scientific background supporting the ACFM/ACE response to the NEAFC request on the impact of area closures (ICES advice 2006, book 9, p. 17).

The WG commended the decision of NEAFC to provide VMS data to ICES. However, the WG also noted a number of limitations in the current data format and structure, which would need to be addressed, to respond more adequately to requests such as those listed in Sections 14, 16 and 17 (Section 15.2).

A link between catch and VMS data at some appropriate spatial and temporal scale is also a requirement to identify and map out deep-sea fisheries (Section 16). Catch data may be derived from log-books or other sources (e.g. EU observers program etc.). With regards to that requirement, members of WGDEEP and WGDEC visited NEAFC in April 2007, with the objective to evaluate whether catch data were available for all contracting parties and, should that be the case, to assess the feasibility of linking those catch data with VMS records. This assessment is presented in Section 15.3.

15.2 Quality of VMS data

First, in the year with the most complete data (2005), more than half of the records did not specify the type of gear used. Therefore, it was not possible to identify the type of activity exerted by vessels for which gear information was not documented. These vessels could target deep-sea species, but they could just as well target other species. It would be highly desirable that in the future, gear information be comprehensively recorded in the VMS data files provided to ICES. This links in particular to the issue of identifying and mapping deep-sea fisheries, which is discussed in Section 16.

Second, the frequency of VMS records ranged from 1 to 2 hours. Preliminary studies indicate that this frequency of recording and reporting might not be unreasonable for trawlers, when the haul duration exceeds that interval, which is generally the case in deep-sea fisheries (Mills et al., 2007). However, a higher frequency of recording would be desirable for monitoring fishing activities in relation to protected areas. There is also some evidence that a 1-2 hour frequency does not allow to identify fishing operations and calculate fishing effort at a satisfactory precision, for vessels using passive gear (WD2). In this WD, a recording frequency of 10-15 minutes was recommended.

Third, anecdotal evidence indicate that there may be an element of mis-reporting in the transmission of VMS data (e.g. by interrupting the signal), which would need to be scrutinised more closely.

Fourth, the NEAFC VMS records covered international waters but not waters under national jurisdiction. It would be desirable that bodies responsible for holding VMS data in national waters grant ICES access to this information.

15.3 Linking catch data with VMS records

Weekly catch data by vessel and by species were made available to ICES by the NEAFC Secretariat. The type of licence (deep-sea fishing or others) attributed to each vessel was also documented. It was concluded that these information would be valuable, and could potentially be linked with VMS data records, at some aggregation level.

However, one major issue appeared to be that data were not recorded consistently, so linking effort and catches through an automated procedure is not straightforward. It is feasible to do this, but would take a substantial amount of time. Given the CD-ROM with NEAFC data was only received shortly before the WGDEEP meeting, it has not been possible to link effort positions, as derived from VMS records, with catches.

The WG was of the opinion that an appropriate exchange format of VMS data and catch information be defined, under the auspices of a dedicated ICES SG, to facilitate the use of these data by ICES and WGDEEP in particular.

15.4 Recommendations

In order to make a better use of VMS data, the WG recommends that a dedicated SG be set up by ICES around the development of methods based on VMS data (SGVMS). This SG should include WGDEEP members, but also experts from other assessment WGs. WGDEEP suggested the following terms of reference

SG on the development of methods based on VMS data (SGVMS)

a) To review existing information based on VMS records available to ICES, including the status, extent, quality, accessibility and restrictions applying to these data.

b) To define a standard format for collating data derived from VMS records. This will include defining an appropriate unit for the time elapsed between consecutive records

c) To review existing methods and possibly develop new methods to separate out fishing positions from plain travelling. These methods should apply to vessels using both active and passive gears.

d) To review existing methods and possibly to develop methods and to identify suitable formats to link fishing effort as derived from VMS data with catches, vessel and gear characteristics, and fishing depth.

16 NEAFC Request concerning the spatial and temporal extent of Deep-water fisheries in the NE Atlantic and the identification of criteria to identify Deep-sea Fisheries

No more data than those used to substantiate ACFM/ACE response to the NEAFC request on the impact of area closures (ICES advice 2006, book 9, p. 17) were available to the WG (see Section 15).

In these data, gear was not recorded consistently (Section 15). In 2005, the best documented year, more than half of the records did not specify the type of gear used, hindering possibilities to identify the type of activity exerted by vessels for which gear information was not documented.

In the absence of gear information, one way to identify fishing operations targeting deep-sea species is to analyse catch profiles, assuming they reflect the fishers' intentions. Catch data were delivered by the NEAFC to ICES, but these could not be used in time before the WGDEEP07 meeting, for the reasons explained in Section 15.

The methods used to differentiate steaming from fishing operations, in the context of the 2006 ACFM/ACE response to the NEAFC request (ICES advice 2006, book 9, p. 17), were applied only to bottom trawlers. In 2005, trawlers represented 70% of the records with gear documented, but only 36% of total records due to the large amount of missing gear information.

Deep-sea fishing is also known to occur with static gears (e.g. nets and long-lines). In the NEAFC VMS database, gill-netters and longliners represented in 2005 9% of the records with gear documented,and 4% of total records. Vessels using such gears may follow different behavioural rules than trawlers. Some methods are being developed to identify fishing operations and also to calculate the fishing effort of longliners (WD2). Such methods however are only applicable when the recording frequency of VMS data is of 10-15 minutes, and these may not apply to the NEAFC VMS database, where the recording frequency ranges between 1 and 2 hours.

Figure 16.1 shows the 2005 spatial distribution and intensity of fishing effort, for bottom trawlers of which the gear code was recorded, representing 36% of total records. The map shows that the bulk of the 2005 fishing effort is distributed on Rockall Bank, Hatton Bank, and the Reykjanes Ridge. These records may include deep-sea fishing, but also operations targeting demersal species (e.g. Rockall haddock, saithe and monkfish).

Without a link with catch information, it is not possible to discriminate the deep-sea and the demersal fishing operations, even when gear is documented.

In order to make progress on the issue of identifying and mapping out deep-sea fisheries, the WG recommends that a dedicated SG be set up to link catch information with VMS data. Terms of reference for this SG have been suggested in Section 15.

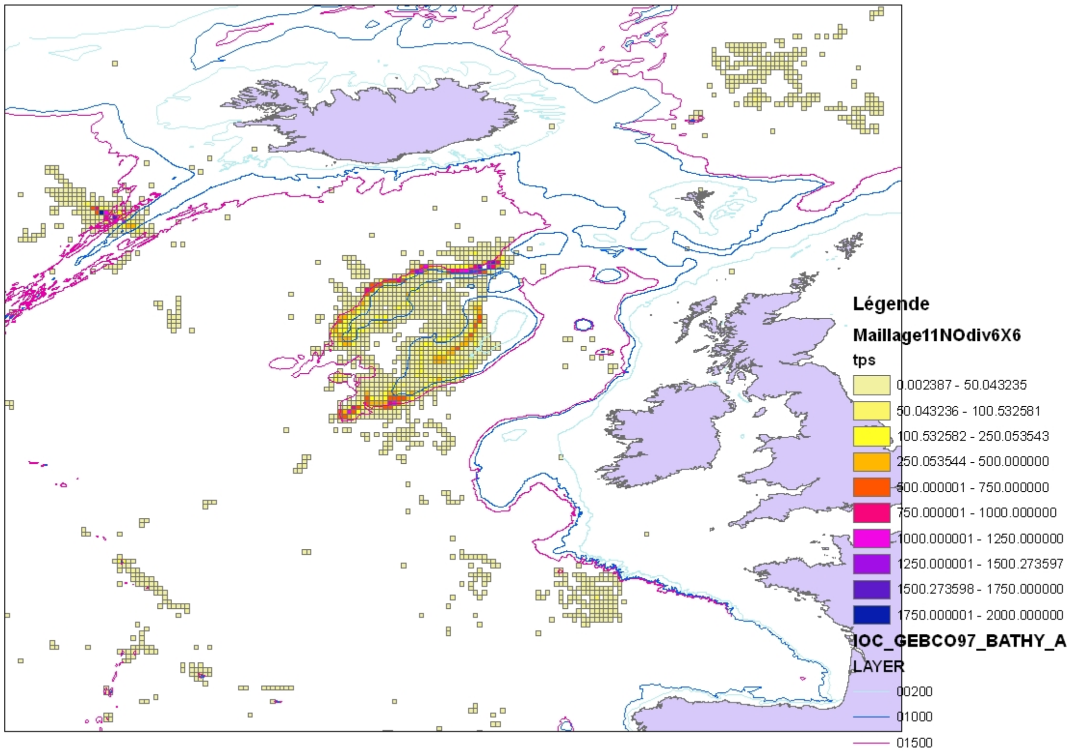


Figure 16.1. 2005 spatial distribution and intensity of the fishing effort of some bottom trawlers (representing 36% of total records) in international waters within NEAFC jurisdiction. The size of each square is of 6 x 6 nautical miles.

17 NEAFC Request concerning the compilation of Data on Spawning/Aggregation areas in the NEAFC Convention Area

NEAFC asks ICES to compile data on documented historical or present spawning/aggregation areas of blue ling in the NEAFC Convention area.

17.1 Background

The above TOR follows a TOR set for WGDEEP in 2004 to compile geo-referenced data on documented historical or present spawning/aggregation areas of species such as blue ling and orange roughy.

