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

2 – 11 MAY 2006

VIGO, SPAIN

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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H.C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

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1 EXECUTIVE SUMMARY

WGDEEP06 has provided management advice 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.

Ling in Va. 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.

Blue ling in Va & XIV. 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}.

Tusk in Va. 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.

Greater silver smelt in Va. 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.

Ling in I&II. If the CPUE from Norwegian long liners is accepted as a valid abundance index, an evaluation in relation to reference points may be proposed. The CPUE estimates from the 1970s were very variable, but the average CPUE was probably around 80kg/1000 hooks. By comparison, the 2000-2005 mean CPUE is 34.0kg/1000 hooks, thus below $U_{pa,}$ but above U_{lim}. Considering that ling in I and II was fully exploited or probably overexploited prior to 1970, this assessment is probably reasonable.

Tusk in I&II. If the CPUE from Norwegian long liners is accepted as a valid abundance index, an evaluation in relation to reference points may be proposed. The CPUE estimates from the 1970s were few and very variable, but the average CPUE was probably around 80kg/1000 hooks. By comparison, the 2000-2005 mean CPUE is around 40kg/1000 hooks, thus at about $U_{pa,}$. Considering that tusk in I and II was fully exploited or probably overexploited prior to 1970, this assessment is probably reasonable yet uncertain.

Ling in Vb. CPUE series suggest that the current abundance is at a low level compared with the historical records from the 1970s-80s, but that there is also a possible improvement in the most recent years. The analytical assessments that were attempted could not be used to evaluate the reliability of these trends.

Blue ling in Vb, VI & VII. Using CPUE as an index of exploitable biomass (U), WGDEEP in 2004 concluded that that blue ling Vb,VI,VII was below Ulim (20% of virgin biomass). There is no new evidence to suggest that this has changed. It seems reasonable to assume, therefore, that current U remains below Ulim. The results from a CSA stock model support the view that that there this been a strong decline in stock over the period analysed (1989 to 2005), broadly similar to that observed over the same period using stock reduction.

Orange roughy in VI. WGDEEP considers that given the experience of fisheries in VI (Hebrides Terrace Seamount), high catch rates will not be sustainable. Furthermore, the other stocks that are fished in VI are almost certainly smaller than that from the Hebrides Terrace Seamount. The orange roughy in Division VIa, mainly distributed on the Hebrides Terrace Seamount is considered to be still below Upa.

Orange roughy in VII. The TAC is lower than the last unregulated landings in 2001 and 2002, although it is similar to the average landings in the period, 1994 to 1998. Declining CPUE is a cause for concern. The individual stock units in VII are most likely smaller than that from the Hebrides Terrace Seamount, and thus sustainable yield for each stock unit or aggregation area will be lower than 100, or perhaps 300 t. Current catches are likely to be unsustainable and the stock units in this area probably already much depleted. Declining catch rates appear to have lead to reduced effort and the TAC to be unrestrictive.

Roundnose grenadier in Vb, VI, VII & XIIb. Given the uncertainty and the fact that there is evidence of depletion, the advice should be precautionary until more evidence is available. Due to technical interactions the group considered that the advice for this species might be consistent with that given for black scabbardfish. For subareas VI, VII and divisions Vb and XIIb a reduction in exploitation of 50% from the 2000-2002 level is required.

Black scabbardfish in Vb, VI, VII & XII. The TAC adopted for 2005 and 2006 in Subareas V, VI, VII and XII might have been an incentive for misreporting of landings. The state of stock remains uncertain. However in order to account to the mixed nature of the fisheries any measure taken to manage this species should take into account the advice given for other species, e.g. roundnose grenadier, caught by the same fishery. Therefore for Subareas Vi, VI, VII and XII a reduction in exploitation of 50% of 2000-2002 level is required.

Roundnose grenadier in IIIa. Until further information to clarify the status of this stock is available, a precautionary management strategy is required, and ICES has previously recommended (for the stocks of roundnose grenadier in IIIa, Vb, VI & VII) a 50% reduction of effort compared with the 2000-2002 level. However, contrary to this ACFM recommendation the effort in IIIa seems to have increased drastically in the last 2 years. Management consultations in 2005 between the EC and Norway have called for restrictions of fisheries that would facilitate reduction in fishing opportunities to a sustainable level. The Group was unable to quantify what would be a sustainable catch level. However, the historical records from 1987 to 2002 did not suggest any negative development of abundance under the exploitation level at that time, and a level of total international catch as in that period may thus be regarded as sustainable.

Black scabbardfish in VIII & IX. There is no new relevant information demonstrating changes on the stock. So the 2004 advice "In Division IXa the adoption of a status quo exploitation level is advised " is maintained.

Red seabream in VI, VII & VIII. The data reported to the group indicate that since the middle of 1980s the landings have been reduced dramatically. In agreement with the ACFM advice saying that 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.

Red seabream in IX. The WG considers that data availability has been improved in recent years. Based on the preliminary assessments, the decrease of the mean length in the landings and the recent increasing trend of landings the fishery may be considered unsustainable.

Roundnose grenadier on the Mid-Atlantic Ridge. The status of the stock is uncertain. Consistent with a precautionary approach the expansion of fisheries should not be allowed until reliable assessments indicate that increased harvests are sustainable.

Red seabream in X. The status of Red blackspot seabream is uncertain but there are signs of increases in indices of abundance from surveys and stable CPUE from the fishery CPUE. The catches of red black spot seabream have been increased until the actual TAC plateau level. Fishing mortality from the catch curve shows an increase trend, with high variability between years. Considering the uncertainty of the assessment fishing mortality should not be increased beyond the actual level until validated assessments indicate that any harvest increase are sustainable.

Ling in combined eco-regions. If the CPUE from Norwegian long liners is accepted as a valid abundance index, an evaluation in relation to reference points may be proposed. The CPUE estimates from the 1970s were rather variable, but the average CPUE was probably around 200, 350, and 160kg/1000 hooks in Division IVa, VIa, and VIb respectively. By comparison, the 2000-2005 mean CPUEs were 50-60kg/1000 hooks, thus below $U_{pa,}$. In Division VIa the recent CPUE may also be below U_{lim}. Considering that ling in IVa, VIa and VIb was fully exploited and perhaps overexploited prior to 1970, this assessment is probably reasonable.

Blue ling in combined eco-regions. Fisheries on blue ling in these areas should be permitted only when they are accompanied by programmes to collect data.

Tusk in combined eco-regions. Recent CPUE in IVa may be around half that in the 1970s or somewhat higher, hence around or higher than U_{pa} if CPUE in the 1970s is taken as a reference $U_{max..}$ If the Norwegian longliner CPUE for Vb are accepted as an index of abundance, then the current level is below U_{pa} but above U_{lim} . For VIa and VIb, it is likely that the tusk is above $U_{pa,}$ mainly because the CPUE appear never to have declined to the same degree as in other Subareas/Divisions. Considering that tusk in the relevant Subareas/Divisions was probably fully exploited prior to 1970, this assessment in relation to reference points is probably reasonable.

Greater silver smelt in combined eco-regions. 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.

Orange roughy in combined eco-regions. WGDEEP considers that given the experience of fisheries in VI (Hebrides Terrace Seamount), high catch rates will not be sustainable.

Roundnose grenadier in combined eco-regions. In compliance with precautionary approach, the general recommendation of the working group for roundnose grenadier in other areas is that the expansion of its fisheries should not be allowed until reliable assessments indicate that increased harvests are sustainable.

Black scabbardfish in combined eco-regions. No new relevant information is available, so the 2004 advice “Fisheries on these stocks 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” is maintained.

Greater forkbeard in combined eco-regions. No stock exploitation boundary can be suggested due to lack of assessment. Furthermore, the knowledge of the biology of the species is insufficient, and it is unclear how vulnerable it is to exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data.

Alfonsinos/Golden eye perch in combined eco-regions. 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.

Other species. No stock exploitation boundary can be suggested for any of these species due to lack of assessment. Furthermore, the knowledge of the biology of these species is insufficient, and it is unclear how vulnerable they are to exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data.

2 INTRODUCTION

2.1 Participants

Odd Aksel Bergstad	Norway
Tom Blasdale	United Kingdom
Ian Doonan	Ireland
Pablo Durán Muñoz	Spain
Guzman Diez	Spain
Ivone Figueiredo	Portugal
Juan Gil	Spain
Lei Harris	Canada
Kristin Helle	Norway
Emma Jones	United Kingdom
Phil Large	United Kingdom
Pascal Lorance	France
Paul Marchal (Chair)	France
Sten Munch-Petersen	Denmark
Chryssi Mytilineou	Greece
Lise Helen Ofstad	Faroe Islands
Alexei Orlov	Russian Federation
João G. Pereira	Portugal
Mario Pinho	Portugal
Thorstein Sigurdsson	Iceland
Vladimir Vinnichenko	Russian Federation

Appendix 1 is a list of the 2006 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 2000b, 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 (see ICES 2001b, 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, 2002).

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, 2004).

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, 2005).

2.3 Terms of reference and special requests

The terms of reference of the Working Group adopted at the 2005 Annual Science Conference (93rd Statutory Meeting) were as follows (C. Res. 2005/ACFM:2ACFM02):

a) compile an inventory of data sources available on landings and effort of deep-water species, including blue ling, ling, and tusk, by ICES Sub-area, Division or preferable by subdivisions; evaluate the quality of these data;

b) compile the data available from these data sources on the finest scale possible;

c) Update descriptions of deep-water fisheries including mapping out deep water fisheries in preparation for collation of fisheries-based catch and effort statistics using among other data sources VMS information. Provide information on as high spatial and temporal resolution as possible on all current deep-water fisheries in the NE atlantic

d) carry out analytical assessments of ling, red (blackspot) seabream, and roundnose grenadier, and assessments of other species if possible;

e) update the data on length/age at maturity, growth and fecundity and document other relevant biological information on deep-water species;

f) update information on quantities of discards by gear type for the stocks and fisheries considered by this group and make an inventory of deep-water fish community data;

g) Initiate work that will allow the WG to evaluate the effects of the closures introduced in 2005 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. Further, prepare for work at the 2007 meeting of the WG on the appropriateness of the continuation of these, or alternative, area closures in 2007.

h) The Chairs of WGDEC and WGDEEP (Mark Tasker, UK and Paul Marchal, France) will cooperate to ensure that expertise on cold-water corals and on deep-water fishing is available at the meeting.

In addition to these terms of reference, the NEAFC and the EC formulated two special requests, which fell in WGDEEP's field of expertise.

The NEAFC requested ICES to provide, preferably not later than May 2006, information on the spatial and temporal extent of all current deep-water fisheries in the NE Atlantic. ICES is also asked to 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. This information is required to enable NEAFC to develop fishery-based management initiatives. WGDEEP addressed this request in Chapter 34 of this report.

The EC requested ICES to propose key areas/species to be recorded on a dedicated internationally coordinated survey. WGDEEP addressed this request in Chapter 35 of this report.

WGDEEP will report by 23rd May 2006 for the attention of ACFM and the Living Resources Committee.

3 Transversal Issues

3.1 Data availability

3.1.1 Data coordination

At the end of the 1998 meeting of the Study Group species co-ordinators were appointed to collate available data prior to the meeting and forward them to an assessment co-ordinator. In 2006, in order to provide advice on a regional basis, each major stock was investigated separately.

3.1.2 Landings

The quality of landings data has improved over the years for most major species, at least from areas within national jurisdiction. Most landings data for 2004 and 2005 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.

3.1.3 Discards

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

A substantial amount of research has been carried out into deep water discarding, largely as a result of the EC FAIR project (Gordon, 1999), however much of this data has remained unpublished or available only in grey literature sources. Due to the inconsistent format in which the data is presented, it has not been possible to pull it all together in a common reference collection. In order to make this work more accessible, an inventory of these existing data was presented in the 2002 report of WGDEEP (ICES, 2002).

More recently, 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). The preliminary results of these investigations have been presented to WGDEEP, and these are summarised below.

Portuguese long-liners. WD16a presents a preliminary study on Portuguese longline fleet discards. Onboard sampling was used to collect discard data on co-operative commercial vessels and it started in mid 2005. Once this sampling didn't reach a year of collected data, the results obtained can't be raised to all fleet and do not reflect all longline fishing practices. Thus, one can infer that longline discards seem to be insignificant in relation to total catch.

French trawlers. Data from the mandatory French sampling programme have been made available for 2004 and 2005. The discard proportion in catches of roundnose grenadier and of all species appears to increase with depth in 2004 and 2005. The mean length of roundnose grenadier discarded is of 13 cm, for all depth classes (Figure 7.5.2). In addition to the regular EU sampling program, the French industry has provided working documents describing the distribution of discards by depth strata. The Working Document provided this year is given as WD12a.

Spanish fleet. Since the start of Hatton bank bottom trawl commercial fishery, monitoring was carried out by Spanish independent scientific observers on board, under the management of the IEO-Vigo. The observers provide data and samples according to IEO protocol. During 2005, 7.4 % of the total fishing days were sampled. Time-series data (2002-2005) of the raised length composition in the discards for roundnose grenadier and smoohhead, have been provided to the WG.

3.1.4 Fishing effort

It continues to be a major problem for the assessment of stock status that data, particularly on fishing effort, are limited or of relatively poor quality. Fishing effort data are often derived from log-books, the reliability of which is not consistent across fleets. In some countries, fishing depth is recorded as a mandatory field. However, the WG did not get access to this information.

The situation however improved a little this year, as a number of EU countries could have access to and make use of fine-scale effort data, in accordance with their obligations under EC regulations 2347/2002 (regulating deep water fisheries) and 1639/2000 (minimum and extended sampling programs). These data were made available for recent years and samples of fishing trips, and including information on fishing depth.

This year, some members of WGDEEP had access to VMS data for Portuguese long-liners, and were able to analyse CPUE based on these (WD16b). The French industry prepared a Working Document (WD12b) on French fishing effort based on VMS data. However, the information presented in WD12b was aggregated at the scale of the ICES rectangle, and was therefore seen as of little utility for the purpose of WGDEEP.

Despite repeated requests and recommendations from ICES, it has to be recognised that the members of the WG have so far had very limited access to VMS data. As long as it is the case, WGDEEP will be unable to derive reliable fishery-based abundance indicators, and to evaluate the impact of management strategies, including area closures (TORg, Chapter 33).

WGDEEP also noted that, although VMS data are still mostly unavailable, some thoughts should urgently be given on how best to use them when WG members are eventually able to access them (WD16b). The WG was of the opinion that the approach for this issue be coordinated by ICES.

3.1.5 Biological parameters

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

BLUE LING (MOLVA DIPTERYGIA)

VARIABLE	VALUE	SOURCE/COMMENT
Longevity (years)	Approx. 30	Bergstad and Hareide 1996, Magnusson *et al.* 1997
Growth rate, K	No data	
Natural mortality, M	around 0.15	Based on review by SGDEEP 2000
Fecundity (absolute)	1-3.5 millions	Gordon and Hunter 1994
Length at first maturity	♂ 75-80 cm ♀ 80-85 cm	Moguedet 1988, Magnusson *et al*. 1997
Age at first maturity	♂ 6-7 ♀ 7-8	Moguedet 1988, Magnusson *et al*. 1997

*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	

GREATER SILVER SMELT (ARGENTINA SILUS)

VARIABLE	VALUE	SOURCE/COMMENT
Longevity (years)	~35	Bergstad 1993 (Skagerrak, North Sea)
Growth rate	Male 0.20 Female 0.17	Bergstad 1993 Bergstad 1993
Natural mortality, M	No data	
Fecundity (absolute)	6-30 thousand	Wood and Raitt 1968
Length at first maturity	Male 36.2 cm Female 37.2 cm	Magnusson, 1988 Bergstad 1993, Gordon, 1999
Age at first maturity	6-9 y 6-9 y 3-10 y in VI/VII	Magnusson, 1988 Bergstad 1993, Gordon, 1999 Heessen & Rink 2001
L-W relationship	Males: W = - 6.557 L3.459 Females:W = - 4.889 L3.017	Irish data, Division Via (ICES C.M. 2002/ACFM:16)

ORANGE ROUGHY (HOPLOSTETHUS ATLANTICUS)

VARIABLE	VALUE	SOURCE/COMMENT
Longevity (years)	130	(Allain and Lorance, 2000; Francis and Horn, 1997)
	187	Talman et al. (WD, 2002)
Growth rate, K	0.04-0.05	(Annala and Sullivan, 1996; Tracey and Horn, 1999)
Natural mortality, M	0.04	Annala (1993)
	0.025	Based on data from Talman (WGDEEP, 2002)
Fecundity (absolute)	28000-385000 ov./ind	Marine station of Concarneau (France)
	20,000 – 244,578 ov/ind	Minto and Nolan (2003)
Length at first maturity	52 cm	Berrehar, DuBuit and Lorance (unpublished data)
	36 cm SL	Minto and Nolan (2003)
Age at first maturity	?	