17.1.1 WGDEEP TOR in 2004

In response, ICES commented that it is important to identify aggregations of these two species that form vulnerable aggregations. In order to define sensible spatial units for management, it is necessary to have information from official logbooks, from biological sampling and VMS. Areas defined need to be sufficiently large to be administratively feasible, yet sufficiently defined to ensure that they achieve the desired management objective. The following is an account of new and previously provided information, but it may not constitute an exhaustive account due to lack of reporting or loss of historical information.

17.1.2 Research Surveys

Data from research surveys provide the best information on the position of such aggregations. However such data are limited in extent. Irish Marine Institute trawl surveys in the Rockall Trough were carried out from 1993-1997. One survey was carried out in April 1993, and spawning blue ling were found at latitude 58 01 55 N and 09 40 10 W. Table 2 shows the details of this haul.

Gonad maturity	f	m	Grand Total
1 virgin	1	7	10
2 developing virgin	20	10	30
3 early maturing	66	33	99
4 late maturing	4	16	20
5 ripe	15	5	20
6 running	6	6	12
7 spent	35	126	161
8 recovering	128	96	224
Grand Total	275	299	574

Table 17.1. Numbers of blue ling in each stage of maturity, from Irish Marine Institute Deepwater Trawl Survey, April 1993. Sample taken from Hebrides Terrace (824 m depth), north west of St. Kilda in Division VIa. Latitude 58 0 01 55 N and 9 0 40 10 W.

Ripe and running fish were encountered in this area and ICES suggested that these data could be used along with other information from elsewhere to verify that spawning occurs in this area.

17.1.3 Commercial Fisheries Data

ICES commented that although blue ling is not as commercially valuable as orange roughy, the positions of the spawning aggregations are also commercially sensitive.

Positional information for blue ling are available for blue ling in Va. These are on the Reykjanes Ridge at the southern border of the Icelandic EEZ and a location in Division Va south of the Vestmanna Isles (see Figure 17.1).

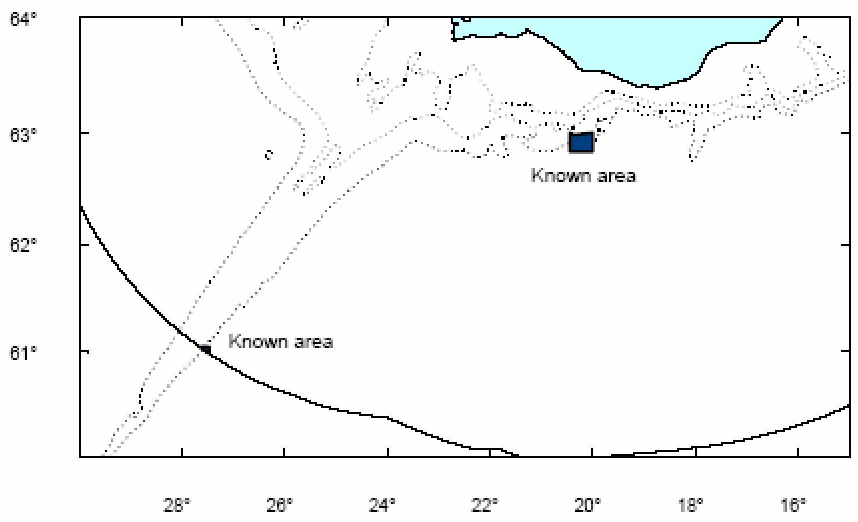


Figure 17.1. Map showing known spawning grounds for blue ling in Icelandic waters. There has been

suggested to close these areas for fishing during the spawning period (15 feb-30 april).

There is also a location in Division Vb. In addition there used to be a spawning aggregation in the Storegga area at about 62o N, in Division IIa: 620 30 to 640 N and 50 E on the continental slopes of the Norwegian Sea. This aggregation supported a gillnet fishery for this species in the 1980s. There is also a spawning aggregation in the northern part of the Rockall Trough in Division VIa (see Research Survey section above). A summary of fisheries dependent data are presented in Table 17.2.

ICES Division	Area	Positions
Va	Reykjanes Ridge at the southern border of the Icelandic EEZ	61^0 N and 27^0 30 W Depth c. 500 m
Va	South of the Vestmanna Isles, in Icelandic EEZ	21^0 30 and 62^0 50 Depth c. 500 m
Vb	A location in Division Vb	
IIa	Storegga, on the continental slopes of the Norwegian Sea	63^0 64^0 N and 5^0 E Depth of 500 to 650 m

Table 17.2. Positional information on spawning aggregations of blue ling.

17.2 New information available

A report has been made available to the European Commission, based on work carried out in a UK(E+W) Fisheries Science Partnership (FSP) survey in Feb/Mar 2004 to obtain data on catches and size compositions of deep water species (blue ling, black scabbard, roundnose grenadier, Portuguese dogfish and other species) on particular fishing grounds to the northwest Scotland.

The Working Group only had a chance to review this report late during the meeting and therefore could not evaluate it. It will be evaluated as part of an EU POORFISH contract (see below)

Apart from this report, monthly landings data from 2005 and 2006 by statistical rectangle from France, Scotland and Ireland were made available and have been plotted by quarter to show broad trends in catch distribution (Section 8.2, Figures 8.2.1 and 8.2.2). However, these data were not deemed to be sufficient to respond this request

17.3 EC POORFISH[2] Contract

The objective of the project is to create an advisory system (assessment, advice, and/or management) approach based on methods able to deal with data poor systems (utilizing both expert knowledge and published information in addition to existing data sets). Guidelines will be developed for assessment and management of fisheries for sustainability in data poor situations. There are basically at least three types of data poor situations:

Small scale fisheries with usually several target species of otherwise mixed fisheries (many coastal fisheries in Mediterranean and northern Baltic areas)

Large scale, but recently developed fisheries (many deep sea fisheries belong to this group)

Large scale fisheries, where the quality of data is getting worse (poor data due to e.g. misreporting and discarding)

This project will focus on each of these types, examining a number of case studies within each category. These case studies will have unique characteristics, allowing appropriate tools to be developed and modelled within a diverse range of examples.

POORFISH involves scientists from the UK, Spain, France, Greece, Mauritania and Senega, and blue ling in Vb,VI and VII is one of eight case studies covered by the project. As part of this case study, a questionnaire designed to obtain expert opinion from a small cross section of fishery stakeholders in six countries that have participated in the blue ling fishery in Vb,VI, and VII, including fishermen, merchants, scientists and managers, has been distributed that will help inform and provide direction for the study. A range of information has been requested, including information on the temporal and spatial extent of spawning aggregations. Information has been supplied by several correspondents, including fishers, however as some of this data is commercially sensitive, confidentiality and anonymity have been guaranteed.

One of the main aims in blue ling case study is to simulate the recovery of this stock under a range of management scenarios, and it is likely that these simulations will include closed areas to protect spawning aggregations. The development of the temporal and spatial bounds of these closed areas will be based on:

- information supplied by fishers
- analysis of historical UK and French EU log-book data, specifically targeting blue ling (identified in trip records by the % of blue ling in the catch recorded in each rectangle).

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[2] Commission of the European Communities, specific RTD programme "Specific Support to Policies", SSP-2004-22745 "Probabilistic assessment, management and advice model for fishery management in the case of poor data availability" (POORFISH).

- Information in a UK(E+W) Fisheries Science Partnership survey (see above)
- Any additional information collected e.g. RV Scotia is currently carrying out a trawl survey to the west of Scotland.

This, in the opinion of WGDEEP, is an appropriate way to generate proposals for closed areas that are scientifically robust and that will be at the highest spatial and temporal resolution practicable, an important consideration given that closed areas are likely to impact on other fisheries for commercially important species.

When linked with logbook data, VMS data is potentially is a very powerful tool to explore the spatial and temporal distribution of spawning aggregations of blue ling.

If suitable methods are available, an attempt may be made to use this approach in POORFISH, however it is noted in Section that methods to link VMS and logbook data require further development.

17.4 Recommendations

- Information on spawning aggregations at Va and II has already been provided and this forms a suitable basis for the introduction of closed areas, if not already implemented.
- Regarding southern blue ling, information on spatial aggregations will be released through the POORFISH contract. NEAFC has repeatedly requested ICES to provide advice on blue ling spawning aggregations. An attempt will be made to accelerate the outcomes of the POORFISH project. However, it will still be necessary to ensure that stakeholders supplying information have an opportunity to review outcomes before they are released into the public domain.

18 NEAFC Request concerning the coordination of scientific Deep-Sea Surveys in the NEAFC Convention Area

NEAFC asks ICES to consider co-ordination of existing deep-sea surveys. The evaluation may also include recommendations for the development of new surveys if it is considered to be appropriate.

18.1 Background

The above TOR follows an EC request in 2006 that ICES WGDEEP should be asked to propose key areas/species to be recorded on a dedicated internationally co-ordinated survey.

18.1.1 EC request in 2006

In response, ICES stated that the choice of key species/areas could depend on a range of criteria, including value of fisheries, state of exploitation, and degree of vulnerability. No single species or area was *a priori* seen as having a higher priority than any other. This request was addressed for all deepwater stocks for which ICES gives advice. Given the size of the geographic area where these stocks are found, a single dedicated survey would not be feasible. ICES recommended a series of dedicated surveys and extensions to existing surveys which would provide appropriate data on the relevant deepwater species in each area.