ROUNDNOSE GRENADIER (CORYPHAENOIDES RUPESTRIS)

VARIABLE	VALUE	SOURCE/COMMENT
Longevity, years	60	Bergstad (1990), Skagerrak
		Kelly et al. (1997), Rockall Trough
		Lorance et al. (2001) West of British Isles
	54	Allain & Lorance (2000), West of British Isles
Growth rate, K	0.11 M	Bergstad (1990), Skagerrak
	0.10 F	Bergstad (1990), Skagerrak
	0.13 M	Kelly et al. (1997), Rockall Trough
	0.10 F	Kelly et al. (1997), Rockall Trough
	0.06 M	Allain & Lorance (2000), West of British Isles
	0.06 F	Allain & Lorance (2000), Southern Brittany
	0.04	Lorance et al. (2003), West of British Isles
Natural mortality, M	0.1	Lorance et al. (2001a,b) West of British Isles
Fecundity (absolute)	23 000 (1)	Allain (2001), Rockall Trough
	11083 – 55 175 (2)	Kelly et al. (1996) Rockall Trough
	8 700 – 56 200 (1)	Alekseev et al. (1992), Reykjanes and Mid-Atlantic Ridge
	12 000 – 35 000 (1)	Muus & Nielsen (1999), Icealnd
Length at first maturity, cm (PAL – preanal length, TL – total length)	9 (PAL)	Bergstad (1990), Skagerrak, averaged values given for males and females
	11.5 (PAL)	Allain (1999), Rockall Trough
	11 (PAL)	Durán Muñoz & Román (2001) Hatton Bank. Females
	45-62 (TL)	Gerber et al. (WD, WGDEEP 2004), Mid-Atlantic Ridge
	45.6 (TL) M	Kelly et al. (1996) Rockall Trough
	54.5 (TL) F	Kelly et al. (1996) Rockall Trough
Age at first maturity, years	9	Bergstad (1990), Skagerrak
	14	Allain (1999), Rockall Trough
	9-11	Kelly et al. (1996) Rockall Trough

(1) species assessed as a batch spawner, the number of batches per year being unknown,

(2) species assessed as a determinated spawner,

M – males,

F – females.

Length-weight Relationship

REFERENCE	NO INDIVIDUALS	A	B	R^2	LENGTH RANGE (CM)	WEIGHT RANGE (G)
Durán Muñoz & Román (2001	22642			0.9504	3.5-28	15-3268
BIM (WD, WGDEEP 2002)	297	0.299	2.796	0.8696	5.5-22.5	34-2000
Vinnichenko and Khlivnoy (WD, WGDEEP 2004)	91	0.178	3.019	0.974	3-18	7-1010

BLACK SCABBARDFISH (APHANOPUS CARBO)

VARIABLE	VALUE	SOURCE/COMMENT
Longevity (years)		
Max Age (year)	8 (whole otolith) 32 (sectionned otolith) but with high inconsistency on age reading	Morales-Nin and Carvalho 1996 Kelly et al., 1998
Linf (cm)	132.6	Anon, 2000
Growth rate, K	0.177	Anon, 2000
Natural mortality, M	0.17	Martins *et al.*,1989
Fecundity (absolute)		
Length at first maturity	110 cm long-liners, subarea IX 102.8 cm (Total length)	Figueiredo and Bordalo 2002 Anon, 2000; Figueiredo et al. 2003 a
Age at first maturity	7	Anon, 2000
Spawning season(s)	Sept. – Dec. (Madeira) Set - Febr. (Madeira)	Carvalho, 1988; Anon, 2000 Figueiredo at al., 2003 a
Spawning time in relation to size of spawners	Larger individuals undertake spawning later in the spawning season (Jan - Febr)	Figueiredo at al., 2003 a
Female growth parameters	Immature Linf (cm) 138.3(s.e. 8.52); k 0.285(s.e. 0.013); t0 1.74 (s.e0.18) Mature Linf (cm). 130.5 (s.e2.150); k 0.2606(s.e 0.0026); t0 0.374(s.e 0.0036)	Figueiredo et al., 2003 b

RED (=BLACKSPOT) SEABREAM (PAGELLUS BOGARAVEO)

VARIABLE	VALUE	SOURCE/COMMENT
Longevity (years)	16	Menezes et al., 2001
Growth rate, K	♂ 0.17 ♀ 0.102 ♂♀ 0.169	Menezes et al., 2001 Sobrino and Gil (2001)
Natural mortality, M		
Fecundity (absolute)	290000-1125000 25712-1821188	Krug (1998) Gil & Sobrino, 2001
Length at first maturity (cm)	♂ 30.1 ♀ 35.1 ♂ 26.2 ♀ 29.2	Strait of Gibraltar, Gil & Sobrino, 2001 Azores, Mendoça et al., 1998
Age at first maturity	♂ 3 ♀ 4 ♀	Azores, Mendoça et al., 1998 Gil *et al.* , WD20 (WGDEEP 2006)

GREATER FORKBEARD (PHYCIS BLENNOIDES)

Variable	Value	Source/comment
Longevity (years)	15?	Gordon (FAIR) 1999, Sub-t. 5.12, Doc.55
	14	Casas & Piñeiro, 2000
	♂ 7	Kelly, 1997
	♀ 9	
Growth rate, K	♂ 0.217	Casas & Piñeiro, 2000
	♀ 0.087	
	♂ 0.43	Kelly, 1997
	♀ 0.39	
Natural mortality, M		
Fecundity (absolute)		
Length at first maturity	♂ 31 cm	Kelly, 1997
	♀ 32 cm	
Age at first maturity		

ALFONSINOS/GOLDEN EYE PERCH (BERYX SPP)

Beryx splendens

Variable	Value	Source/comment
Longevity (years)	11	Azores, Krug et al.,1998
Growth rate, K ♂ ♀	0.134 0.141	Azores, (Menezes, et al., 2001)
Natural mortality, M	No exact data available.	
Fecundity (absolute)	millions	No exact data available.
Length at first maturity ♂ ♀	22.9 23	Azores, Mendonça et al., 1998
Age at first maturity ♂ ♀	2 2	Azores, Mendonça et al., 1998

Beryx decadactylus

Variable	Value	Source/comment
Longevity (years)	13	Azores, Krug et al.,1998
Growth rate, K ♂ ♀	0.11 0.165	Azores, (Menezes, et al., 2001)
Natural mortality, M	No exact data available.	
Fecundity (absolute)	millions	No exact data available.
Length at first maturity ♂ ♀	30.3 32.5	Azores, Mendonça et al., 1998
Age at first maturity ♂ ♀	4 4	Azores, Mendonça et al., 1998

MEDITERRANEAN STOCKS AND SPECIES

Variable	RED SEABREAM (*PAGELLUS BOGARAVEO*)	WRECKFISH (*POLYPRION AMERICANUS*)	BLUE MOUTH (*HELICOLENUS DACTYLOPTERUS*)	SILVER ROUGHY (*HOPLOSTETHUS MEDITERRANEUS*)	GREATER FORKBEARD (*PHYCIS BLENNOIDES*)
Longevity (years)					
L∞	63.38 (otoliths) Petrakis et al., 2001 ♂ 54.21 (scales) Chilari et al., 2006 ♀63.38 (scales) Chilari et al., 2006	141.04 (Machias et al., 2001)	37.05 (Mytilineou, unpubl. data)	36.17 (Mytilineou, unpubl. data)	57.68 (Petrakis, unpubl.data)
Growth rate, K	0.07 (otoliths) Petrakis et al., 2001 ♂ 0.06 (scales) Chilari et al., 2006 ♀ 0.07 (scales) Chilari et al., 2006	0.0837 (Machias et al., 2001)	0.093 (Mytilineou, unpubl. data)	0.112 (Mytilineou, unpubl. data)	0.168 (Petrakis, unpubl.data)
Natural mortality, M		0.170 (Z= 0.491) (Machias et al., 2001)			0.32 (Petrakis, unpubl.data)
Fecundity (absolute)		Relative: 80000-150000 eggs/Kg (Machias et al., 2001)	103,143 (Terrats, 2003)	10,778 (Terrats, 2003)	
Reproduction period	Winter Chilari et al., 2006	December-March (Machias et al., 2001)	January-March (Terrats, 2003)	Mach-July (Terrats, 2003)	Winter (Petrakis, unpubl.data)
Length at first maturity		70-80 cm (Machias et al., 2001)	23.8 (Terrats, 2003)	16cm (Terrats, 2003)	
Age at first maturity					

3.1.6 Abundance indices

3.1.6.1 Research surveys

In the 2001 report of WGDEEP a document discussing the applicability of various surveys for obtaining relevant data for assessments of deep-water fishes was provided. Information was also given on surveys being conducted by different countries. The following is a shortened version of the description of national surveys.

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.

Also, annual bottom trawls surveys are carried out in the Cantabrian and Galicia sea (ICES VII and IX) and in the Gulf of Cadiz (ICES IXa south), from 1983 and 1992 on, respectively. More recently, in 2001, an annual stratified random bottom trawl survey has been conducted in ICES VII (Porcupine Bank). It is a multispecies survey that samples depths from 190 to 800 meters in two geographic sectors and three depth strata (<200, 200-400 and 400-800 in the first two surveys and <301, 301-450 and 451-800 m in the 2003 one). The most abundant species are Blue whiting (*Micromesistius poutassou*) and Argentines (*Argentina silus*). Information regarding these surveys are available in the ICES IBTS Working Group Reports and WDs.

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.

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, and estimates of biomass and abundance and length frequencies on roundnose and roughhead grenadier were provided for 2003. Further, information on sex, length and weight on the very few tusk, ling, smoothheads, argentines and different species of elasmobranchs that were recorded during the survey. The utility of this survey for assessment purposes cannot yet be evaluated. No survey information was available for 2004 and 2005.

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.

This survey has been used for assessing blue ling in Va.

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).

This survey has been used for assessing red seabream in X.

Portugal (mainland)

Portugal carries out bottom trawl surveys more or less regularly in Division IXa waters shallower than 900 m. Most of the catches are composed of species which have yet relatively low or no commercial value. The survey does not provide data for assessment of e.g. black scabbardfish.

Ireland

The Marine Institute began a deepwater research survey programme to the west of Ireland in 1993. To date ten surveys have been carried out, five each by trawl and longline. The survey programme was initiated to obtain samples of deepwater fish for biological analysis. The surveys have also produced catch per unit effort (CPUE) and discarding information.

One year after the ICES triennial mackerel and horse mackerel egg survey, a further egg survey was carried out to assess whether significant spawning occurs outside the ICES standard area. 173 ICES rectangles were sampled on the Porcupine, Rockall and Hatton Banks, the Rockall Trough and the Faeroes waters using standard methodology for the collection of mackerel and horse mackerel eggs. This survey was organised to assess if the current standard grid was covering the distribution area of mackerel. The survey also provided extensive information on deepwater fish eggs and larvae from Rockall and Hatton Banks, including ling, tusk, greater argentine and greater forkbeard (Dransfeld and Dwane 2004).

The Marine Institute carried out an Orange Roughy survey along the Porcupine Bank in February 2005. It was carried out by two vessels, the *RV Celtic Explorer* and the *MFV Mark Amay*. The *Celtic Explorer* would carry out all the acoustic and oceanographic operations connected with the survey, while the *Mark Amay* would carry out fishing operations on the peaks. WD13b details the fishing operations on board the *Mark Amay.* The full explanation of the materials and methods used on board the *Celtic Explorer*, and the objectives of the survey, are presented in WDs13a, c-e.

UK (Scotland)

A deepwater trawl survey of the continental slope to the west of Scotland has been carried out biennially 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 ranges from 300-1900m. 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.

Russian Federation

In May – July 2003 the complex survey of roundnose grenadier stock in the mid-Atlantic Ridge area was carried out by R/V *Atlantida*. Estimation of grenadier biomass was fulfilled with the acoustic method on 26 seamounts between 47–58° N in the depth range 900 -1400 m. A mesoscale hydrological survey was conducted and also micro-surveys at individual seamounts, total number of stations 59. Data on distribution and behaviour of grenadier were collected. For biological sampling 42 control hauls with the pelagic trawl were made. The results of the survey were presented in WGDEEP04. As the subject of estimation was only pelagic aggregations of grenadier, it should be considered that the survey did not cover the full range of the stock distribution.

Data on biology and distribution of young roundnose grenadier were collected in May-July 2003 during the redfish trawl-acoustic survey of R/V “Smolensk” in the Irminger Sea, as well as during works on the national program of investigations of redfishes in the areas of the West Iceland and East Greenland. Results of the observations show that juvenile roundnose grenadier are occurred not only on the shelf, continental slope and seamounts, but in the pelagic waters of the open ocean as well. The main results of this investigation were presented in WGDEEP04.

3.1.6.2 Commercial CPUE

In the absence of better data, the evaluation of abundance trends of the deepwater species relies to a high degree on CPUE data from commercial fisheries. Few relevant survey series are available. Questions are often raised concerning the quality of the commercial CPUE series, and there is frequently doubt as to whether trends in CPUE reflect stock dynamics or shifts in fishing regimes. Also, several key series have changed or been interrupted because it has been impossible to update the estimates in a consistent manner.

The latter has been the case for the particularly important French CPUE series previously used by the Working Group in attempts to evaluate abundance of a number of species fished off the West of British Isles. For these species, assessments in 2000 were largely based on the catch per unit of effort data series from French reference trawlers, i.e. the fleet landing a major proportion of deep-sea fish in these areas. Due to changes in formatting of the French commercial database, directed effort data could not be extracted for 1999 and 2001, and thus many assessments could not be conducted in the 2002 meeting. The only updated effort series available from France in 2002 was the total effort directed at all deep-sea species. In 2004, an alternative approach was adopted to derive a full CPUE time series for French trawlers (see Section 4.1.2 of the WGDEEP04 report for a full description of the methodology). However, the WG was of the opinion that the derived CPUE series were still reflecting a combination of shifts in stock abundance and fishing strategy, such as changes of fishing grounds (at a rectangle scale) or within a rectangle of working depth.

In 2006, investigations have been carried out to highlight, within CPUE signals, the main feature of the biomass evolution. ‘Reference zones’, split into ‘Continental slope’ and ‘Other areas’, including the same set of ICES rectangles throughout the whole time series, have been identified and CPUE index calculated in each of them. This procedure was aimed at calculating CPUE in a similar way to abundance indices derived from surveys, i.e. over clearly defined areas. For comparison purposes, CPUE were also calculated for ‘New grounds’, which were only visited in recent years, and which largely contribute to the current deep species landings. A full description of the analysis underlying the derivation of the CPUE series used at this meeting is given in WD11.

These new CPUE series proved useful in describing the fisheries dynamics for the stocks fished off the West of British Isles (see e.g. Section 20). The WG also observed that the blue ling CPUE series were consistent across reference areas, and that the CPUE signal was robust to sequential fishing which have occurred in relation to that stock. Therefore, the WG suggested that a combined areas CPUE could be regarded, in the absence of survey indices, as a first proxy abundance index to attempt a preliminary assessment of that stock (Section 7.2). The CPUE series of roundnose grenadier and black scabbardfish were inconsistent across reference areas. These contrasted trends are likely to reflect a difference in fishing regimes in both areas, possibly combined with distinct stock dynamics. The WG also noted that the reference areas included large depth variations (Figure 7.5.9), and also that there are evidence that sequential fishing may have occurred over this depth range. For instance, the highest roundnose grenadier CPUE were recorded in 2005 deeper than 1400 m (Table 7.5.11), while the peak was at 800m in earlier years (Ehrich 1983). Therefore, the WG decided not to use the French CPUE series for assessing the stocks of roundnose grenadier and black scabbardfish off the West of the British Isles (Sections 7.5 and 7.6). The WG recommends that future investigation be carried out to refined CPUE series, e.g. using a reference fleet and standardising these series using some GLM approach.

A number of investigations were carried out by WG members to derive fishery-based abundance indicators, especially for longliners. Norwegian CPUE were thus derived for ling, tusk and blue ling, based on a reference long-liners fleet and log-book data for the entire high-seas long-liners fleet (see WD3 for full details). These data are referring to the period 2000-

2005, and were combined with data from 1972-1996 presented to earlier WGDEEP sessions. Standardised CPUE were calculated for the Azorian long-liners harvesting red seabream. The CPUEs of Portuguese long-liners and of Faeroese long-liners were also considered in relation to the assessments of black scabbardfish (VIII, IX) and ling (Vb) respectively.

A generalized linear model (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 year, month, boat class and target were used to adjust the nominal catch per unit of effort. Once the effects of the explanatory variables 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). The standardized CPUE has been used for assessing red seabream in X.

3.1.7 Stock structure

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

3.2 Methods and software

This section summarises the methods and software used by the Working Group in recent years.

3.2.1 Methods

3.2.1.1 Catch curve analysis

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

3.2.1.2 Depletion models

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

3.2.1.3 Production models

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

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

3.2.1.4 VPA analysis

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

3.2.1.5 Stock reduction models

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

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

The method provides an estimate of virgin biomass (B_0) and current biomass from which a depletion ratio can be calculated. The stock reduction model developed by Francis also provides an estimate of the annual mean catch that can be taken, consistent with a 10% probability of spawning stock biomass falling below 20% of virgin SSB. In New Zealand and Australian fisheries this catch is termed the maximum constant yield (MCY). Given that age of recruitment and age of maturity are reasonably similar for some species e.g.blue ling, 20% of virgin SSB can be considered to be broadly equivalent to 20% of virgin exploitable biomass. It should be possible, therefore, to estimate a sustainable constant catch broadly consistent with a high probability of maintaining exploitable biomass above the limit reference level for deep-water stocks in the ICES area.

3.2.1.6 Catch Survey Analysis (CSA)

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

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

where:

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

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

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

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

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

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

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

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

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

where:

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

η and δ : normally distributed random variables.

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

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

3.2.1.7 *Ad hoc* methods

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

3.2.2 Software

Assessment software used at recent Working Groups includes CEDA (Catch Effort data analysis, produced by MRAG Ltd, 27 Campden Street, London W8 7EP, UK.) ASPIC, PMOD (stock reduction program), the Lowestoft VPA package,Winbugs (version 1.4 http://www.mrc-bsu.cam.ac.uk/bugs/winbugs) and CSA.

3.3 Biological reference points and Harvest Control Rules

3.3.1 Biological Reference Points

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

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

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

Where U is the index of exploitable biomass.