In general terms, the survey(s) should cover the distribution area of the stocks. ICES recommends that surveys be conducted regularly for the fully- or heavily exploited stocks. The frequency of these surveys would depend on the requirements for stock assessments and management.

Sub-areas I and II. For these Subareas, a dedicated survey should focus on greater silver smelt, using acoustics in combination with mid-water trawls. This survey could operate in the troughs of the Norwegian continental shelf down to a depth of approximately 700 m. There may also be scope to extend the coverage of the existing Greenland halibut and redfish surveys.

Division IIIa. In order to evaluate of the stocks of greater silver smelt and roundnose grenadier in this area, ICES recommends extending the coverage of the existing shrimp survey to include the complete distribution range of these stocks.

Division Va. The groundfish survey in October covers the Icelandic shelf and slope down to a depth of 1200 meter (Division Va and XIV). The present coverage has been in place since 2001. Biological information is collected on all species that are retained by the gear. It is expected that in the coming years the survey will become valuable in assessing the stock trends of various deepwater species in Icelandic waters. A dedicated acoustic survey could also be carried out to evaluate the stock of greater silver smelt.

Division Vb. The existing groundfish surveys in the Faroe Islands could be extended to below 500 m to cover the full depth range of ling, blue ling, and tusk. A dedicated acoustic survey could also be carried out to evaluate the stock of greater silver smelt.

Subareas VI - IX. ICES suggests that a dedicated internationally coordinated trawl survey of the continental slope could be undertaken in this large area. This survey could consist of depth transects at selected reference sites, which should include the Hebridean slope, Rockall bank, Hatton Bank, Porcupine Bank, Bay of Biscay, and the area between the canyons of Nazare and Sesimbra, Meriadzec Terrace. The key species to be surveyed are roundnose grenadier, orange roughy, blue ling, black scabbardfish, and deep-sea sharks. The survey could build on the experience from the Scottish, Spanish, and Irish surveys which have been conducted in this area. The depth range of the survey should include the shelf break and the slope within the range 200-2000 m. In identifying reference sites, consideration should be given to the spawning areas identified for blue ling and orange roughy.

Subarea X. A longline survey is currently conducted in the Azores EEZ, and it would be useful to extend the depth range of this survey to cover the full depth range of alfonsinos, *Mora mora*, and deepwater sharks.

Subarea XIV. The existing Greenland halibut survey could be extended to obtain abundance estimates of deepwater sharks. An alternative would be to develop a longline survey which may be a more appropriate gear for sampling the deepwater sharks.

Mid-Atlantic Ridge: ICES recommends that a survey be conducted regularly, but not necessary annually. If exploitation were to increase, then the survey could be upgraded to be conducted annually. The survey design could build on the outcomes of the MAR-ECO project (http://www.mar-eco.no/) and sites should include the NEAFC closed areas. The terrain and species mixture in this region would require the use of a variety of techniques including acoustics, visual survey methods, and trawling.

18.1.2 Recent developments at WGDEC

ICES WGDEC has recently addressed a Term of Reference to 'Compile a map of areas where biological research/survey has occurred in the deepwater area (>200m) of the North Atlantic'.

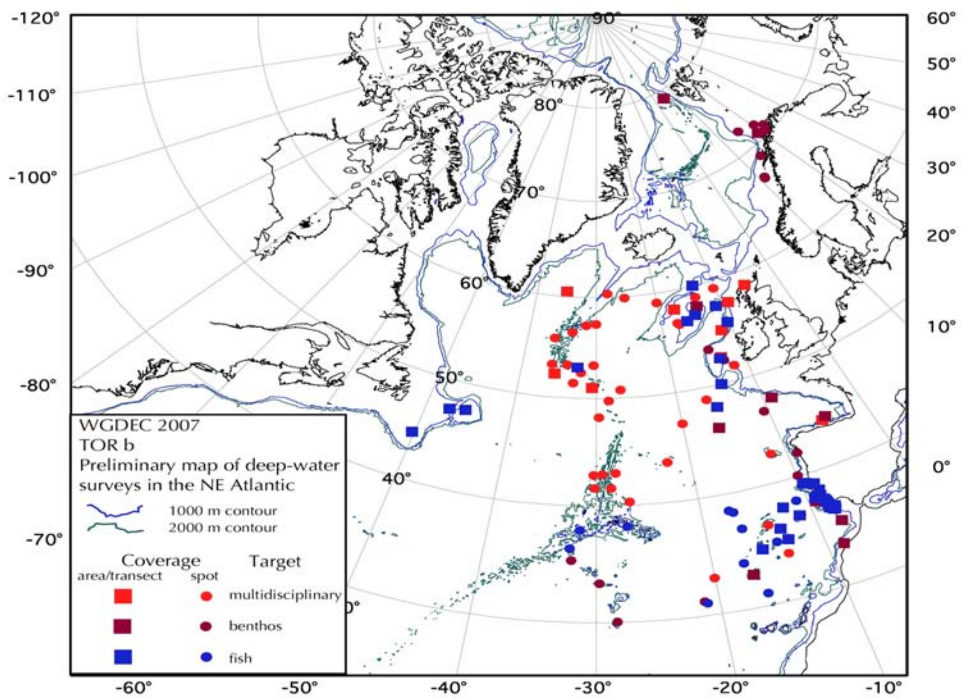

Figure 18.1. Locations of deep-water surveys entered into database by WGDEC in 2007.

In addressing this TOR, WDEC decided to populate the information collected from recent deep-water surveys in the NE Atlantic into a meta-database. Members of WGDEC provided information from their respective institutes or collaborators on deepwater surveys. In addition cruise reports and published studies were included and the references given in the database. Surveys with the sole aim of collecting hydrological/oceanographical data were excluded.

This database was made available towards the end of the WGDEEP meeting. This is work in progress and it is unclear as to who should further develop, manage and update this database on a permanent basis, although it was suggested by WGDEC that this might be a role for ICES. There is also a requirement to upload details of historical surveys.

18.2 Outcome of WGDEEP plenary with Paul Kaiser (Chair of ACME) and Mark Tasker (Chair of ACE and WGDEC)

Concern was expressed that the above NEAFC request had not also been submitted to ICES WGDEC. In order to get around this, at least for the purposes of the WGDEEP response to the NEAFC request, the Chair of WGDEC agreed to contact available members of his Group in order to obtain a provisional list of priorities for future seamount/closed area studies. This information was a made available informally in the course of WGDEEP.

The Chair of ACME provided, prior to the meeting, a WD (WD10) outlining the background to suggested further sampling of deep-water fish populations for contaminants, parasites and diseases.

The deep oceans can act as both a source (e.g., for mercury) and a sink for contaminants. Due partly to the high cost of sampling and partly to the concentration of monitoring effort in coastal waters close to pollution sources, few data are available for contaminants in deepwater fish species. Trace elements arise from natural processes as well as anthropogenic sources and, as has been seen for mercury, their concentrations may be enhanced in the deep ocean. This can lead to elevated concentrations in deepwater fish (Monteiro *et a*l., 1996) and animals (such as marine mammals) which prey on them (Law *et a*l., 2001). For synthetic organic contaminants, such information would provide additional information on spatial distribution, bioaccumulation and bioavailability, and transport pathways

There is an apparent lack of information on diseases and parasites in deep-sea fish species and it is, therefore recommended to fill these gaps. Results of a study on disease prevalence (both grossly visible diseases and liver histopathology) and on parasite burdens could provide useful baseline information on the health status of fish species in an environment less exposed to anthropogenic stressors compared to shallow shelf sea and coastal ecosystems. Data from commercial deep-sea fish species could also be useful in the context of human health risks.

WGDEEP agreed to recommend the collection of tissue samples from a range of deep-sea fish species and locations for the analysis of trace elements and organic contaminants, in order to provide information on their distribution within the deep oceans. In addition, it was agreed to recommend the collection of data on the prevalence of diseases and parasite burdens.

The chair of ACME agreed to provide contact details and detailed protocols covering the collection and preservation of tissue samples for study and for disease examination . These will be sought from the Working Groups on Marine Chemistry (MCWG) and on Pathology and Disease of Marine Organisms (WGPDMO).

18.3 Proposals for survey extensions and new surveys

WGDEEP agreed to review and, where necessary, revise the deep-water survey proposals made in 2006 (see above). This was carried out taking into account new information and priorities (including those for studies of seamounts and closed areas communicated by the

Chair of WGDEC), the requirement for internationally co-ordinated surveys (to cover the large spatial areas involved), the need for survey purposes to be more clearly identified, and a perceived need (by the Group) to identify scientific priorities between surveys.

It was agreed that for the purposes of this exercise, the NE Atlantic could be divided into three areas comprising:-

Northern area comprising ICES areas I, II, IIIa, Va, Vb and XIVb

Continental slope and adjacent areas extending through ICES areas VI, VII, VIII and IX.

Mid-Atlantic Ridge and the Azores comprising ICES areas X and XII.

The Group recognised that extending surveys may generate extra costs and logistical problems regarding time-tabling, additional staffing priorities and the general requirements to use standardised fishing gear and sampling protocols. However, it is more cost-effective to expand existing surveys than recommend new dedicated deep-water surveys.

A list of existing surveys that do or could cover the relevant areas and depth ranges was constructed.

Building on this list of existing surveys, a single internationally co-ordinated survey in each of the three areas was identified as a scientific priority.