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

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

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

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

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

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

1. The thresholds should be higher than those suggested for category 2 species (respectively 50% and 20% of the virgin biomass for U_{pa} and U_{lim}), and their values should be decided by managers;
2. The thresholds should be set provisionally at 75% and 50% of the virgin biomass for U_{pa} and U_{lim} respectively, to accommodate the PA approach in a data poor context;

The WG could not agree on which option to choose and to date no guidance from managers or ICES (from ISGMAS, for example) has been received. At the 2006 WG, the WG again could not agree a way forward and decided to request advice from ACFM on this issue. The WG recognized that it is desirable that BRPs based on SSB and F levels, instead of CPUE levels, should be introduced as more reliable stock assessments become available.

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

3.3.2 Harvest Control Rules

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

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

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

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

4 Stocks and fisheries of Greenland and Iceland Seas

4.1 Fisheries Overview

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 2005, 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 fising for pelagic fishes during different time of the year.

The total catch in Icelandic waters in 2005 amounted to 1.8 million tonnes where pelagic fishes amounted to 1.2 million tonnes, but deep sea species amounted to around 16000 tonnes (Figure 4.1.1; Table 4.1.1).

Total of 728 vessels reported landed of deep sea species in 2005, from less than 10 kg. to more than 700 t, as can be seen in the table below:

2005	Ling	Blue ling	Tusk	Gr. silver smelt
No vessels	554	208	570	41
max catch	173.1	69.9	327.5	1141.4
min catch	< 0.1	< 0.1	< 0.1	< 0.1
Mean	7.8	7.3	6.2	112.1

4.1.1 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 1000 tonnes. In 2005 around 6700 tonnes of deep water species were caught in bottom trawl, whereof 4400 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 2005, compared with 2004. Table 4.1.1 gives the catches the most important deep-sea species taken by different gears in recent years and Table 4.1.2 gives the total landings of deep-sea species from sub-division Va since 1988.

4.1.2 Technical interactions

Table 4.1.1 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 aby 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 saith 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. Targetted 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 entierly caught as a bycatch, specially after the closure of known spawning aeras for blue ling in 2003.

Some of the species caught in Icelandic waters are caught in fisheris targeting only one species, with very little bycatch. An exsample 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 importand 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 4.1.2 and 4.1.3).

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 4.1.4 – 4.1.6. In general, the trawlers operate further away from the shore than the longliners and the gillnetters.

4.1.3 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.

4.1.4 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 4.1.5). Inspectors from the Directorate of Fisheries supervise these closures in collaboration with the Marine Research Institute. In 2005, 85 such closures took place.

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

Table 4.1.1. Technical interactions in Division Va.

year	2005

Sum of Kg		species									
main gear	ICES area	ARU	BLI	BSF	FOR	LIN	ORY	RNG	SBR	USK	ZZZ
bottom trav	Va		55643			1737		83		8192	
lines	Va		19615		466	179890				303395	

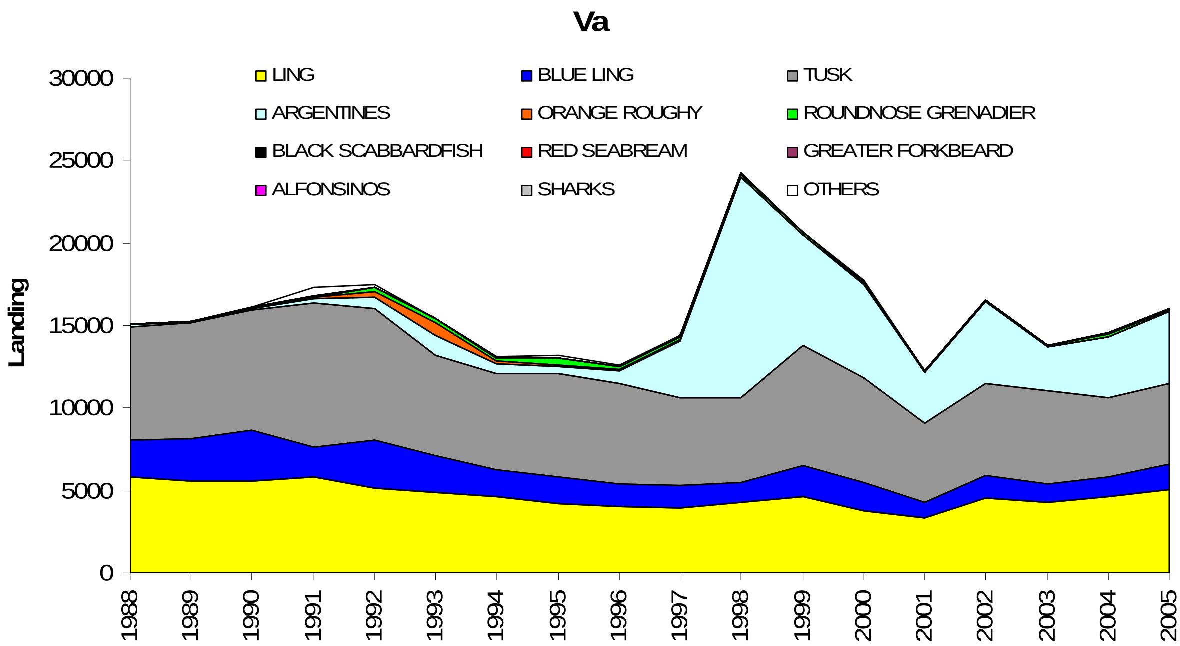

Figure 4.1.1. Fishery of deep-sea species in sub-Division Va since 1988, by species.

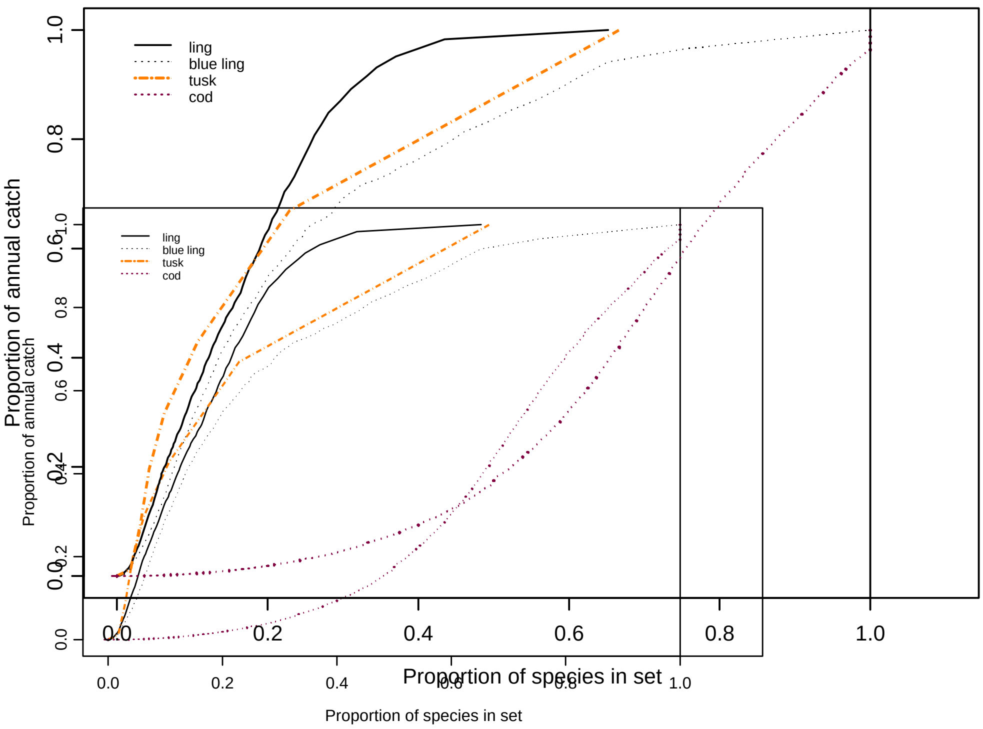

Figure 4.1.2. Cumulative plot for long line in 2005. An example describes this probably best. Looking at the figure above it can be seen from the solid line that 50% of the catch of ling comes from sets where tusk is less than 15% of the total catch while only unsignificant % of the catch of cod sets 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.

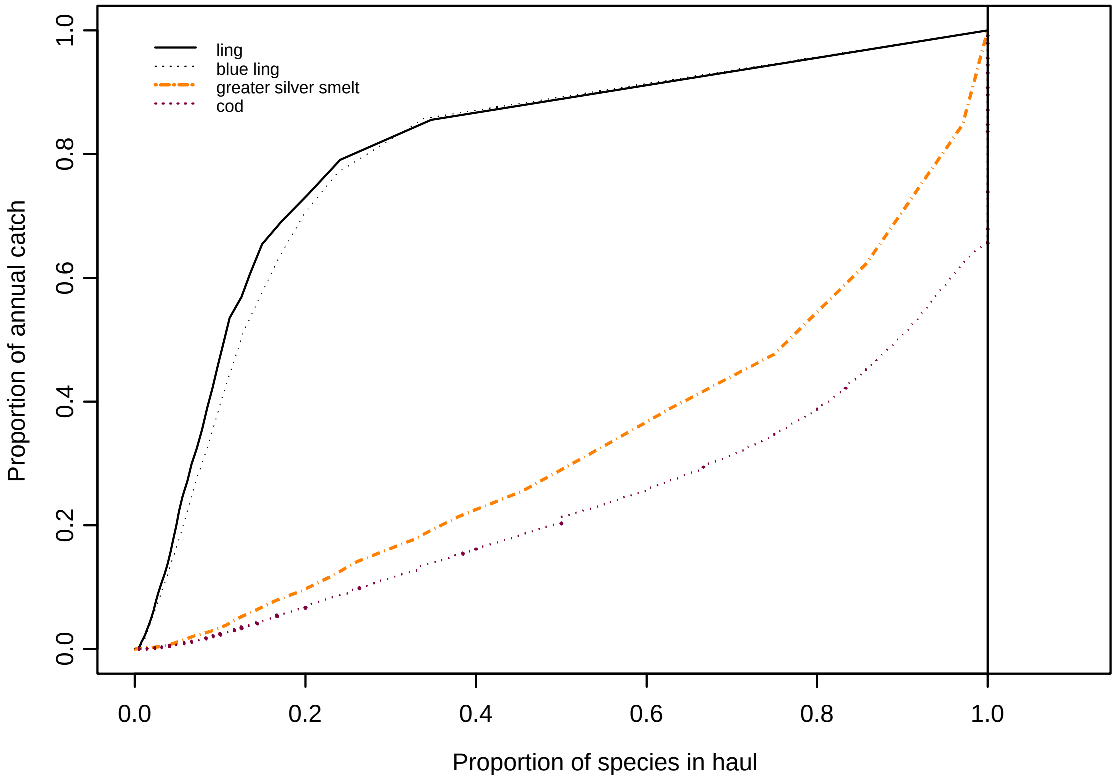

Figure 4.1.3. Cumulative plot for bottom trawl in 2005. See figure 4.1.2 for explaination.

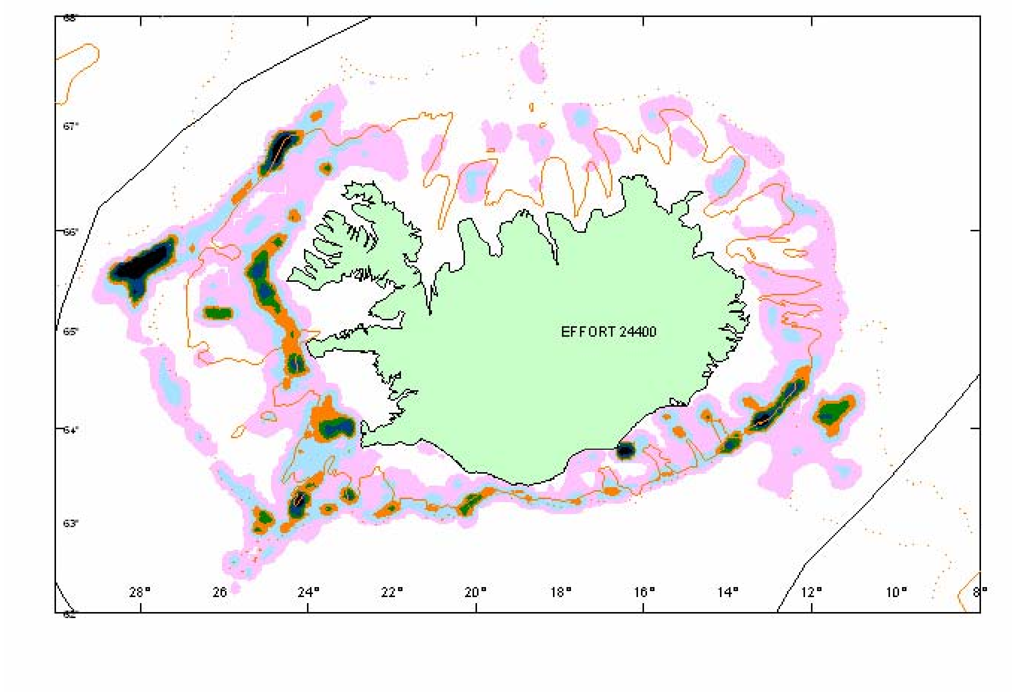

Figure 4.1.4. Effort of the trawler fleet in 2005. The dark colours show the areas of the greatest fishing effort to be off the southeast to the west coast and off Northwest Iceland.

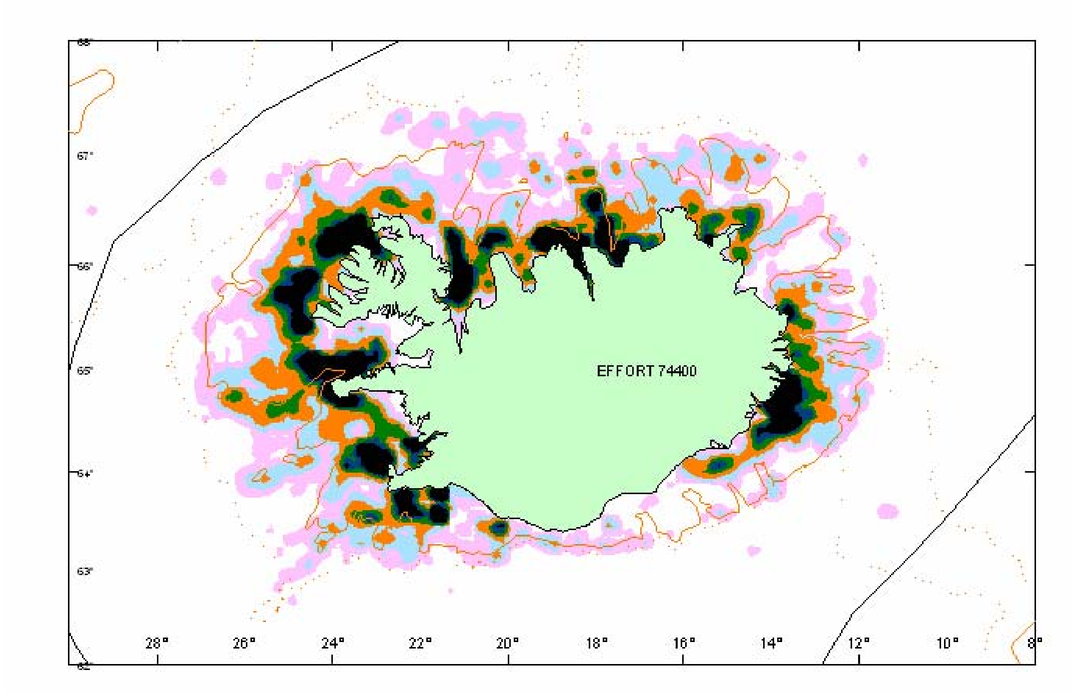

Figure 4.1.5. Effort in the longline fleet in 2005. The dark colours show the areas of the greatest fishing effort to be off the northwest and west coast but fishing is also concentrated along the entire southwest and south coast. The main targeted species for longline fishing are cod, haddock, catfish and in few instances tusk.

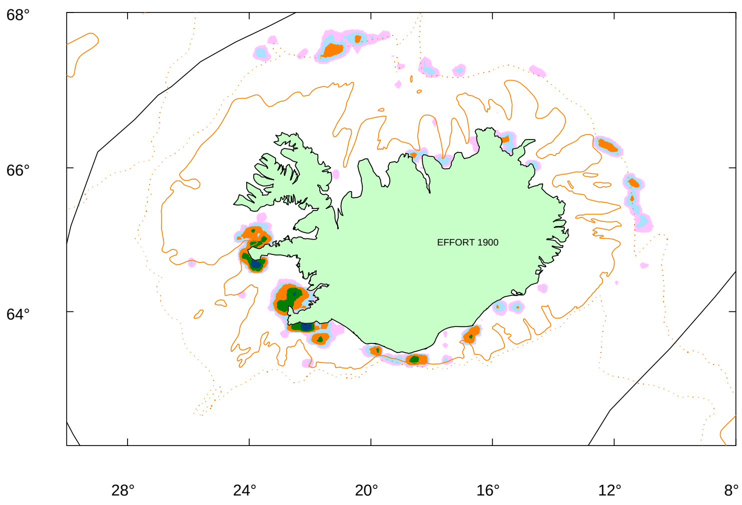

Figure 4.1.6. Effort in the Icelandic gillnet fleet in 2005. The dark colours show the areas of the greatest fishing effort to be off the southwest and west coast. The main targeted species for gillnet fishing are cod, haddock and Greenland halibut.

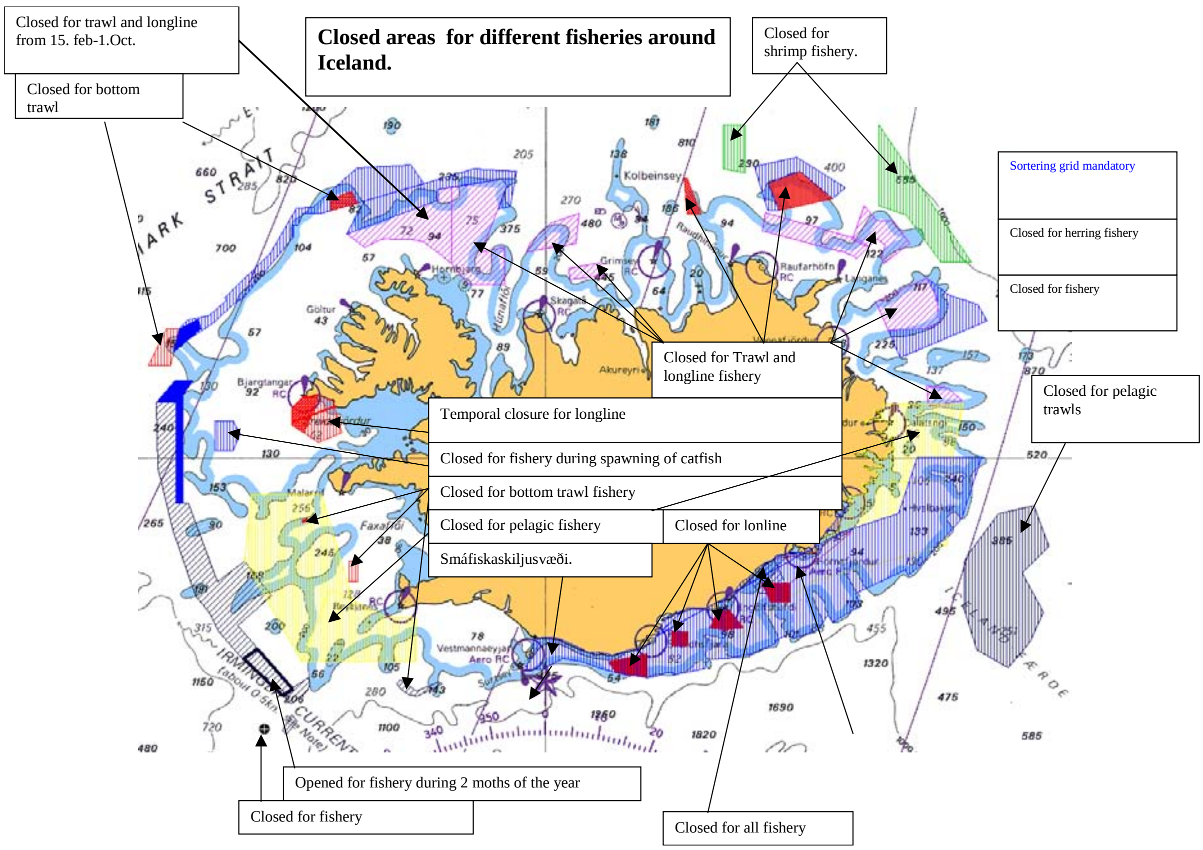

Figure 4.1.7. Overview of closed areas around Iceland. The boxes are of differnt nature and can be closed for differnt time period and gear type.

Table 4.1.1. Overview of the deep-sea fishery in Icelandic waters (Va) in 2005 by gear type (t).

Species and gear		Landings (tonnes)
Ling	Bottom trawl	989
	Danish seine	252
	Gillnet	515
	Hook	8
	Long-line	2801
Ling Total		5065
Blue ling	Bottom trawl	1295
	Danish seine	118
	Gillnet	9
	Long-line	134
Blue ling Total		1570
Tusk	Bottom trawl	113
	Gillnet	19
	Hook	19
	Long-line	4606
Tusk Total		4824
Greater silver smelt	Bottom trawl	4401
Greater silver smelt, Total		4401

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

Va	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
	ALFONSINOS (Beryx spp.)																		
	ARGENTINES (Argentina silus)	206	8	112	247	657	1255	613	492	808	3367	13387	6704	5657	3043	4960	2683	3645	4401
	BLUE LING (Molva dypterigia)	2171	2533	3021	1824	2906	2233	1632	1635	1323	1344	1154	1877	1711	941	1377	1158	1204	1570
	BLACK SCABBARDFISH (Aphanopus carbo)							1			1		9	18	8	13	14	19	19
	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
	MORIDAE																		
	ORANGE ROUGHY (Hoplostethus atlanticus)				65	382	717	158	64	40	79	28	14	68	19	10	1	28	9
	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
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	2	4	7	48	210	276	210	398	140	198	120	129	67	57	60	57	181	76
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)																		
	SHARKS, VARIOUS		31	54	58	70	39	42	45	65	70	87	45	45	57	47	62	66	54
	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	4836	4824
	WRECKFISH (Polyprion americanus)																		

4.2 LING (*MOLVA MOLVA*) IN DIVISION Va

4.2.1 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's-1970's, vessels from other nations caught more than 50%. The fishing grounds in 2000, 2003 and 2005, as recorded in logbooks, are shown in Figure 4.2.1.

4.2.1.1 Landings trends

In 1950's – 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 3000 and 7000 t since then. Since 1980, the catches have been between 5 200 t and 3 200 t, lowest in 2002. (Tables 4.2.0 and 4.2.1). In 2005, total of 4306 tonnes were landed by 554 Icelandic vessels, whereof 2044 tonnes with logline, 515 tonnes with gillnets and 987 tonnes with bottom trawl. In addition to above mention landings, there are reported 759 tonnes of ling in Icelandic waters taken by Faroe Island & Norwegian vessels. The preliminary total international landings in 2005 amounted therefore to 5 065 t.

4.2.1.2 ICES advice

The latest advice is from ICES ACFM in October 2005.

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

4.2.1.3 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 2005 – 31. August 2006 was set to 4500 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 average catch of vessels from Norway and Faroe Island have been around 550 tonnes in last 5 years.

4.2.2 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.

4.2.3 Data available

4.2.3.1 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.

4.2.3.2 Length compositions

Table 4.2.2 gives the overview of measured fishes in Va by gear type and surveys. The length distributions from the catches and the Icelandic spring survey are shown in Figure 4.2.2 and figure 4.2.4, respectevely.

4.2.3.3 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.

4.2.3.4 Weight at age

No data available

4.2.3.5 Maturity and natural mortality

No data available

4.2.3.6 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 cover the most important distribution area of ling. Figure 4.2.3 shows the trend in the fishable biomass of ling. Number of stations with the species differs from year to year. Survey length distributions of ling are shown on Figure 4.2.4.

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 4.2.6 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 4.2.3).

4.2.4 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.

The survey index indicates a decrease in the fishable biomass since the survey started in 1985 until 2001, but since then the index has increased significantly. The index of fishable stock of ling is now similar as it was in 1985 after a steep increase in recent surveys. This increase is also confirmed by the Icelandic autumn survey which has been conducted in October since 1996 (Figure 4.2.5), with same design as the March survey but extends down to 1200 m (430 stations).

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 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.

4.2.5 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 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.

4.2.5.1 Management considerations

The status of the ling stocks are uncertain but there are signs of increases in indices of abundance from surveys. 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 series from the groundfish survey, for the years 1985 to 2006, shows a rather clear icreasing trend since 2000-2001. According to the survey data, the stock has started to recover from it’s low level in 1995-2000 and is now comparable with the beginning of the survey index of the March survey in 1985.

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 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.

Table 4.2.0. 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	2864	117	1		**3346**
2002		1629	0	2844	45	0	0	**4518**
2003		565	2	3587	108	2	0	**4264**
2004		739	1	3726	139			**4605**
2005*		645	1	4306	180			**5132**

*Preliminary.

Table 4.2.1. 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	3 726	744	4 470
2005[1)]	4 306	750	5 065

[1)] *Provisional figures.*

Table 4.2.2. 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	/	/	/	512 / 136	/	/	/

Table 4.2.3. Effort and cpue in ling as calculated from the Icelandic long-line logbook data. 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	7019	29.8
2005	7355	30.8

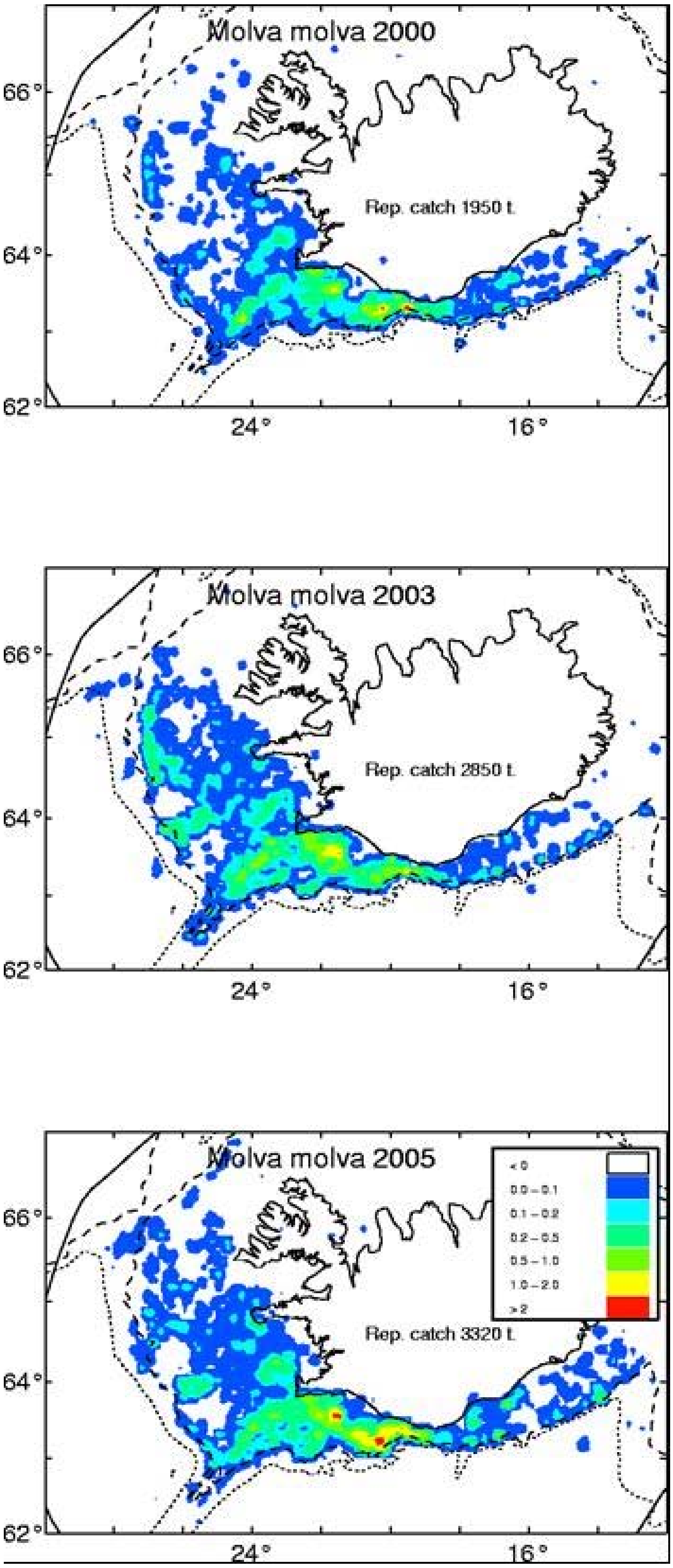

Figure 4.2.1. Ling. Icelandic fishery in 2000, 2003 and 2005 as reported in the logbooks. All gear types combined.

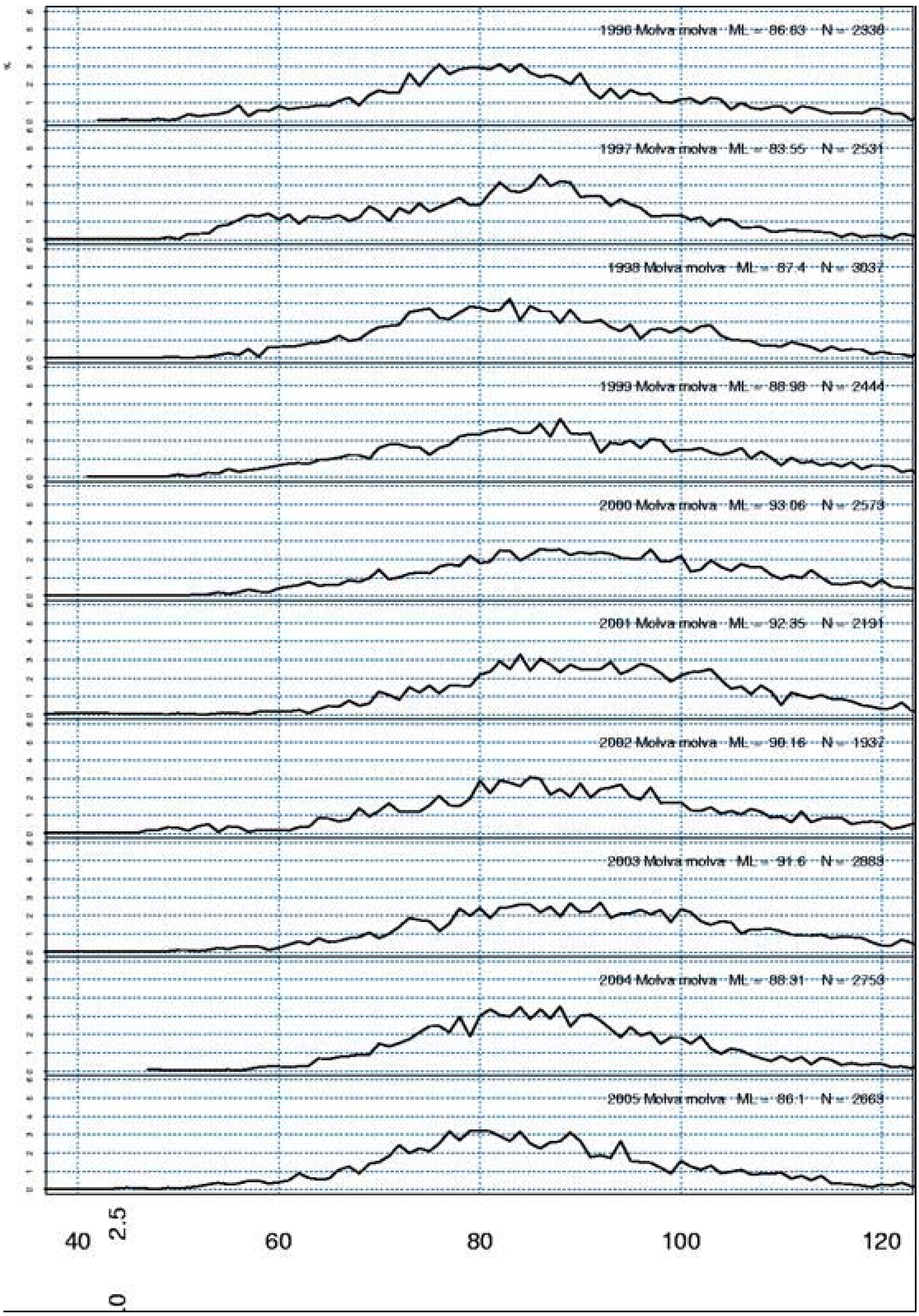

Figure 4.2.2. Length distribution of ling in the Icelandic catches since 1996. The number of measured fishes and mean length is also given.

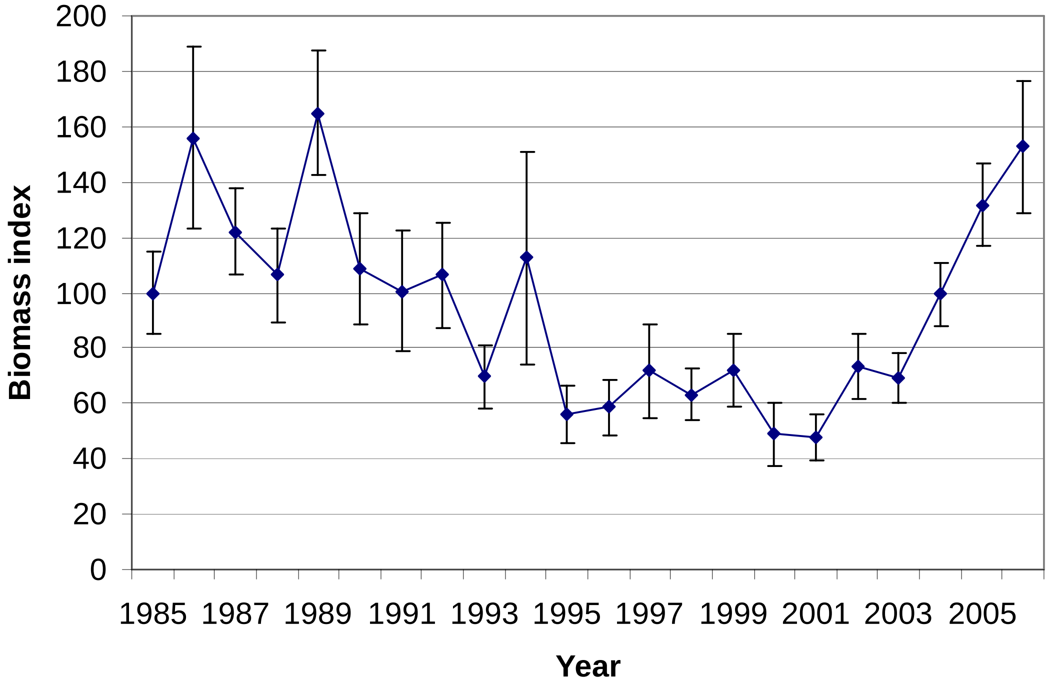

Figure 4.2.3. Ling. Index on fishable biomass (40 cm +), calculated form the Icelandic groundfish survey at the Icelandic shelf.