The table below shows a summary of the characteristics and purposes of existing surveys (plain text), proposed amendments to these surveys and new surveys (italic text in bold), and prioritised surveys in each of the three areas (bold and yellow)

e of Survey	Co-ordination	Country	Area	Depth Range	Period	Frequency	Demersal / Pelagic/ Benthic/ Ichtyoplanton (D / P / B/I)	Sampling gear	Abundance & Species	Data Types Collected															Survey effort	
										Biodiversity	Biological paramters	Ichtyoplanton	Morphometrics	Genetics	Diet & isotope studies	Basic hydrography	Habitat mapping	Benthos sampling	Seamount & vulnerable habitats studies	Contaminant Studies	Parasitology studies	Cetaceans & seabirds	Closed Area Studies	Fish Behaviour studies	dedicated deepwater days	deep-water fishing hauls
VIa &b, VII, VIII & IX																										
Western IBTS 4th quarter		UK, IRL, FR, ES, POR	VIa, VIIa, VIII, IXa	20-600m	Oct-Nov	A	D/B	T	Groundfish Survey (Gadoids + Pelagics)	A	A/ P				O	A	A	?		A/ P	P	A ?		O	?	?
Extension to western IBTS	*x*	*FR, ES, POR*	*VIIj & VIIId, VIIIc, IXa*	*500-2000m*					*RNG, BSF,SKH, GFB, RBM, ANG, LIN?*	*A*	*A/P*		*O*	*O*	*O*	*A*	*P*	*P*		*A/P*	*P*	*A*			*?*	*?*
FRS Deepwater survey	x	UK (Scotland)	VIa	500-1900m	Sept	A	D/B	T	RNG, BSF,SKH, GFB,	A	A/ P		O	O	O	A	A		O	A/ P	P	A			12	20 - 30
Extension to FRS Deepwater survey	*x*	*UK (Scotland)*	*VIb*	*500-2000m*					*RNG, BSF,SKH, GFB, + BLI?, USK?*	*A*	*A/P*		*O*	*O*	*O*	*A*	*P*	*P*	*O **	*A/P*	*P*	*A*	*P*		*?*	*?*

Marine Institute Deepwater survey	x	IRL	VIa - VIIb & c	500-1500m	Sept	A	D/B	T	RNG, BSF,SKH, GFB	A	A/P			O	O	A	x	x				A			14	25
Extension to Marine Institute Deepwater survey	*x*	*IRL*	*VIIk*	*500-2000m*					*ORY?*	*A*	*A/P*		*O*	*O*	*O*	*A*	*P*	*P*	*O*	*A/P*	*P*	*A*	*P*		*?*	*?*
ARSA		ES	IXa	30-800 m	March	A	D	T	Groundfish Survey	A	A/P			O		A				x		x			3	6
ECOVUL/ARPA		ES	VIb1,XIIb	850-1500 m	Oct	A	D/B	T	RNG, BSF, BLI	A	A/P				A	A	A	A	A	A					25	14
Possible extention to Hatton Bank survey			*?*	*?*					*?*																*?*	*?*
Porcupine Bank	x	ES (IRL)	VIIc, VIIk	300-800m	Setember	A	D/B	T	HKE, GFB, ARG, RBM	A	A/P			O		A		x		x					13	30
FRS monkfish survey		UK	IVa,VIa &b (prov)	1000 m	Nov	A	D	T	ANG		A/P					A									14	38
I, II, IIIa, Va, Vb, XIVb																										
Silver smelt survey	x	NOR	IIa,IVa, IVb, IIIa	200-900	May	?	P/D	A + T	ARG	A	A/P				O	A									24	?
Extension to silver smelt survey	*x*	*ICE, FAR, NOR, DEN (?)*	*Va, Vb & IIIa*	*200-900m*	*Apr*	*A*	*P/D*	*A + T*	*ARG, RNG*	*A*	*A/P*			*O*	*O*	*A*									*?*	*?*
Greenland halibut survey		NOR/RUS	IIa, IIb	200-1000	August	A	D	T	GHL,REB	A	A/P				O	A	A		O						22	200
Shrimp survey		NOR	IVb, IIIa	150-650	Oct or Mar	A	D	T	PRA +Dem spps	A	A/P					A	A		O						21	100
Bottomtrawl winter survey (4 -5 vessels)	x	NOR, Russia	I, IIa, IIb	50-600	February	A	D	T	Groundfish Survey (Gadoids)	A	A/P			O	O	A	A		O	A/P?		A			0	0
Spring groundfish survey (5 vessels)		ICE	Va	25-500	March	A	D	T	Groundfish, LIN, USK	A	A/P					A									90	550

Autumn groundfish survey (2 vessels)		ICE	Va	25-1200	October	A	D	T	Groundfish, LIN, USK, BLI, RNG	A	A/P			O		A									60	381
Faroese spring groundfish survey		FAR	Vb1	< 500m	Feb-Mar	A	D	T	Groundfish, LIN, USK	A	A/P			O	O	A									14	100
Faroe Bank spring groundfish survey		FAR	Vb2	90-600m	Mar - Apr	A	D	T	Groundfish survey LIN, USK	A	A/P			O	O	A									7	29
Extention to Faroe Bank spring groundfish survey		*FAR*	*Vb*	*600-800m*	*Mar -Apr*	*A*	*D*	*T*	*Groundfish survey BLI, RNG, BSF*	*A*	*A/P*			*O*	*O*	*A*									*?*	*?*
Faroese summer groundfish survey		FAR	Vb1	< 500m	Aug /Sept	A	D	T	Groundfish survey LIN, USK	A	A/P			x	x	A									14	200
Faroe Bank autumn groundfish survey		FAR	Vb2	90-600m	Sept	A	D	T	Groundfish survey LIN, USK	A	A/P			x	x	A									7	29
Faroese Greenland halibut survey		FAR	Vb1	350-600m	Sept	A	D	T	GHL	A	A/P			x	x	A									14	55-65
Faroese redfish survey		FAR	Vb	300-700m	Oct	A	D	T	RED	A	A/P			x		A									14	55-65
Faroese O-group surveys		FAR	Vb	0-100m	June - July	A	I	T	O- group gadoids	A	A/P	x				A									14	110
Greenland deep sea survey		GRL	XIVb	400-1500m	Jun	A	D/B	T	GHL, RNG,RHG Groundfish	A	A/P			O		A					O				12	70
MAR & X																										
Bottom Longline Survey, ARQDAÇO	x	POR	Xa2	20-600m	2nd Quarter	A	D	L	SBR, RBM, GFB, ALF	A	A/P		O	O	O	A	O			O	O	A		O	45	35

Extention to Bottom Longline Survey, ARQDAÇO	x	POR	Xa2	600-1200m	2nd Quarter	A	D	L	RBM, MOR, ALF, SKH	A	A/P		O	O	O	A	O		O	O	O	A		O	30	25
MAR-ECO (15 surveys, ~ 7 vessels?)	x	NOR, ICE, GER, POR, RUS, USA	Xb, X11a, & c, Va	?-4500m	2002-2005, 2007	O	D/P/B/I	T,P, A, L, ROV, BUC		O	O	O	?	O	O	O	O	O	O	?	?	O		O	280	?
MAR SURVEY	x	RUS, EC, NOR, ICE	Xb, XIIc, XIIa1	200-2000	2nd Quarter	P(5 YEARS)	D/P/B	T,P, A, L, ROV, BUC	ALF, ORY, RNG, SKH, BSF	P	P		P	P	P	P	P	P	P**	P	P	P	P**	P	?	?
Dedicated Seamount Survey	x	POR & ES	IXa & IXb	?	Any	O	D/P/B/I	L, A, ROV, BUC, box core		O	O	O		O		O	O	O	O***	O	O	O	O	O	?	?

A = Annual P = Periodic
O = Occasional

Sampling Gears: T = Bottom trawl, P= Pelagic trawl, A = accoustic, L= Longline, BUC = Baited underwater camera

* proposed seamount studies by WGDEC - Rosemary, Anton Dohrn and Hebrides Terrace (group1)

** proposed seamouont studies by WGDEC: group 2

*** proposed seamouont studies by WGDEC: group 3

The following bullet points relate to the definition of column headings:-

Co-ordination – flagged if international co-ordination is deemed appropriate

Abundance & species – species flagged as having data usable in assessments (existing surveys) and potentially usable (extended/new surveys).

Dedicated deep-water days and fishing hauls are approximate estimates of deep-water effort at depths greater than 400 m in existing surveys and suggested deep-water effort in amended/new surveys.

The surveys identified as high priority all require international co-ordination and two are consistent with the ecosystem approach in that they cover a wide range of activities including collecting data for use in abundance indices for stock assessments, carrying out seamount studies and monitoring the efficacy of closed areas introduced to protect vulnerable habitats. The three surveys are:-

Internationally co-ordinated trawl survey of the European continental slope from ICES sub-areas VI in the north to IX in the south, commencing 2009.

This survey would comprise existing dedicated deep-water surveys carried out by UK(Scot) and Ireland and possibly to the Spanish survey currently carried out on Hatton Bank (VIb1 and XIIb). In addition, the WGDEEP suggested that further deep-water work could be appended to the IBTS surveys currently carried out by France, Spain and Portugal to cover the areas not accounted for by existing deep-water surveys. It is suggested that the survey protocol comprises transects across the continental slope and that standardised gear should be used where possible. These proposed surveys would take place annually in Sept - Dec. These surveys would a potential source of abundance indices for roundnose grenadier, black scabbardfish, deep-water sharks, bluemouth redfish and greater forkbeard and also be a platform for carrying out studies of seamounts identified by WGDEC and any related studies of the efficacy of closed areas. These may include (see Figure for geographical position):-

In VI:- Rosemary Bank

Anton Dohrn
Hebrides Terrace

in IX:- Josephine

Terressa
Erik
Hirondelle

Additional information would be collected on biodiversity, biological parameters, morphometrics, benthos and samples would be collected for studies of genetics, diet, contaminants, parasites, cetaceans and sea-birds.