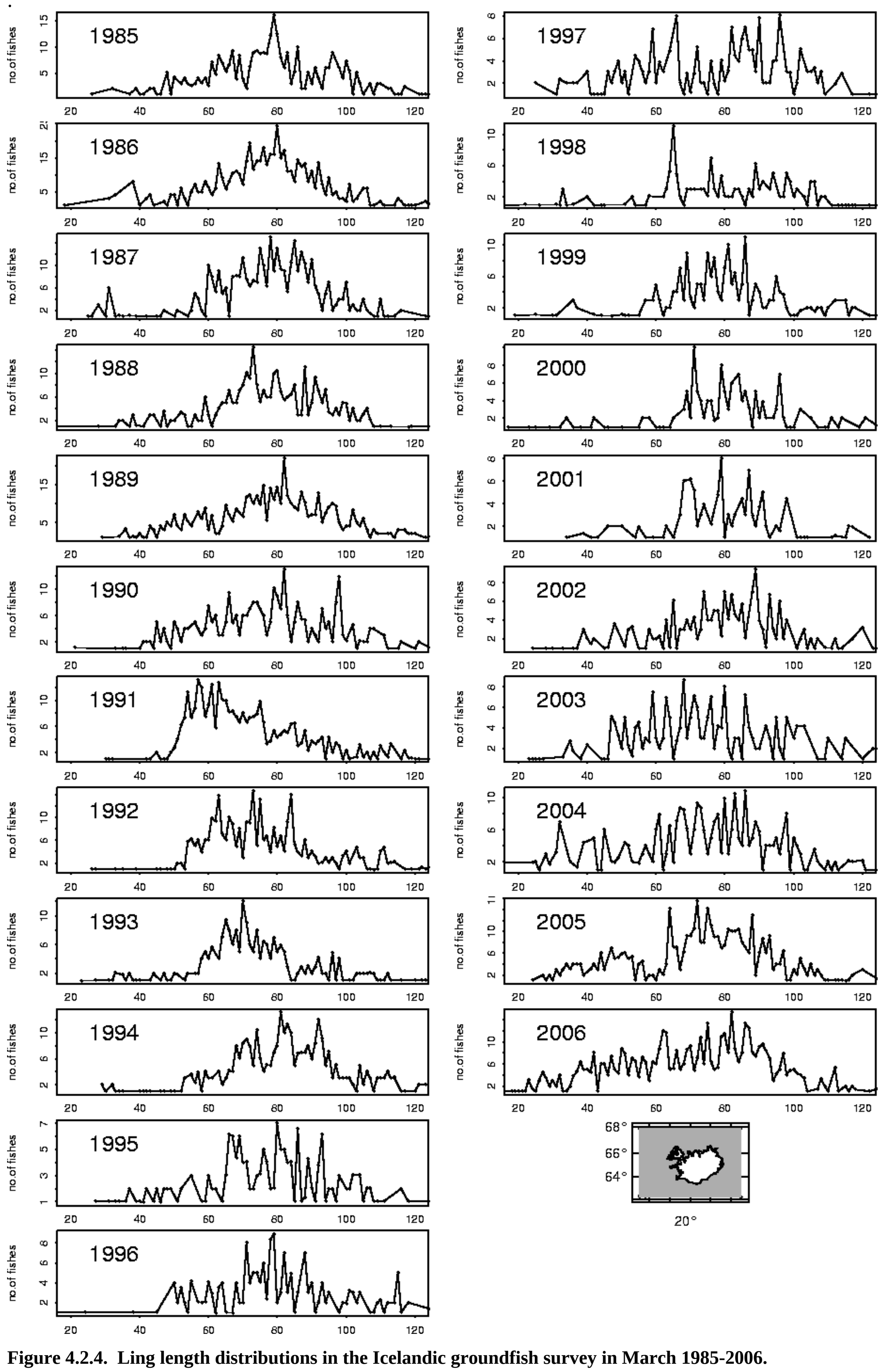

Figure 4.2.4. Ling length distributions in the Icelandic groundfish survey in March 1985-2006.

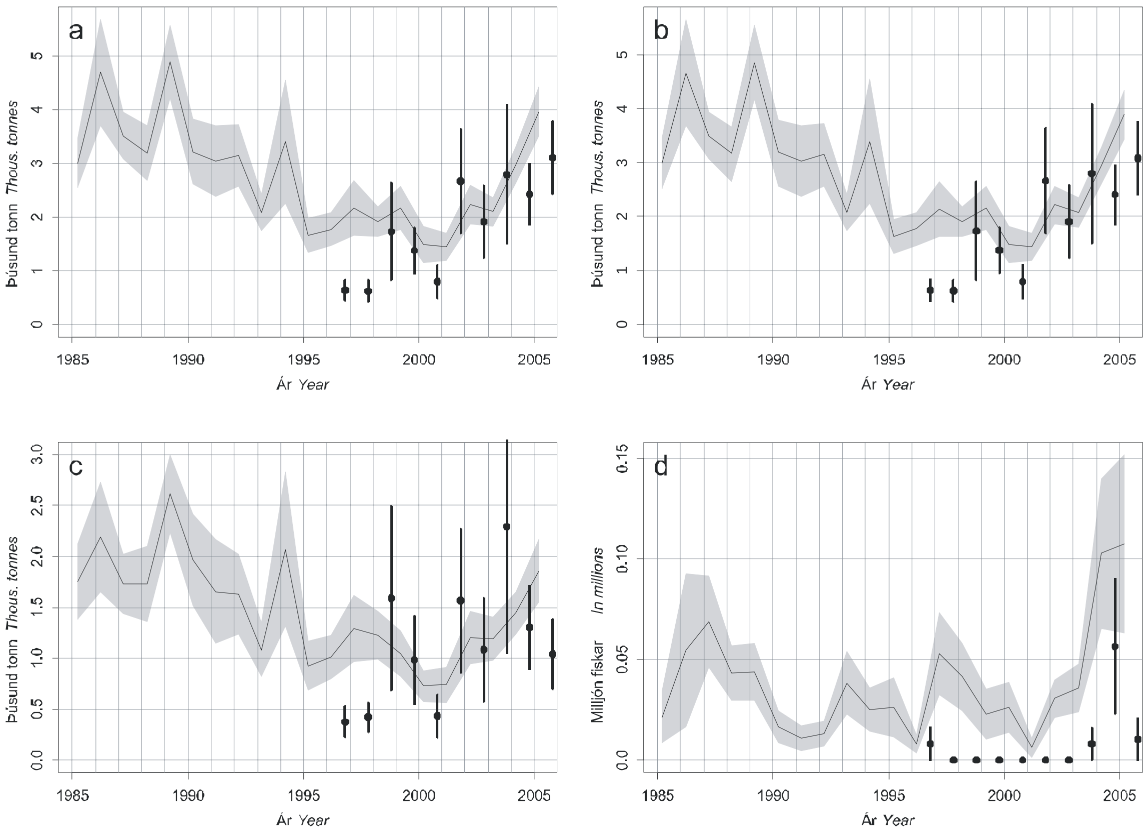

Figure 4.2.5. Ling. Indices form the groundfish survey in Autumn (SMH) a) Total biomass index, b) Biomass of 50 cm and larger, c) Biomass 90 cm and larger, d) Abundance of < 40 cm. Corresponding indices from the spring survey are also shown (solid line).

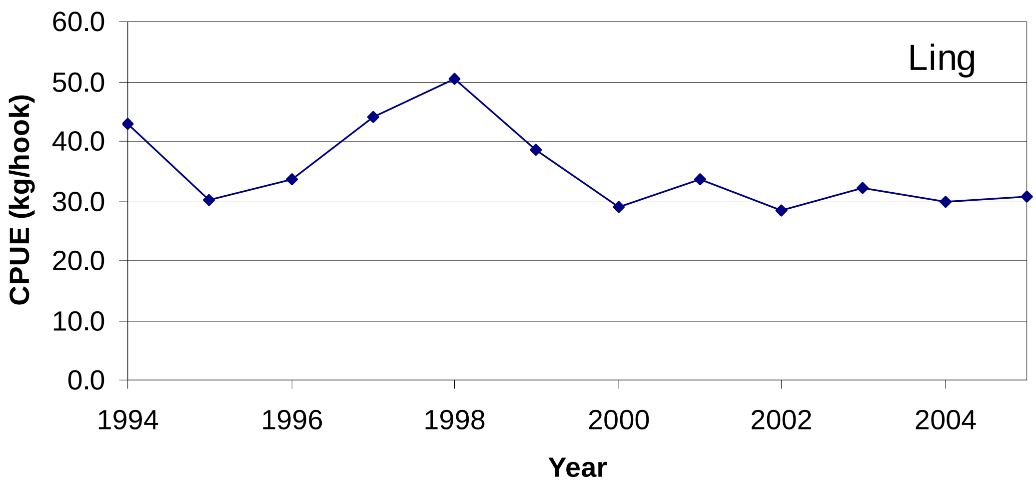

Figure 4.2.6. Ling catch per unit of effort calculated from the Icelandic long-line fishery.

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

4.3.1 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 2005, as recorded in logbooks, are shown in Figure 4.3.1.

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 4.3.2). This was a transient fishery that declined rapidly in the years thereafter.

There is currently no fishery in Sub-area XIV.

4.3.1.1 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 have been around 1000 to 1600 t per annum (Table 4.3.0a). The preliminary total international landings in 2005 were 1576 t. and these included 1251 t and 108 t from Icelandic bottom trawlers and long-liners, respectively

Total international landings from XIV (Table 4.3.0b) 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 2005 were only 6 t.

4.3.1.2 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.

4.3.1.3 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 4.3.2. These were introduced in 2003.

4.3.2 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.

4.3.3 Data available

4.3.3.1 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

4.3.3.2 Length compositions

Length distributions from the Icelandic trawl catches for the period 1995-2005 and from an Icelandic spring groundfish survey are shown in Figures 4.3.3 and 4.3.4. Sampling levels are summarized in Table 4.3.2.

4.3.3.3 Age compositions

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

4.3.3.4 Weight at age

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

4.3.3.5 Maturity and natural mortality

No new data on maturity were available.

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

M = LN(100)/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.

4.3.3.6 Catch, effort and RV data

Effort and CPUE data from the Icelandic trawl fleet are given in Table 4.3.1 and Figure 4.3.5.

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 4.3.4) A total of more than 500 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 1997 was expanded in 2001 to cover depths down to 1200m i.e. the entire depth distribution of blue ling. Time-series abundance data from the spring and autumn trawl surveys are compared in Figure 4.3.8. Autumn survey data pre-2001 should not be considered because the depth range of these early surveys was very limited.

4.3.4 Data analyses

The number of measurements and mean length in length distributions from the Icelandic commercial trawl catches for the period 1995-2005 are given on the figures for each year (Figure 4.3.3). The number of fishes measured from the catches are low, only about 1200 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 4.3.4) 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 4.3.5). 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 4.3.6), 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 (2004-2006) 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 4.3.3). However, neither is it driven by isolated large catches at a few survey stations (Figure 4.3.7). 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 4.3.8).

This year no analytical assessments were attempted.

4.3.4.1 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.

4.3.5 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 4.3.0a. 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	17	20	1500	20	19		1576

*Preliminary.

Table 4.3.0b. 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		3		6

*Preliminary

Table 4.3.0c. 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*	1576	6	1582

*Preliminary

Table 4.3.1. 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 (T)	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	301948	2226.65	136

Table 4.3.2. 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	182 / 53	305 / 4
1997	711 / 3	107 / 24	118 / 46	259 / 37
1998	/	243 / 32	126 / 49	925 / 39
1999	1674 / 12	531 / 47	257 / 61	288 / 49
2000	931 / 8	313 / 41	856 / 91	400 / 38
2001	39 / 1	411 / 48	1280 / 112	523 / 51
2002	399 / 4	215 / 39	1121 / 108	317 / 51
2003	295 / 3	399 / 51	955 / 118	973 / 49
2004	150 / 1	556 / 40	939 / 108	1179 / 42
2005	94 / 1	460 / 56	799 / 125	371 / 27
2006	/	555 / 64	/	/

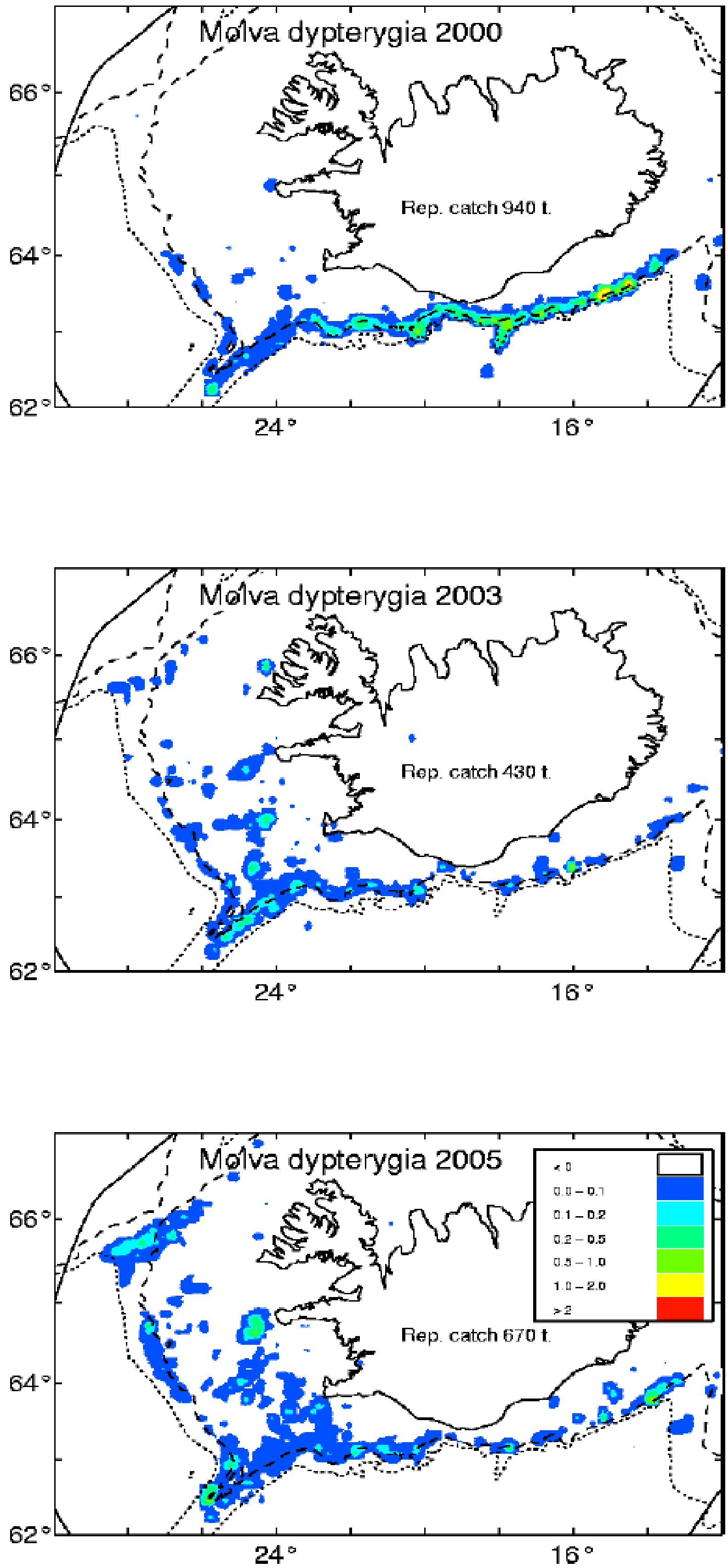

Figure 4.3.1. Icelandic fishery for blue ling as reported in logbooks (all gear types combined)

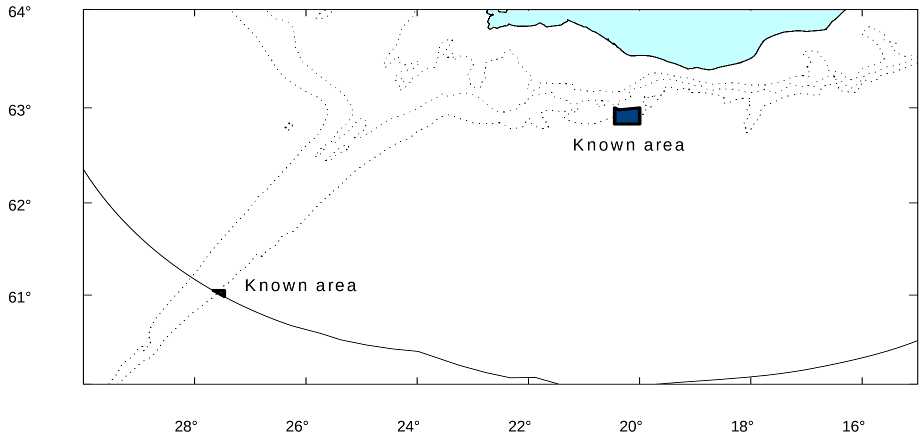

Figure 4.3.2. Known spawning grounds for blue ling in Icelandic waters

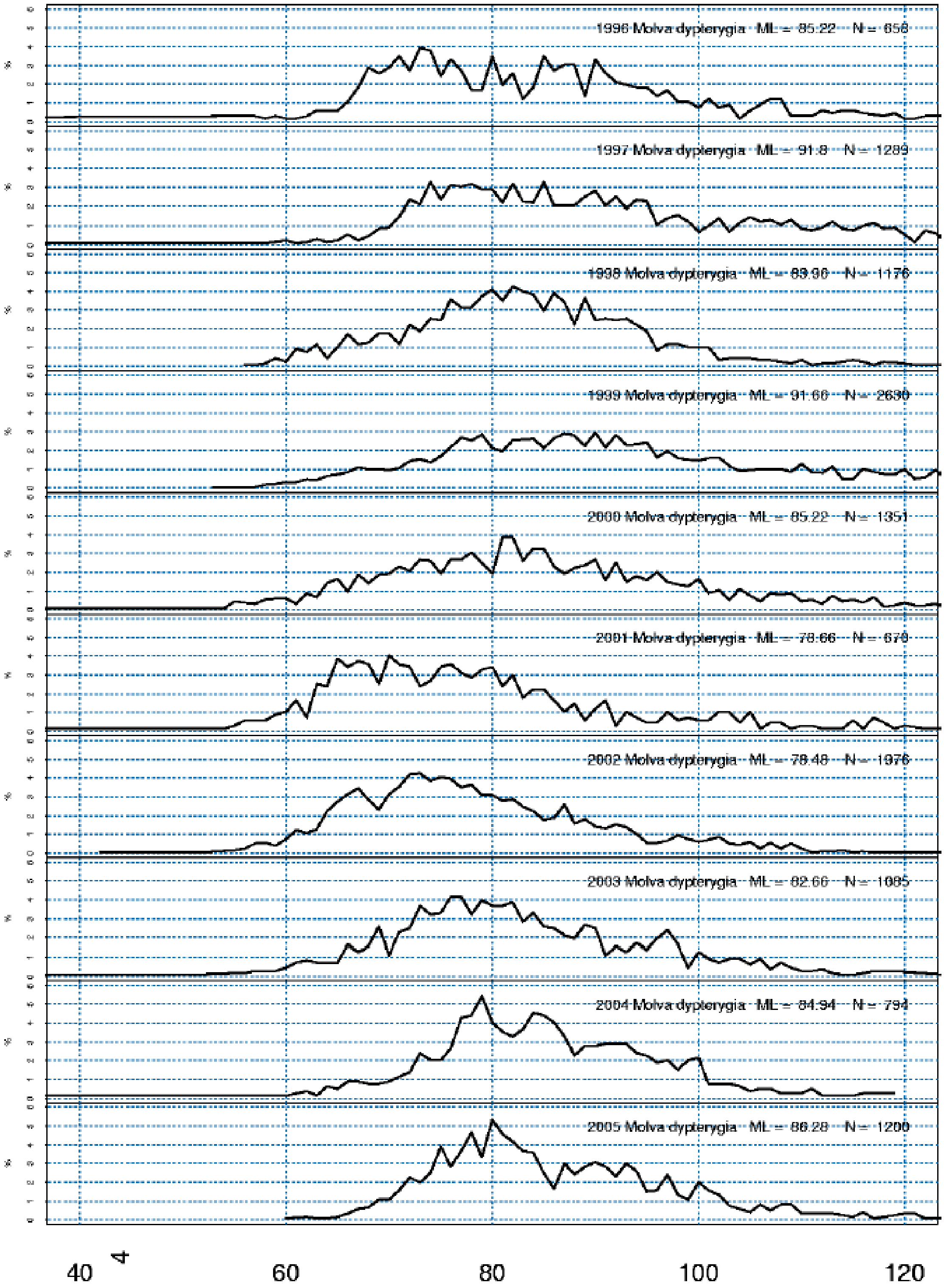

Figure 4.3.3. Length distributions of Icelandic landings of blue ling from Division Va. The number of measured fish and mean length is also given.

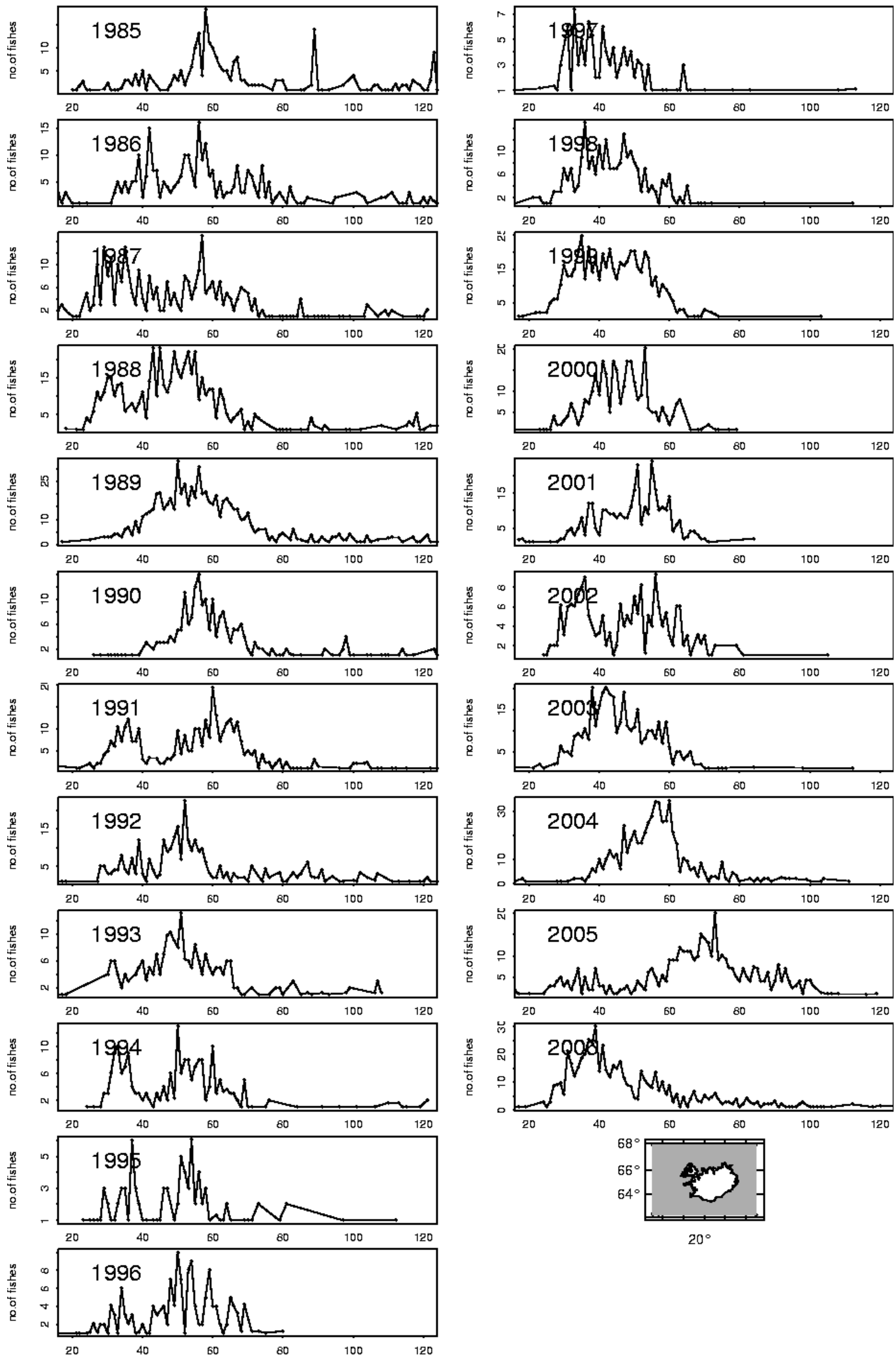

Figure 4.3.4. Blue ling length distributions in the Icelandic groundfish survey in March 1985-2006.

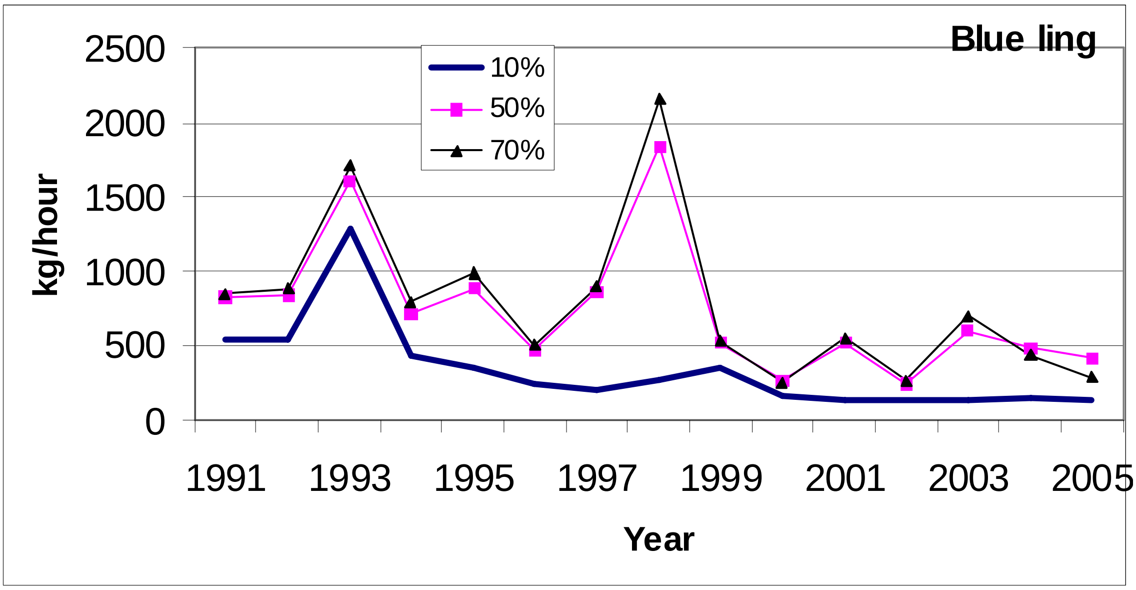

Figure 4.3.5. Blue ling catch per unit off effort calculated from the Icelandic trawl fishery.

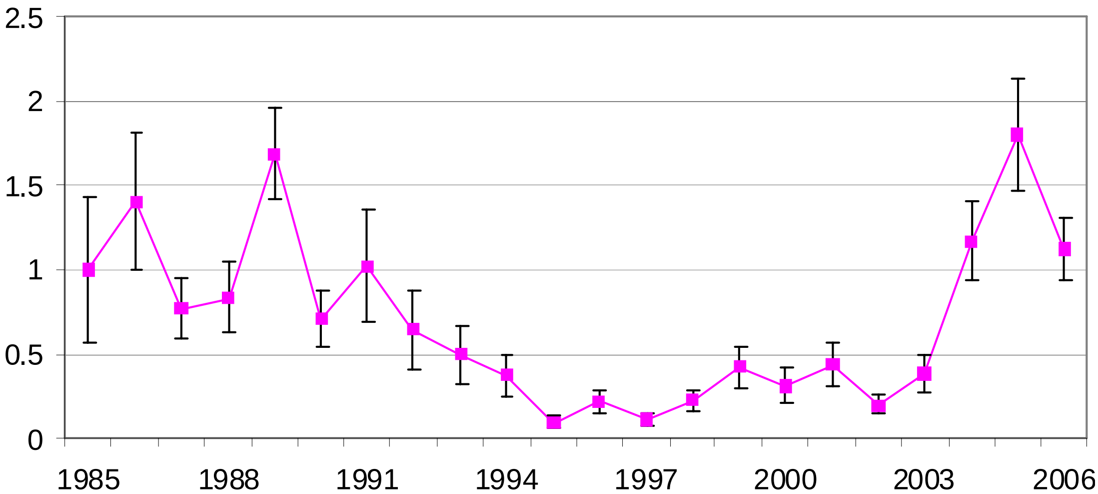

Figure 4.3.6. Blue ling. Index on biomass (40 cm +) calculated form the Icelandic spring groundfish survey at the Icelandic shelf

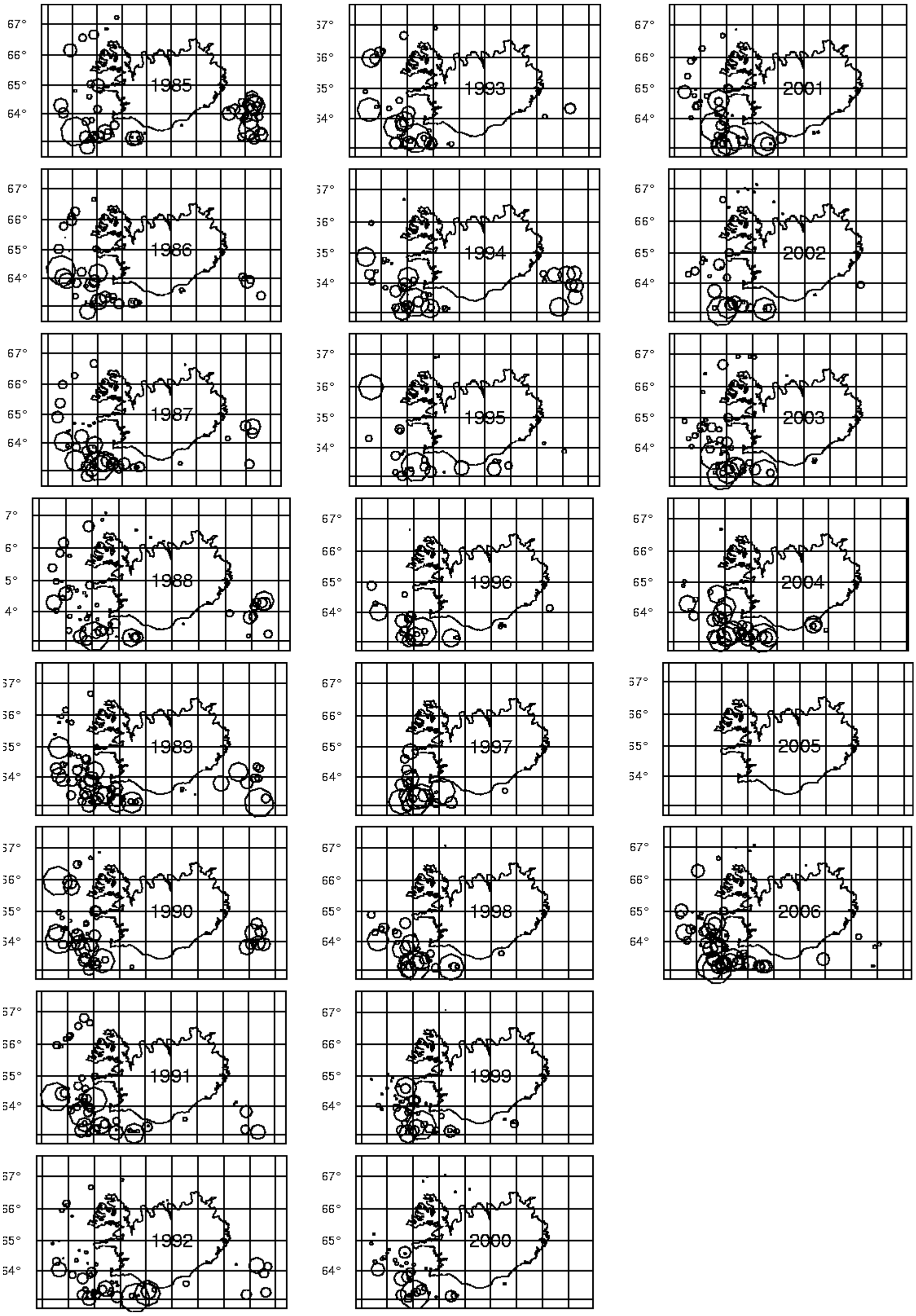

Figure 4.3.7. Blue ling. Distribution of CPUE in the groundfish survey in March since 1985. The size of the circles indicates kg/station.

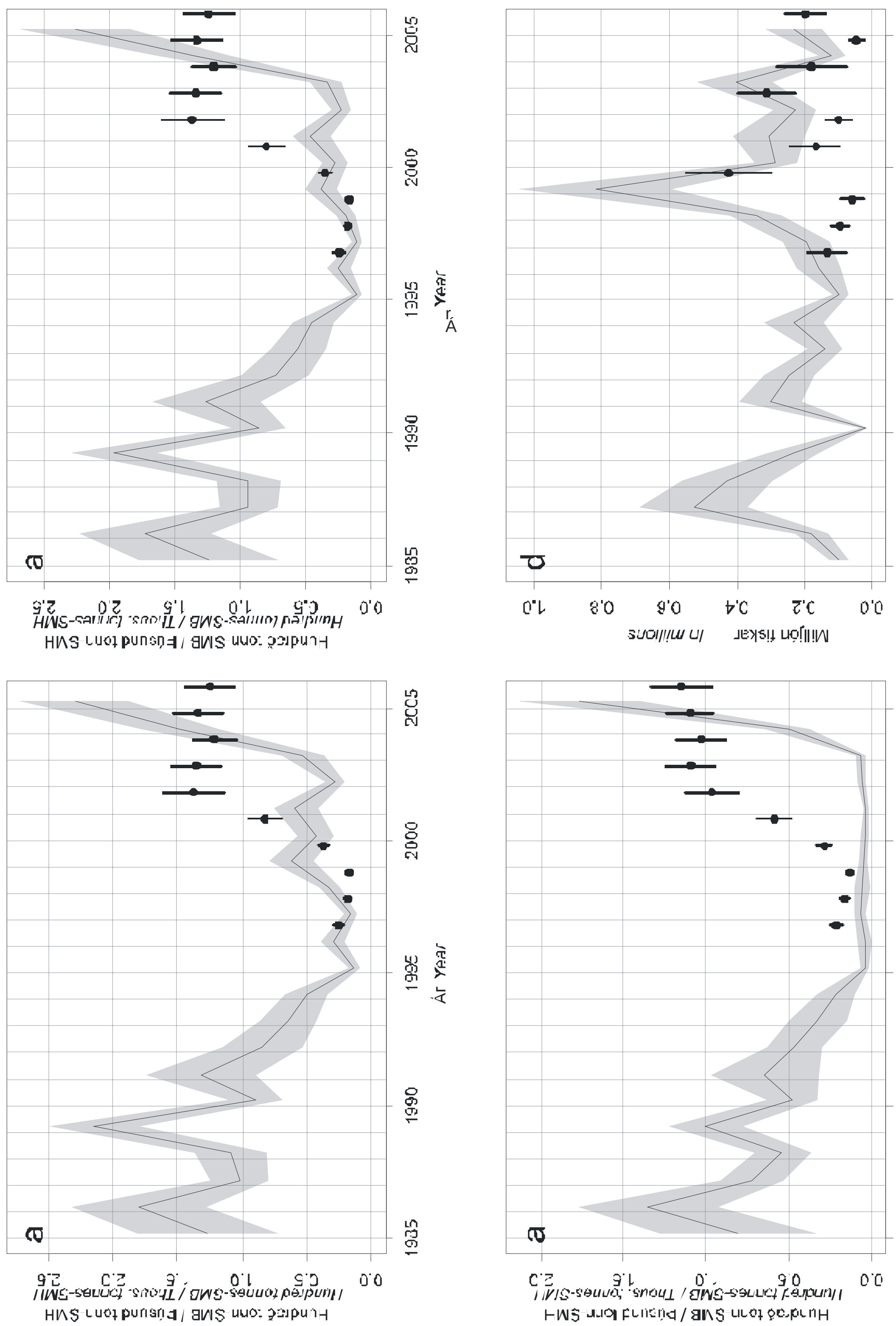

Figure 4.3.8. Blue ling. Indices from the groundfish survey in Autumn (SMH) a) Total biomass index, b) Biomass of 50 cm and larger, c) Biomass 90 cm and larger, d) Abundance of < 40 cm. Survey estimates pre 2001 should be ignored because the survey area/depth coverage was considerably expanded in 2001. Corresponding indices from the spring survey are also shown (solid line).