Internationally co-ordinated trawl and acoustic survey of the Mid-Atlantic Ridge (MAR) commencing 2009

This survey would build on previous surveys carried out on the MAR under the MAR-ECO project, and involve Norway, Russia, Iceland and EC Member States. The survey would be carried out between April and June every five years and provide regular periodic indications of the biomass of roundnose grenadier, orange roughy, alfonsino, deep-water sharks and black scabbardfish. The proposed surveys would also provide a platform for carrying out studies of seamounts identified by WGDEC and any related studies of the efficacy of closed areas. These may include:-

In XII:- Eriador

Hectate*
Faraday
Altaire*

In X:- Chaucer

Crumb
Antialtair*
North Atalante

*Denotes protected by closed area

Additional information would be collected on biodiversity, biological parameters, morphometrics, benthos and samples would be collected for studies of genetics, diet, contaminants, parasites, cetaceans and sea-birds.

Internationally co-ordinated acoustic and trawl survey for greater argentine and roundnose grenadier in ICES areas II, Va, Vb & IIIa, commencing 2009.

This is a more provisional proposal than those for the other two surveys because the Group did not have the full expertise for assessing its feasibility. Further consideration outside WGDEEP (eg PGNAPES) is required in the light of results from a Norwegian acoustic/trawl survey currently taking place.

Countries involved would provisionally include Iceland, Faroes, Denmark and Norway. The proposed co-ordinated survey would be take place annually in April.

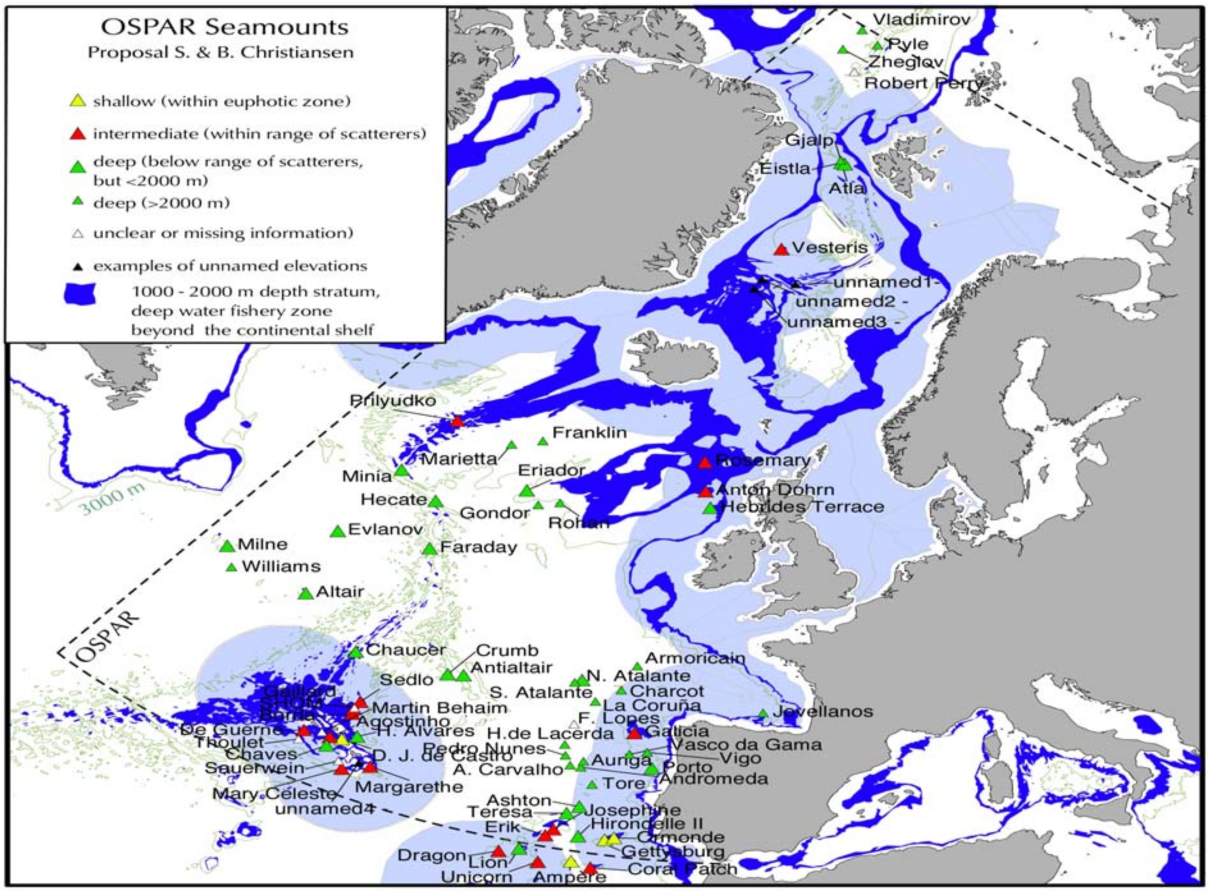

Figure 18.2. Seamounts in the NE Atlantic (from WGDEC report in 2007)

18.4 Survey co-ordination including suggested TOR

It is proposed that one or several ICES Planning Groups for international Northeast Atlantic Deepwater Surveys be formed to co-ordinate the prioritised surveys in the three geographical areas identified above. Composition of this group(s) may change in accordance with the TOR (see below) and should include members from both WGDEEP and WGDEC. The aim of this co-ordination should be to plan survey design, methods and sampling protocols to address the main purposes of the surveys (see above). This should also include standardisation of fishing gear within surveys where appropriate

18.4.1 Co-ordination of an annual Internationally co-ordinated trawl survey of the European continental slope from ICES sub-areas VI in the north to IX in the south, commencing 2009.

The relevant Irish and Scottish surveys have already been co-ordinated .A planning meeting building on this co-ordination should take place alongside the 2008 IBTS Working Group in order to ensure the presence of relevant survey co-ordinators and take advantage of the Group's expertise. The aim of this meeting would be to plan for surveys in the Q3 & Q4 of 2009 providing ship time is available. It is anticipated that provisional funding from the EU Data Collection Regulation will be flagged in September 2007 and the fine details of the proposed survey(s) will be finalised at a planning meeting in 2009.

Suggested TOR for a planning meeting in parallel to the ICES IBTS co-ordination meeting in 2008 may include:-

e) plan and coordinate an annual Internationally co-ordinated survey of the European continental slope from ICES sub-areas VI in the north to IX in the south, commencing 2009.

f) review existing NE deep-water & slope surveys in terms of sampling strategy, protocols and intercomparability.

g) to agree on suitable survey design, gear, sampling effort and sampling protocols for the proposed survey in order to provide the following future data to WGDEEP, WGEF and WGDEC and other ICES WGs as appropriate: -

- abundance indices for roundnose grenadier, black scabbardfish, deep-water sharks, bluemouth redfish and greater forkbeard and other species as appropriate
- biological parameters for the key species
- biodiversity indices for fish communities and benthos as appropriate
- data on habitat mapping (video/TV) of identified seamounts and other vulnerable habitats .
- fish /environment interaction in the deepwater habitats

h) develop and standardize methods for the computation of abundance indices

i) review existing databases for bottom trawl surveys such as DATRAS for the management and storage of data from the survey.

j) co-ordinate the production and dissemination of species identification and maturity keys for the proposed deepwater survey

k) Evaluate the requirements and consider the feasibility of collecting additional data on the surveys, such as genetics, data for contaminant studies, observations of mammals and birds and others.

18.4.2 Co-ordination of an Internationally co-ordinated trawl and acoustic survey of the Mid-Atlantic Ridge (MAR) commencing (to be specified)

Given the proposed periodicity of this survey (every 5 years) and its scale and complexity, WGDEEP suggests that co-ordination of this survey could be through a 3 year study group cycle starting with a meeting the year before the survey, an execution meeting the year of the survey and a results review meeting the year after the survey, followed by a 2 year break. It is anticipated that the study group meetings would also be attended by scientists in the current MAR-ECO Steering Group. The terms of reference of such a group should build on the recent and ongoing Mar-Eco and Eco-Mar projects and should also consider sourcing funding for the survey. Potential funding could be raised by the EU, Iceland, Norway etc. It is anticipated that provisional funding from the EU Data Collection Regulation (for participating EU member states) be flagged in September 2007 and the fine details of the proposed survey(s) will be finalised at the above study group meetings (to be specified).

Suggested TOR for a study group meeting in (to be specified):

l) plan and co-ordinate an international multidisciplinary survey of the MAR from ICES Sub-area Va in the north to X in the south, commencing in (to be specified);

m) to review possible funding sources and co-ordinate application for international funding .

n) to review the existing MarEco MAR surveys in terms of objectives, sampling strategy and major findings.

o) To agree on suitable survey design, gear, sampling effort and sampling protocols for the proposed survey in order to provide the following future data to WGDEC, WGDEEP, WGEF, NEAFC and other WGs as appropriate:

- the distribution, abundance and biodiversity of fish and benthic communities along the MAR.