4.4 TUSK (*BROSME BROSME*) IN DIVISION Va

4.4.1 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 (300 t in 2005) 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 2005, as recorded in logbooks, are shown in Figure 4.4.1.

4.4.1.1 Landings trends

In late eighties directed effort towards tusk started and the landings increased t**o** 8700 and 8000 tonnes in 1991 and 1992, respectively. Since then, the landings were between 5100 and 6200 tonnes until 2001. Since 2001 the total landings have been between 4500 t, and 5300 t. 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 4.4.0. Total landings since 1963 are given in Table 4.4.1.

4.4.1.2 ICES advice

The latest advice is from ICES ACFM in October 2005.

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

4.4.1.3 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 2005 – 31. August 2006 was set to 3500 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 1350 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**.**

4.4.2 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.

4.4.3 Data available

4.4.3.1 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.

4.4.3.2 Length compositions

Table 4.4.2 gives the overview of measured fishes in Va by gear type and surveys. The length distributions from the catches are shown in Figure 4.4.2.

4.4.3.3 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.

4.4.3.4 Weight at age

No data available

4.4.3.5 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.

4.4.3.6 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 500 stations are taken annually in the survey at depths down to 500 meters, including the most important distribution area of tusk. Figure 4.4.4 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 index of fishable biomass of tusk has increased from being below 50% of the 1985 index in 2001 to being around 75% of the 1985 value in 2006. As can be seen, both from the recruitment index and from the length distribution in the survey (Figure 4.4.5), there seems to be some sign of recruitment into the fishable stock (> 40 cm) in nearest future.

In WD6 (Sigurdsson, 2006) survey indices form Icelandic autumn survey are also shown, 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 430 stations. The results of the autumn survey show similar trend in recent year (Figure 4.4.6), except for the recruitment index which is much lower than from the spring survey.

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

Figures 4.4.6 and 4.4.7 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.

4.4.4 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, at least 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 4.4.8 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 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 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.

4.4.5 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 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.

4.4.6 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 4.4.0. 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**

* Preliminary

Table 4.4.1. 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	3 135	1 530	4 665
2005[1)]	3 539	1 285	4 824

[1)] *Provisional figures.*

Table 4.4.2. 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	1562 / 80	5 / 3	6398 / 308
1997	/	/	2923 / 14	847 / 227	/	1575 / 73	3653 / 61	8998 / 375
1998	/	/	3277 / 13	757 / 208	/	1797 / 70	342 / 22	6173 / 313
1999	/	/	3805 / 24	768 / 201	/	1541 / 73	103 / 36	6217 / 334
2000	/	/	2995 / 19	959 / 233	/	1977 / 101	83 / 28	6014 / 381
2001	/	/	3097 / 19	919 / 270	4 / 4	1401 / 143	244 / 29	5665 / 465
2002	/	/	2843 / 21	949 / 252	/	2378 / 131	34 / 16	6204 / 420
2003	/	/	8444 / 47	1167 / 269	/	1860 / 133	76 / 28	11547 / 477
2004	/	/	3844 / 29	1692 / 281	/	1848 / 139	111 / 25	7495 / 474
2005	/	/	6007 / 54	1921 / 297	/	1604 / 142	164 / 33	9696 / 526
2006				1943 / 305				

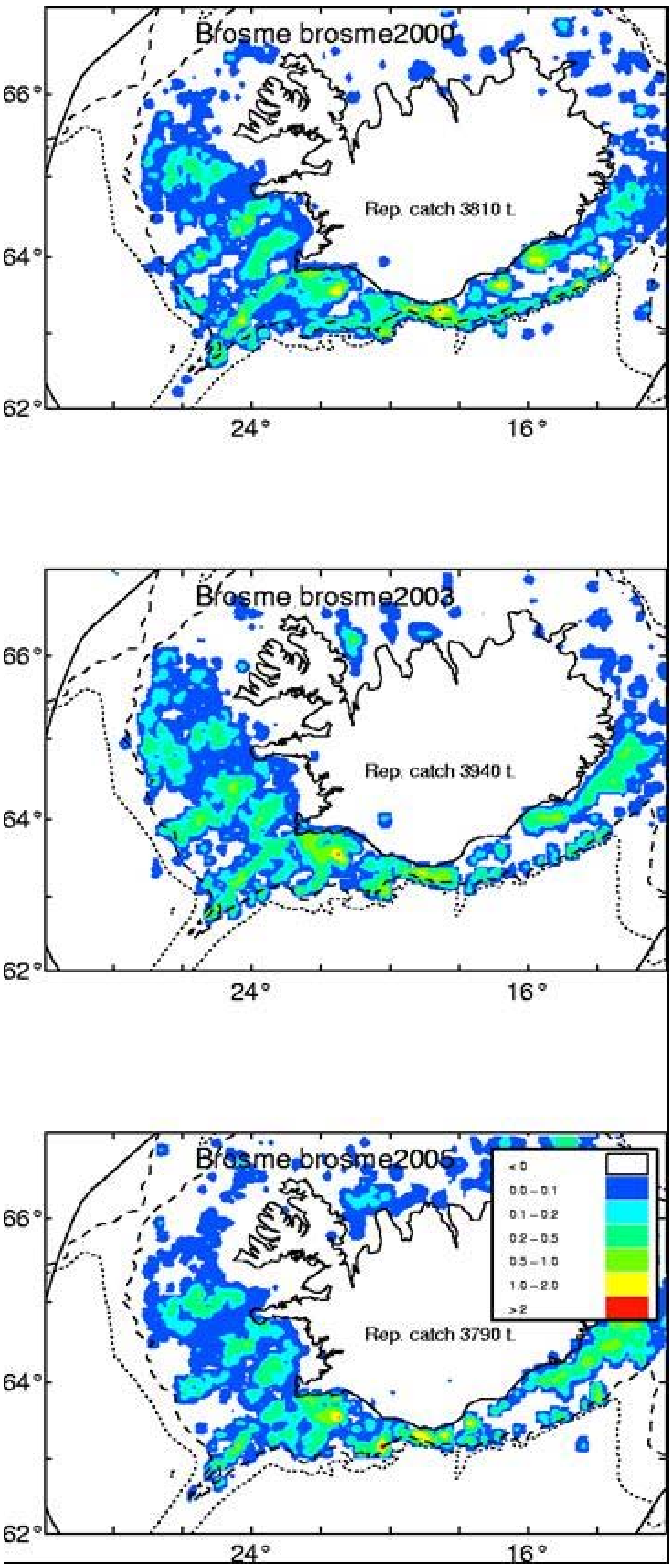

Figure 4.4.1. Tusk. Icelandic fishery in 2000, 2003 and 2005 as reported in the logbooks. All gear types combined.

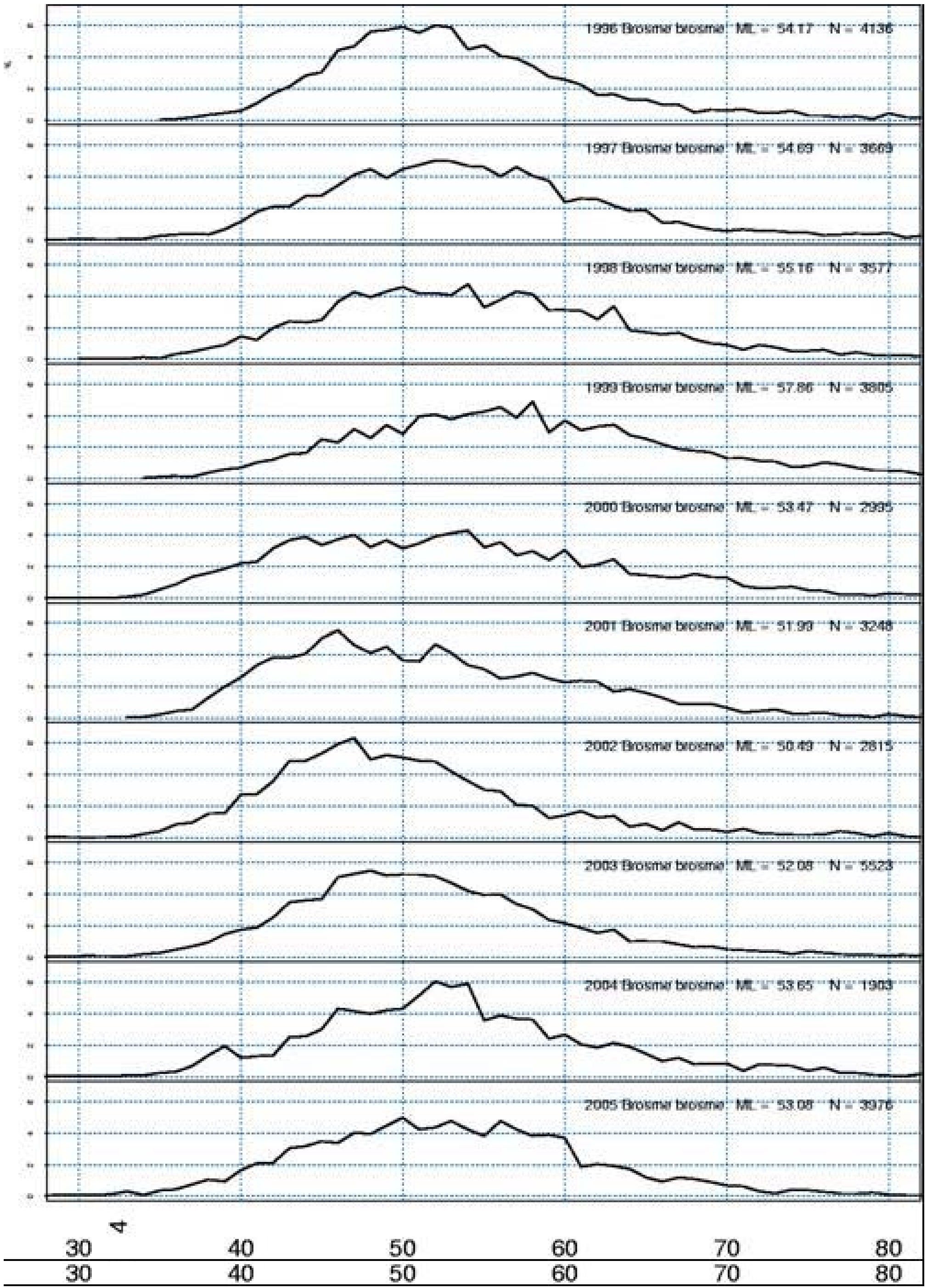

Figure 4.4.2. Length distribution of tusk in the Icelandic catches since 1996. The number of measured fishes and mean length is also given.

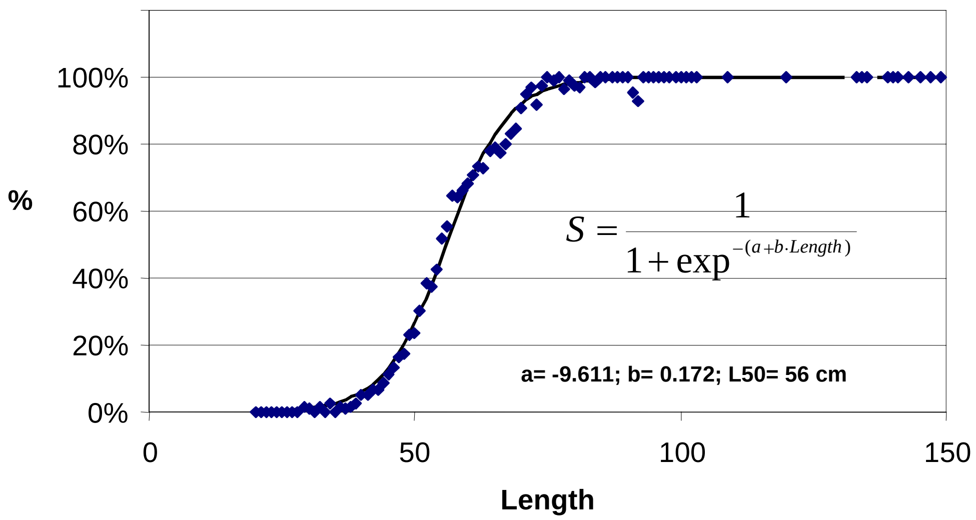

Figure 4.4.3. Tusk maturity. The figure shows average maturity at given length in the Icelandic catches. The fitted curve is also shown and the constants in the equation.

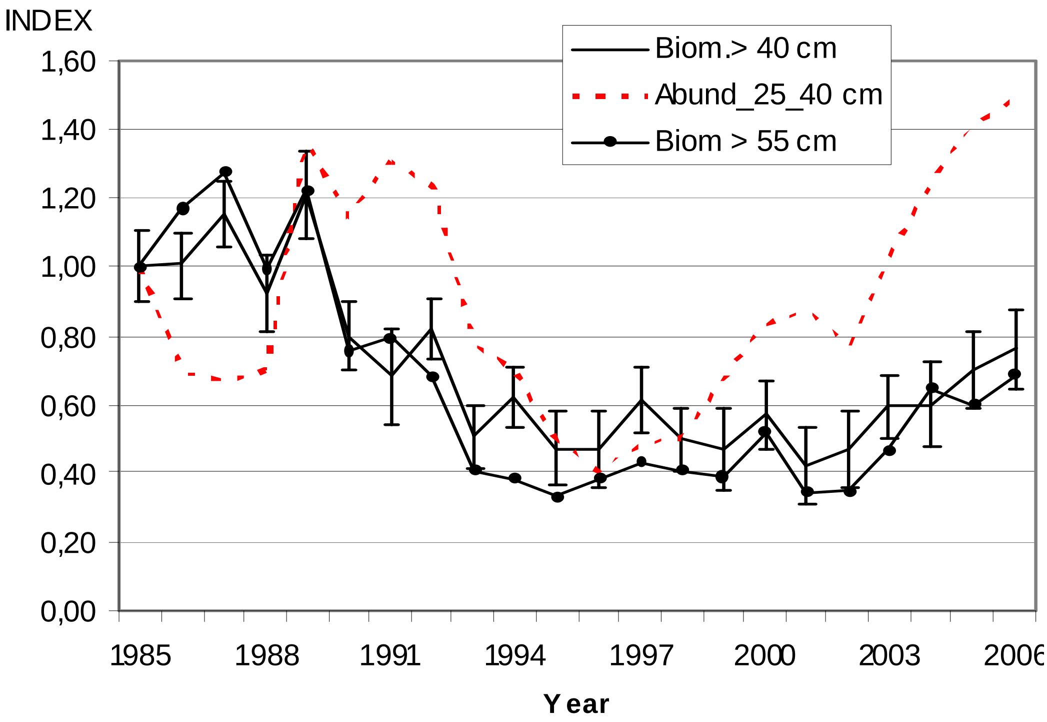

Figure 4.4.4. Tusk. Index on fishable biomass (40 cm +), adult stock biomass (> 55 cm) and recrutement, calculated form the Icelandic groundfish survey at the Icelandic shelf.