- further characterization of the various MAR habitats in terms of geology, hydrography, chemistry and ecology.
- indications of abundance of roundnose grenadier, orange roughy, alfonsino, deep-water sharks and black scabbardfish
- Biological parameters for the key species
- data on habitat mapping including video/TV and grab samples to show the distribution and extent of vulnerable habitats .
- data on habitat mapping (video/TV) of identified seamounts .

p) Evaluate the effects of closed areas.

q) Evaluate the requirements and consider the feasibility of collecting additional data on the surveys, such as genetics, data for contaminant studies, observations of mammals and birds and others.

r) review the data management, storage and dissemination of existing MARECO data/results and decide on application for future use.

18.4.3 Co-ordination of an annual Internationally co-ordinated acoustic and trawl survey for greater argentine and roundnose grenadier in ICES areas II, Va, Vb & IIIa, commencing 2009.

This is a more provisional proposal than those for the other two surveys. If there is agreement to proceed, the details of the survey co-ordination will be planned at that time, probably involving the Planning Group on NE Atlantic Pelagic Ecosystem Surveys [PGNAPES]

18.5 Proposals for updating the WGDEC database

WGDEEP commends WGDEC for this initiative. Clearly, this database is and will provide an important foundation for co-ordination of current surveys and the planning and commissioning of future surveys. WGDEEP is of the opinion that the database should be reviewed to ensure that all surveys, including those commissioned with the primary purpose of constructing abundance indices for use in stock assessments, are incorporated. In practice, many of these surveys are or are becoming multipurpose in that they also provide information on non-commercially exploitable species and vulnerable habitats. Thus, the collation of data from all types of surveys is consistent with the ecosystem approach to management. However, it is noted that the database includes data from surveys at depth >200 m, whereas the international definition of deep-water is waters at depths >400 m. Notwithstanding, WGDEEP can see some benefit in staying with >200m since this will include surveys focussed on the continental slope which may take a by-catch of deep-water species.

18.5.1 Suggested procedure

WGDEEP suggests that a protocol for updating this database be agreed by correspondence between WGDEC and WGDEEP. WGDEEP suggests that the database be updated intersessionally before the meetings of WGDEC and WGDEEP in 2008. Since the database is currently maintained by WGDEC it is suggested that the member of WGDEC currently having responsibility for the database should carry out the updating using information described below which would be provided intersessionally by members of WGDEEP.

18.5.2 Data sources

WGDEC generated a table listing the institutes or collaborators providing information on deepwater surveys that was included in the database (Table 18.2).

Table 18.2. List of institutes from which data was included in the survey database.

Institute	Information	Provider/contact
FRS Marine Lab, UK	Deepwater fish surveys (1996-2006) Zooplankton surveys (1998-2005)	F.Neat
SAMS, UK	Deepwater fish surveys (1975-1992)	K. Howell
PINRO, Russia	MAR grenadier survey (2002) Hatton/Lousy Bank fish survey (2001)	V.Vinnichenko
MARECO	MAR (2004)	Odd-Aksell Bergstad
DTI	Hatton Bank (2005-2006)	K. Howell
Marine Institute, Eire	Deepwater fish survey (2006) Orange roughy acoustic survey (2005)	B. O'Hea
IMR Bergen, Norway	coral reefs surveys Norway (2005, 2006)	P. Mortensen
Instituto Español de Oceanografía (Spain)	Deep-water fish and multidisciplinary surveys (1988-2007): NAFO RA, Porcupine Bank, Hatton Bank, Le Danoise Bank	P. Durán Muñoz, A. Serrano
IHF Hamburg, Germany	Seamount surveys deep-sea programmes on abyssal plains: BIOTRANS, BENGAL, DEEPSEAS	B. Christiansen
University of Plymouth	coral locations	J. Hall-Spencer
AWI, Bremerhaven, Germany	"Hausgarten" long-term study	T. Soltwedel
IPIMAR - Portugal	Deepwater fish surveys Portuguese mainland coast, Madeira and Azores islands	I. Figueiredo P. Machado
University of the Azores, UAç/DOP, Portugal	Deepwater fish and crustacean surveys in the Azores and Madeira islands Hydrothermal vents surveys (IFREMER, WHOI) Various seamounts surveys	G. Menezes
Department of Trade and Industry, UK	Geophysical surveys SEA 7, AFEN	J. Hartley K. Howell

It is suggested that members of WGDEEP review this table and provide any additions to WGDEC.

18.5.3 Design of the database

WGDEC observed that survey data can be summarised at different spatial scales from the individual point location of a sample or trawl to an aggregated area covered within a cruise. WGDEEP agrees that point/station data are too detailed for the purpose of the database but should eventually be linked. WGDEC included the following parameters in the database:-

1) Latitudinal limits of the survey (minimum and maximum)
2) Longitudinal limits of the survey (minimum and maximum)
3) Depth range (minimum and maximum)
4) Geographical locality, e.g. Rockall Bank
5) ICES/NAFO/CECAF areas
6) Whether the survey was in 'high seas' or within areas of national jurisdiction
7) The 'target' of research, e.g. fish, zooplankton etc
8) The type of survey method, e.g. trawl, acoustic, box core etc
9) Whether seabed acoustic surveys were undertaken, e.g. multibeam, side scan etc
10) Specific remarks, e.g. number of surveys/cruises
11) The research programme/project/funding agency
12) Year(s) of survey
13) Institution associated with the data
14) Reference to data (if published)

In addition to these, WGDEEP suggests that information on the following parameters should be included:-

15) Whether the survey is targeted at specific fish species and, if so, which.
16) Availability of abundance indices by species (defined as time-series of 5 years or more), and
17) whether these are relative or absolute..
18) Whether available abundance indices are used in assessments.
19) Whether survey grids correspond to stock distribution, where known.
20) Number of stations and survey design (random, stratified etc)
21) Current or historical

If WGDEC agrees with this, it is suggested that members of WGDEEP provide this information intersessionally.

18.6 Recommendations

- It is proposed that there be an internationally co-ordinated trawl/seamount survey of the European continental slope from ICES sub-areas VI in the north to IX in the south, commencing 2009, and an internationally co-ordinated trawl, acoustic and seamount survey of the Mid-Atlantic Ridge (MAR) commencing (to be specified)
- Further evaluation of a proposed acoustic/trawl survey for greater argentine and roundnose grenadier is required.
- The prioritised surveys and aims should be evaluated by WGDEC, IBTSWG and PGNAPES prior to review by ACFM, ACE, ACME
- It is proposed that provisional agreement for funding should be sought from national institutes and also the EC Data Collection Regulation (meeting Sept 2007).
- ICES should provisionally convene one or more planning groups to co-ordinate the prioritised surveys in the geographical areas identified above.
- WGDEC is contacted regarding agreement on the proposals made above regarding updating the deep-water survey database.
- If agreed by WGDEC, this work in WGDEEP should be carried out and co-ordinated intersessionally by the survey specialists in WGDEEP from the Marine Institute (Ireland) and FRS (Scotland).

19 RECOMMENDATIONS

19.1 General issues

- The WG was of the opinion that deep-sea sharks should be assessed by WGDEEP, these these species are caught together with roundnose grenadier in the same mixed fishery.
- The WG notes that assessment expertise has weakened over the past years. ICES should encourage national institutes to allow more assessment experts to participate in WGDEEP.
- The WG recommends that in future meeting, WGDEEP and WGDEC should meet back to back

19.2 Specific issues

19.2.1 CPUE standardisation

To choose a reference fleet is believed to be an appropriate preliminary filter. This however does not prevent from applying any of the standardisation methods mentioned above (statistical analyses, selection of reference fishing grounds).

To systematically standardise the CPUE used in stock assessments. In doing so, a limited number of protocols should be followed, and these should be formatted as much as possible, to facilitate traceability and quality control. In doing so, it is suggested that a suite of common codes (written in e.g. FLR or SAS) be developed and delivered to stock coordinators.

To convene an ICES SG, involving stock coordinators from WGDEEP, but also from other assessment WGs. The remit of this SG would be to identify protocols and develop the common methodological approach for CPUE standardisation.

19.2.2 Stock identification

19.2.2.1 Tusk

Based on the genetic investigation, the group suggests the following stock units for tusk:

tusk in Va and XIV

tusk on the MAR

tusk on Rockall

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.

- Get more samples around Iceland, Faroe Island, Hatton Bank and Western Scotland to disentangle potential structure within and among these areas
- Get more samples from other parts of tusks distribution range (Barents Sea, North Sea, West Greenland also) to get a more complete picture of the species population structure.

19.2.2.2 Ling

- Available information is not sufficient to suggest changes to current ICES interpretation of stock structure. However, an ongoing project microsatellite

DNA primer development is soon to be completed, funded by the Norwegian Ministry of Fishery and Coastal Affairs and by Grant MAR-ECO (www.mar-eco.no), a field project under the Census of Marine Life programme. Further, samples from several areas within ling's distributional range will be obtained. DNA analysis will be initiated autumn 2007 funded by Norwegian Ministry of Fishery and Coastal Affairs and ESF (www.esf.org; contact person: dr. Halvor Knutsen, IMR: halvor.knutsen@imr.no).

19.2.2.3 Blue ling

- Available information is inadequate to evaluate the stock structure of blue ling in the NE Atlantic. It is suggested that the current practise of separating blue ling into a northern stock (Va and XIV) and a southern stock (Vb,VI,VII) is continued until information from microsatellite studies is available. The stock structure should then be reviewed. Future research should aim at developing msat DNA primers, as genetic analysis has proven very informative in detecting potential population structure in other marine fish species such as e.g. the Atlantic cod and Greenland Halibut.

19.2.2.4 Greater argentine

- 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.

19.2.2.5 Black scabbardfish

- A wide sampling area coverage of the genetic study that is now undertaken under the EURODEEP Project;
- in parallel with that study that aims the identification of genetic stocks further cooperative investigation should be carried on in order to support the conclusion of that project. In particular, life history traits and ageing studies, should be implemented both at the northern and southern areas. A standardization of techniques should be firstly defined a joint workshop should be held to jointly analyse the results.

19.2.2.6 General

- To hold the next WGDEEP/SIMWG when new genetics results are available. Such results are expected to be available soon for ling and, later, black scabbardfish;
- To carry out in first priority a genetics project on orange roughy, blue ling and greater argentine. This is to the depleted status of these species, and also to their aggregating behaviour, which could be consistent with the assumption of more than one stock;
- To carry out in second priority genetics projects on roundnose grenadier and alfonsinos

19.2.3 NEAFC Request concerning the quality of VMS, Catch and Effort Data

To establish a dedicated SG be set up by ICES around the development of methods based on VMS data (SGVMS). This SG should include WGDEEP members, but also experts from other assessment WGs. WGDEEP suggested the following terms of reference

To review existing information based on VMS records available to ICES, including the status, extent, quality, accessibility and restrictions applying to these data.

To define a standard format for collating data derived from VMS records. This will include defining an appropriate unit for the time elapsed between consecutive records

To review existing methods and possibly develop new methods to separate out fishing positions from plain travelling. These methods should apply to vessels using both active and passive gears.

To review existing methods and possibly to develop methods and to identify suitable formats to link fishing effort as derived from VMS data with catches, vessel and gear characteristics, and fishing depth.

19.2.4 NEAFC Request concerning the compilation of data on Spawning/Aggregation Areas in the NEAFC Convention Area

- Information on spawning aggregations at Va and II has already been provided and this forms a suitable basis for the introduction of closed areas, if not already implemented.
- Regarding southern blue ling, information on spatial aggregations will be released through the POORFISH contract. NEAFC has repeatedly requested ICES to provide advice on blue ling spawning aggregations. An attempt will be made to accelerate the outcomes of the POORFISH project. However, it will still be necessary to ensure that stakeholders supplying information have an opportunity to review outcomes before they are released into the public domain.

19.2.5 NEAFC Request concerning The Coordination of Scientific Deep-Sea Surveys in the NEAFC Convention Area

- It is proposed that there be an internationally co-ordinated trawl/seamount survey of the European continental slope from ICES sub-areas VI in the north to IX in the south, commencing 2009, and an internationally co-ordinated trawl, acoustic and seamount survey of the Mid-Atlantic Ridge (MAR) commencing (to be specified)
- Further evaluation of a proposed acoustic/trawl survey for greater argentine and roundnose grenadier is required.
- The prioritised surveys and aims should be evaluated by WGDEC, IBTSWG and PGNAPES prior to review by ACFM, ACE, ACME
- It is proposed that provisional agreement for funding should be sought from national institutes and also the EC Data Collection Regulation (meeting Sept 2007).
- ICES should provisionally convene one or more planning groups to co-ordinate the prioritised surveys in the geographical areas identified above.
- WGDEC is contacted regarding agreement on the proposals made above regarding updating the deep-water survey database.
- If agreed by WGDEC, this work in WGDEEP should be carried out and co-ordinated intersessionally by the survey specialists in WGDEEP from the Marine Institute (Ireland) and FRS (Scotland).

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20.2 Working Documents

WD1: Ofstad L.H., 2007. Data on Faroese deep sea fisheries. 12pp.

WD2: Bordalo-Machado P. and Figueiredo, I., 2007. Common problems in the interpretaion and analysis of VMS data from artisanal longline fisheries. 8 pp.

WD3: Marchal P., Eastwood, P., Laurans, M., and Mills, C., 2006. A response to the 2005 and 2006 NEAFC requests regarding deep-sea species.

WD4: Gil, J., J. Canoura, C. Burgos. & I. Sobrino, 2007. Red seabream (*Pagellus bogaraveo*) fishery of the Strait of Gibraltar (ICES IXa south): Update of the available information.

WD5: Pennington, M., and Helle, K., 2007. Some sampling considerations for estimating population characteristics.

WD6: Helle, K., and Pennington, M., 2007. Estimating effort, CPUE and mean length for the Norwegian commercial catch of ling, blue ling and tusk.

WD7: Sigurdsson, T., and Kristinsson, K., 2007. Information on Deep Sea species in Icelandic waters.

WD8: Bordalo-Machado, P., and Figueiredo, I., 2007. A description of the black scabbardfish (*Aphanopus carbo* Lowe, 1839) fishery in the Portuguese continental slope.

WD9: Vinnichenko, V.I., 2007. Russian deep-sea investigations and fisheries in the Northeast Atlantic in 2006.

WD10: ACME, 2007. Advice to WGDEEP.

Annex 1: List of participants

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Annex 2: Technical minutes. Deepwater Special Request Review Group

Working group	WGDEEP
Year	2007
Review group chair	Ciarán Kelly
Review group participants	Henk Hessen, Beatriz Roel, Jake Rice, Martin Pastoors, Fatima Borges
WG chair	Paul Marchal
Date of review	21-22 May 2007

The meeting was held by correspondence on the 21&22 May. As there was no stock specific catch advice to be given by ICES this year, the reviewers focused on the sections of the report dealing with stock identity (Section 4) and answers to the NEAFC request (Sections 14–18). Time did not allow a review of the other information in the report.

General report comments

The reviewers were aware of the short time between the conclusion of the meeting and the review and appreciate the efforts of the WG chair to have a draft report ready in time.

An executive summary would be useful especially for the reviewers. Such a summary should contain the general conclusions of the WG, as well as information on how and in which sections the ToR's are dealt with.

In general much of the report is written with assumed knowledge, which makes it difficult for a reviewer to follow the text. For example the stock identity sections conclude with the sentence that "information is not sufficient to suggest changes to current ICES interpretation of stock structure". However the current interpretation of stock structure although discussed at the opening of each section is not clearly stated. Given the volume of information and complexity of argument it would much easier for a reviewer to get this information from a table.

Section 3

If data on official landings are not available to the WG, then the WG should identify which countries have not supplied the data. Under the EU MoU with the ICES, the EU have requested to know the detail of data transmitted to the WG for the purposes of identifying countries which have been paid for data collection under the DCR but who have failed to transmit such data to ICES. To this effect tables indicating which countries have deep water fisheries, and then for those countries an indication of whether data has been sent to the WG on catches, discards, and biological data are requested. Also an indication of the quality of this data would be useful.

Under ToR 2 the WG are asked to compile data on landings discards and effort on the finest scale possible. The logbooks were not used for this as there were only records from some countries. The reviewers consider that if the WG begin the process of "name and shame" those countries which do not supply data, this limitation could be addressed.

Section 4

The WG, presented a detailed report of the stock ID workshop, where it is apparent that much work is still underway and maybe available over the next years. Whilst this means that a definitive answer to the question of stock ID may be some years off, the reviewers felt that for the purposes of delivering stock advice in the short term, the issue of stock ID is still not resolved. Notwithstanding that hardly any new information was available for most stocks, the default conclusion in these cases that “there were insufficient data to suggest any changes to the ICES perception” does not address whether the experts in this group consider if the ICES perception is valid. The reviewers found inconsistencies in the way that the “current perception” deals with the stock issue for some species. For example Tusk (in IVa, Vb, VIa, VII…) are grouped into a single stock in the absence of conclusive information, even though the WG believe this species to be sedentary, while Black scabbard is separated into 2 stocks (Vb VI VII & XII and VIII & IX) on the basis of a similar lack of information, even though they believe this species to be migratory. This issue needs to be resolved before ICES has to give stock specific advice in 2008.

The reviewers were not convinced of the arguments for analysing fishery dependent dynamics for stock discrimination (e.g. CPUE), as is presented in almost all cases. It is noted however that the WG accepts that this should only be used in support of stronger evidence.

The issue of Stock ID for Tusk needs some clarification. The reviewers understood that genetic analyses could differentiate between Mid Atlantic Ridge (MAR), Rockall, and Canadian stocks. However it is not clear from the information presented where on the MAR the samples were taken. In the conclusions the MAR stock is assigned to XIIb which is the western Hatton Bank, which is a long way from where the MAR sample is indicated to be taken in figure 4.3.11. While the Rockall population is split by the international zone existing either in VIb1 or VIb2. The reviewers felt that this would require further explanation before the stock units could be adopted by ICES.

Further specific comments on the report Section 4 is given in appendix 2.

Reviewer comments on response to NEAFC requests by WGDEEP

14 Impact of area closures NEAFC request 3a

NEAFC asked ICES to *“continue to provide all available new information on distribution of vulnerable habitats in the NEAFC Convention Area and fisheries activities in and in the vicinity of such habitats. Particularly relevant is information assisting NEAFC in evaluating appropriateness and effectiveness of the temporary closures of the Faraday, Hecate, Antialtair, Altair seamounts and the area on the Southern Reykjanes Ridge. NEAFC also requests advice on other possible actions to protect vulnerable habitats in the Regulatory area.”*

Where area closures consist of areas smaller than a stat rectangle VMS data is required to map out the vessel activity related to such area closures, and this appears to be what NEAFC are looking for “*an evaluation of fisheries activities in the vicinity of such habitats*”. It is clear that the analyses of such data in order to elaborate on this element was not done for technical and operational reasons.

NEAFC requested information on the “*appropriateness and effectiveness of the temporary closures*” The WG could have been more helpful by simply stating that if the closures are observed, then damage to the benthos caused by fishing activities which make bottom contact should be avoided, however any temporal opening of these closures would work against this effect.

In order to be helpful even if no VMS data were available, the reviewers felt that more effort should have been spent on the (incomplete) logbook data. From the catch by stat rectangle you can show whether the closed areas are within or without areas where any commercial species are caught and –crudely- suggest the degree of fishing activity in the vicinity.

Some detail in the report was expended on the effect of the closures on deep sea fisheries, however NEAFC did not request any information on the impact of area closures on the deep water fisheries. Even if they did, it is not apparent what impact the WG is expecting to measure from the analysis of spatial data, apart from effort displacement. Even for this the WG would need before and after records, and it is not clear that these would be available. If the WG were trying to measure any effect on the deep water stocks as a result of the closed areas, what impact could reasonably be measurable within 2 years of some area closures given that most of these species are long-lived, slow-growing, late maturing?

NEAFC request 3b

NEAFC are looking for 4 things here

Comment on the quality of the VMS data for provision of spatial and temporal extent of deep water fisheries (WGDEEP Section 15)

To develop suitable criteria to differentiate fisheries into management types (WGDEEP Section 16)

To categorise fisheries according to these criteria (Not done)

To highlight shortcomings in the quality of the data (WGDEEP Section 15&16)

15 NEAFC request concerning the quality of vms, catch and effort data

In response to this request ICES had already told NEAFC that it would meet with NEAFC in the spring to determine what data were required to provide a response in continuation of the advice given in 2006 (letter to NEAFC 2nd March).

From the WG it appears that it is not straight forward to link VMS to fishing activity, and quite a lot of text is expended in explaining precisely why this is the case. So in the spirit of being proactive maybe the WG could suggest another route of informing NEAFC on the spatial and temporal extent of deep water fisheries, e.g. logbook data?

16 Criteria to identify deep-sea fisheries

The reviewers felt the WG could have done more with the data available. For example evaluate the degree to which the positions of the 36% of records that did have gear type reported were a representative/random sample of the positions of all the VMS records. The results of that evaluation would not allow the results to be used in any definitive way, but at least they would provide some context for interpreting Figure 16.1. If this figure is a representative sample of all fishing, then with some caution it can begin to be taken into spatial management considerations. It would then also be worth investing in making more useful figures for reporting the results. The one figure is too small, and part of the most information it does potentially contain is obscured by wrapping off the figure on the left and down towards off Iberia at the bottom. If the data with gear information are entirely unrepresentative of all the data then we should at least call attention to the ways in which they are unrepresentative. We must know what proportion of the catch came from the different types of gears. We must know something of at least the number of vessels of the different types that operate out there. That has to give us *some* contextual information for telling NEAFC what is and is not legitimate to infer from the one figure we do provide. That would show that we are trying to be as useful as we can be with the information available, rather than just making a habit of complaining that the data aren't good enough yet to say much of anything useful.

A much simpler approach would be to plot the logbook data by stat rectangle. A series of maps by species where groupings of species gears areas and times were identified would be useful for managers to get a handle on the management types.

Section 17

Section 17 of the report deals with the NEAFC request to ICES "*to compile data on documented historical or present spawning/aggregation areas of blue ling in the NEAFC Convention area.*" There is no part of this request which requires that the response be exhaustive nor to a specified level of precision either spatially nor temporally, so the reviewers felt that there was no need to qualify the response as such. The information presented relating to existing material is fine. However with regard to the new information the reviewers felt that the WG didn't achieve very much. These are vulnerable aggregations of depleted stocks, and it would be consistent with a precautionary approach to deliver whatever information is available. The "wait and see" approach pending the outcome of some studies is not satisfactory. The information on the "Poorfish" doesn't really help ICES to answer the request for information on spawning aggregations. The reviewers felt that it would have been more helpful if the WG could have plotted the available information and given some expert judgement on the size of area closures which would be necessary to protect aggregations.

Section 18 NEAFC request concerning the coordination of scientific deep-sea surveys in the NEAFC convention area

This deals with the NEAFC request to " *to consider co-ordination of existing deep-sea surveys. The evaluation may also include recommendations for the development of new surveys if it is considered to be appropriate.".* The reviewers have some specific queries which are in the appendix. However in contrast to the other requests this appears to be dealt with satisfactorily, and is consistent with what ICES said it would deliver in it letter to NEAFC on March 2nd.

Appendix 1

Specific comments to Section 4

4.2.2.1 The statement “Undoubtedly, given the poor knowledge of deep water species, the collection of basic life-history and ecological data is an essential pre-requisite for the successful identification of stocks.” Seems a strange conclusion. If many deep-water species are relatively long-lived, late-maturing, slow-growing, and all the other stereotypes, it would seem particularly hard to identify consistent and significant (either biologically or statistically) differences in life histories among adjacent stocks of a species, particularly if fishing mortality has historically not been applied evenly in space. Everyone agrees that it is important to collect more basic life-history and ecological data for deep-water species for many reasons. Being a pre-requisite for stock identification would not be near the top of my list of reasons however, and life history data would hardly be considered a pre-requisite for stock identification.

The justification for the proposed stock units is not always clear from the text. Please cross-reference relevant sections in 4.3.2.3 and 4.3.2.4. Section 4.3.2.3

Genetic analysis, 2nd par, 1st line, is that Knutsen *et al.* 2007? Figure 4.3.11. Spell sample locations in the legend. Section 4.3.2.3 Genetic analysis, last paragraph. Insert before the sentence starting with “First”, the words: “the reasons are: first,.....” or use equivalent wording that will provide the link between statements.. Figure 4.3.1.1 missing.

Suggest shortening some of the sections in 4.3.2.3 (i.e. CPUE) as most of the indicators examined do not appear to be useful indicators of stock structure

4.3.3 Ling. What is the relevance of the table presented in 4.3.3.2? It is not referred to in the text. In any case it needs a legend. Fig 4.3.23. Legend. The constants in the equation (parameters of the fitted curve?) are not shown. Section 4.3.3.3 CPUE: if the intention is to compare trends from different areas, CPUE needs to be standardized. Target and non-target CPUE should be treated separately.

Appendix 2

Section 16

It is not clear where the effort data comes from. Given problems with frequency of VMS records and difficulty in establishing whether the vessel is steaming or fishing it would be difficult to derive effort from VMS data.

Are there log-books available to supplement the catch and VMS data? Information on shooting time, trawl duration, shoot and haul positions would come handy.

It is not clear what temporal resolution the WG are seeking for the VMS data

If the VMS analysis is not done at the WG when is it proposed that it should be done?

Section 17

17.1.2 Research surveys. Spawning blue ling found only in one trawl out of how many performed in the area?

Was the timing not right for the other surveys and does that explain the lack of spawning blue ling in the catch?

17.1.3. Fisheries data.

Table 17.2. Position of the location in Div Vb?

Not clear whether the the spawning aggregation in the Storegga area, Div IIa still exists. If the only fishery data belongs to a fishery in the ‘80s would that be an indication that it has been fished out?

17.2 New information available.

Did the survey cover division Via?

Did the survey obtain data on maturity stages of the deep water species?

Are there more surveys planned for the future?

17.3 POORFISH.

Will this project have sources of information on spawning areas additional to the ones available to the WG?

How reliable is the expert’s opinion regarding blue ling maturity stages?

Log-book data used to identify spawning aggregations, does that mean that the fishery only targets spawning aggregations?

17.4 Recommendations

Do spatial aggregations equal spawning aggregations?

When is the earliest POORFISH results could become available to ICES?

Section 18

Figure 18.1 Which is the period corresponding to the surveys plotted?

1) Internationally coordinated survey of European continental slope…

Extensions to a number of existing surveys were highlighted in the table, is it proposed that all plus the existing surveys become part of the new coordinated survey? Not clear which scientific priorities between surveys were identified.

2) Internationally co-ordinated survey of the Mid-Atlantic Ridge (MAR)

Is the evaluation of closed areas a sensible objective for this survey?

3) Internationally co-ordinated survey for greater argentine and roundnose grenadier in areas II, Va, Vb and IIIa. On what basis did the extension to silver smelt survey become high priority?

Survey 1) consists of trawling only while 2) and 3) include acoustics. A justification of the use of acoustics in terms of the survey objectives would be useful.

Regarding the proposals for survey extensions in section 18.3 WGDEEP states that it is more cost effective to expand existing surveys than recommend new dedicated deep-water surveys. This might be true but the reviewers noted that this depends of the objectives the existing surveys, protocols used e.g. In the case of Western IBTS 4^{th} quarter in place for VIa, VIIa, VIII, IXa it is not the right time of the year. In Southern IXa the survey is timed for the recruitment season of the shelf stocks and the IBTS gear type is not useful for slope fishing in this area. In this case it is better to move to March were some of the countries have already an existing survey time series dedicated to catch the adult component of the stocks and may be can be adjusted for deep-sea fish using several gear types.