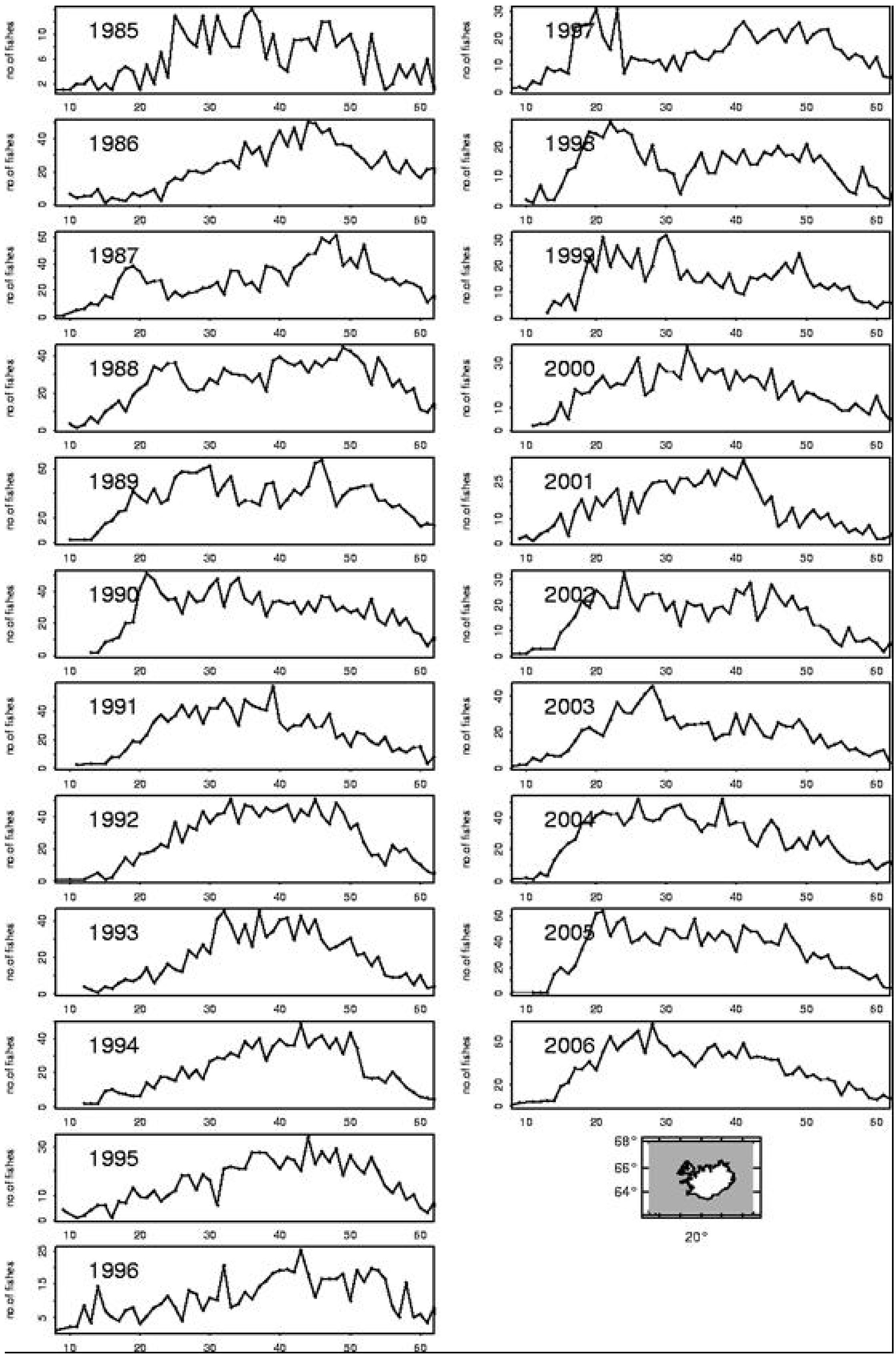

Figure 4.4.5. Tusk length distributions in the Icelandic groundfish survey in March 1985-2006.

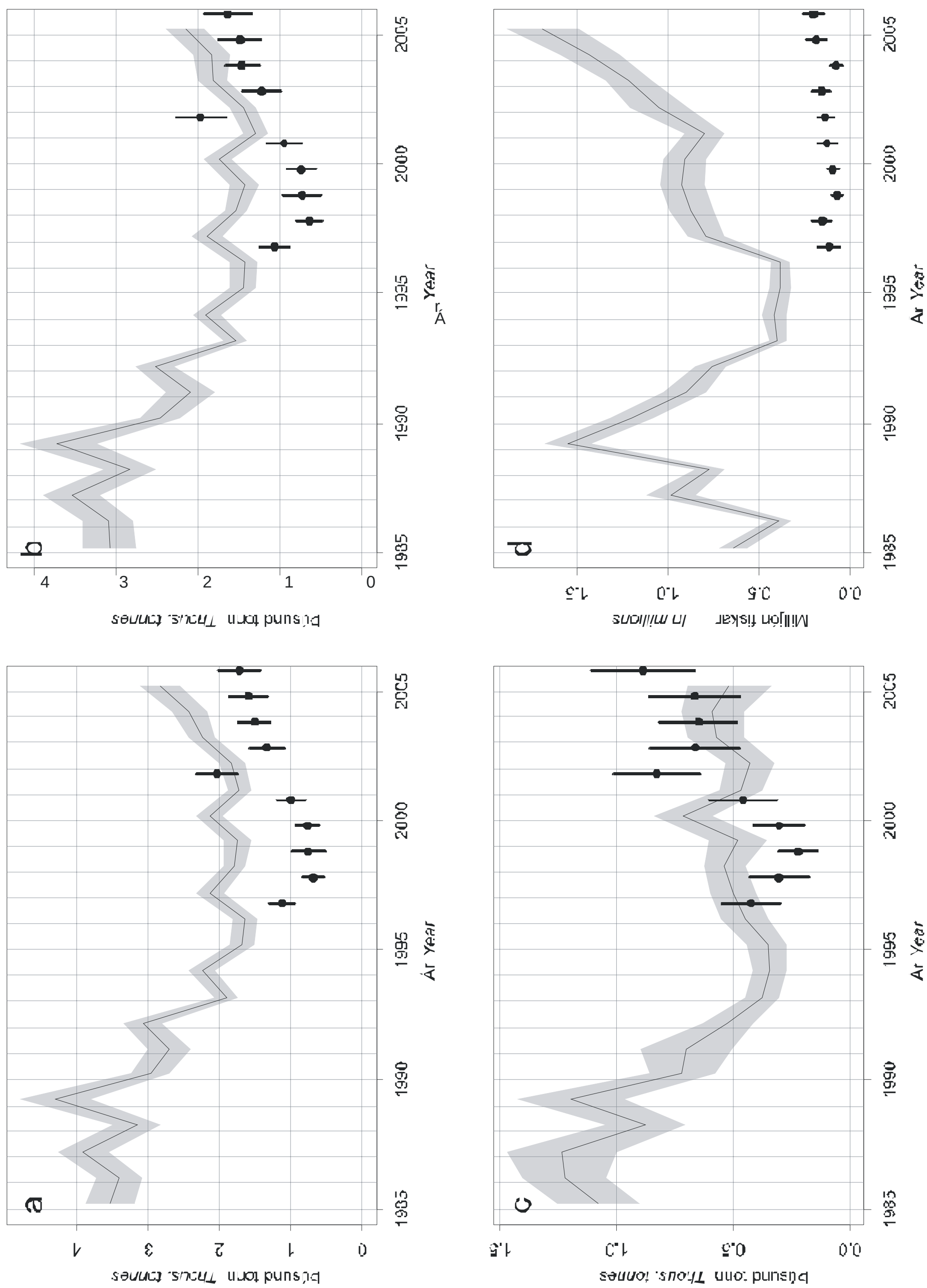

Figure 4.4.6. Tusk. Indices form the groundfish survey in Autumn (SMH) a) Total biomass index, b) Biomass of 50 cm and larger, c) Biomass 60 cm and larger, d) Abundance of < 40 cm. Corresponding indices from the spring survey are also shown (solid line).

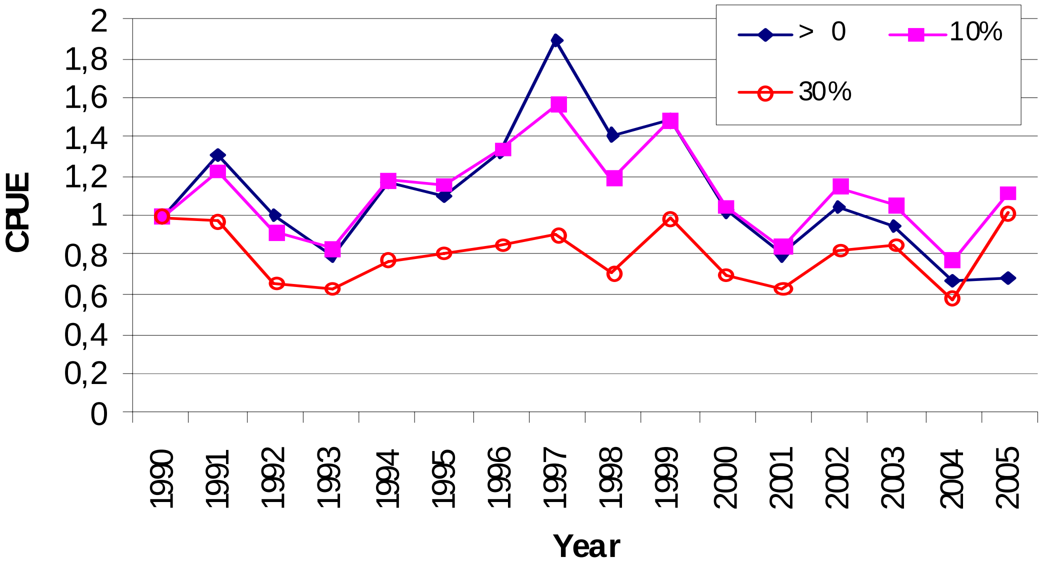

Figure 4.4.7. Tusk catch per unit of effort calculated from the Icelandic long-line fishery using different criteria for the calculations. >0 = all sets where tusk was reported in the log-books; 10% = sets where 10% or more of the catch in given set was tusk; 30% = sets were 30% or more of the catch in given set was tusk. All values standardized to 1 in 1990.

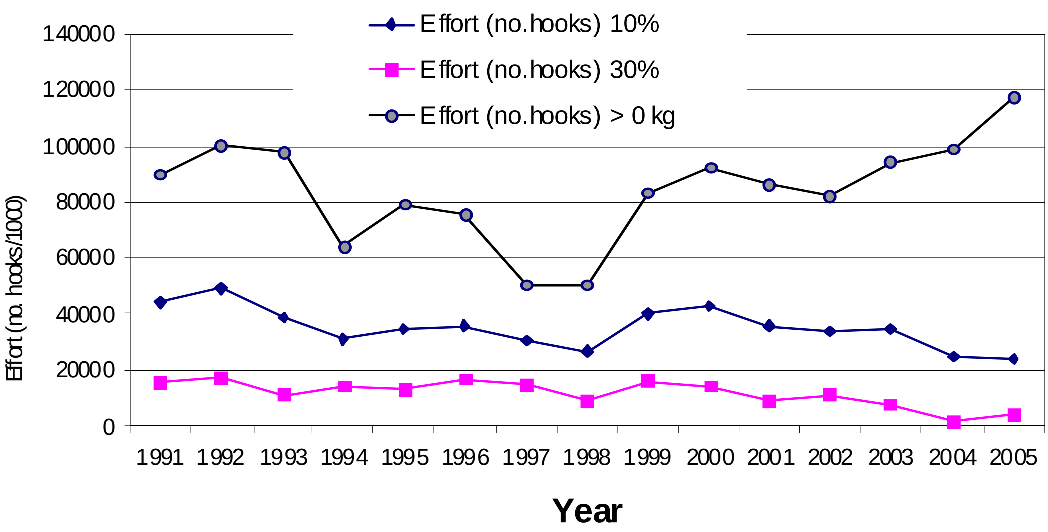

Figure 4.4.8. Tusk. Effort of the Icelandic long-line fishery using different criteria for the calculations. >0 = all sets where tusk was reported in the log-books; 10% = sets where 10% or more of the catch in given set was tusk; 30% = sets were 30% or more of the catch in given set was tusk.

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

4.5.1 The fishery

Greater silver smelt have been caught in bottom trawls for years, as a 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 a bycatch in the redfish fishery.

Total of 41 vessels landed the species in 2005 and the range of the landed catch by vessel were from only few kilos to 1100 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 2005, as recorded in logbooks, are shown in Figure 4.5.1.

4.5.1.1 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 2.700 tonnes in 2003. Total landings in 2005 were 4400 t, increased by 800 tonnes compared with 2004. The variations in the catches are largely due to market situations.

4.5.1.2 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.

4.5.1.3 Management

The Icelandic Ministry of Fisheries is responsible for management of the Icelandic fisheries and implementation of the legislation. The management on Great 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.

4.5.2 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.

4.5.3 Data available

4.5.3.1 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.

4.5.3.2 Length compositions

Table 4.5.2 gives the overview of measured fishes in Va by gear type and surveys. The length distributions from the catches are shown in Figure 4.5.2.

4.5.3.3 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.

4.5.3.4 Weight at age

No data available

4.5.3.5 Maturity and natural mortality

No data available

4.5.3.6 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 4.5.3.

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

Figure 4.5.4 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.

4.5.4 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 4.5.3).

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

4.5.5 Comments on the assessment

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

4.5.6 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 4.5.0. 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		**4401**

*Preliminary

Table 4.5.1. 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[1)]	4 401

1) *Provisional figures.*

Table 4.5.2. Greater silver smelt. Overview of sampling. Number of fishes and number of stations/samples by gear type/survey type

YEAR	COMMERCIAL LONGLINE	MARCH TRAWL SURVEY	OTHER SURVEYS	OCT. TRAWL SURVEY	COMMERCIAL TRAWLS	TOTAL
1986	561 / 6	1258 / 246	/	/	248 / 18	2259 / 272
1987	774 / 4	1552 / 287	/	/	5270 / 111	7596 / 402
1988	/	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	3563 / 24	818 / 216	/	56 / 28	61 / 13	4502 / 282
1996	4136 / 14	627 / 207	68 / 4	1562 / 80	5 / 3	6398 / 308
1997	2923 / 14	847 / 227	/	1575 / 73	3653 / 61	8998 / 375
1998	3277 / 13	757 / 208	/	1797 / 70	342 / 22	6173 / 313
1999	3805 / 24	768 / 201	/	1541 / 73	103 / 36	6217 / 334
2000	2995 / 19	959 / 233	/	1977 / 101	83 / 28	6014 / 381
2001	3097 / 19	919 / 270	4 / 4	1401 / 143	244 / 29	5665 / 465
2002	2843 / 21	949 / 252	/	2378 / 131	34 / 16	6204 / 420
2003	8444 / 47	1167 / 269	/	1860 / 133	76 / 28	11547 / 477
2004	3844 / 29	1692 / 281	/	1848 / 139	111 / 25	7495 / 474
2005	6007 / 54	1921 / 297	/	1604 / 142	164 / 33	9696 / 526
2006		1943 / 305	/	/	/	

Table 4.5.3. 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%

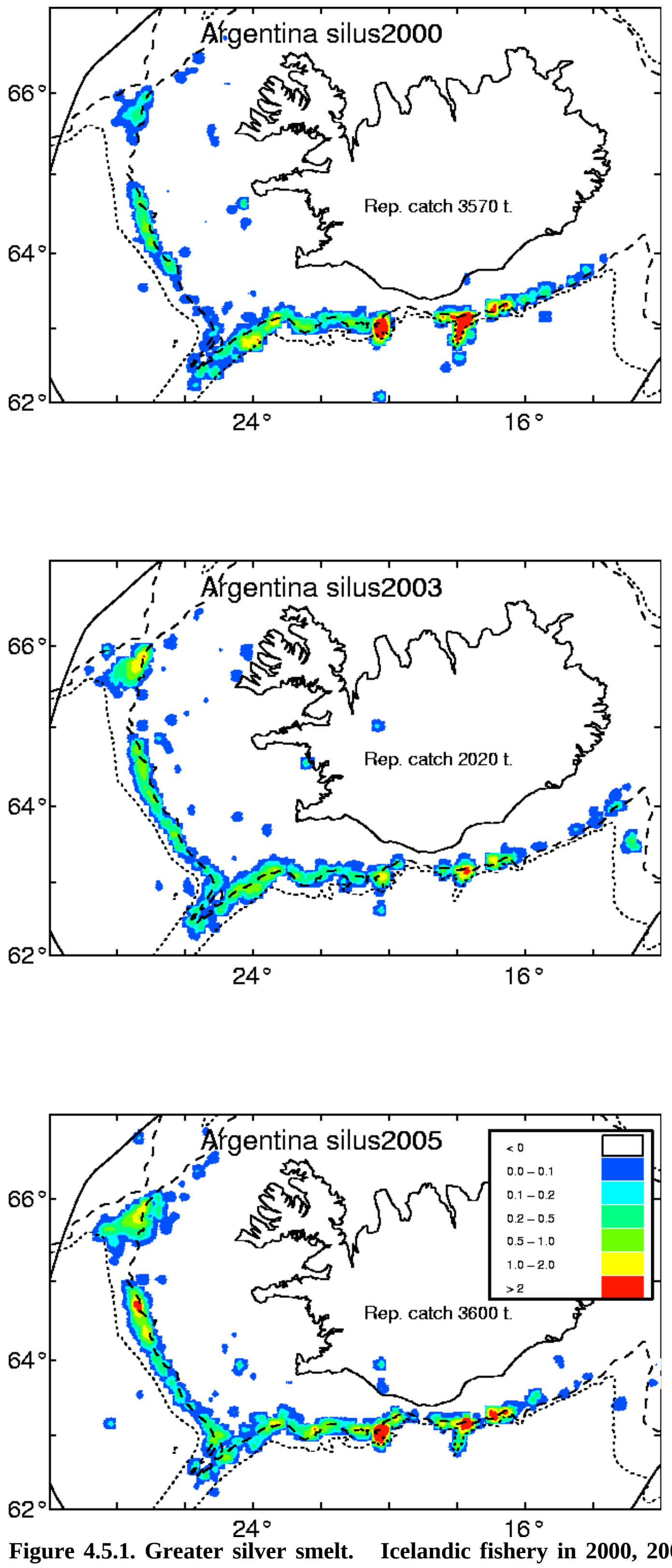

Figure 4.5.1. Greater silver smelt. Icelandic fishery in 2000, 2003 and 2005 as reported in the trawlers logbooks.

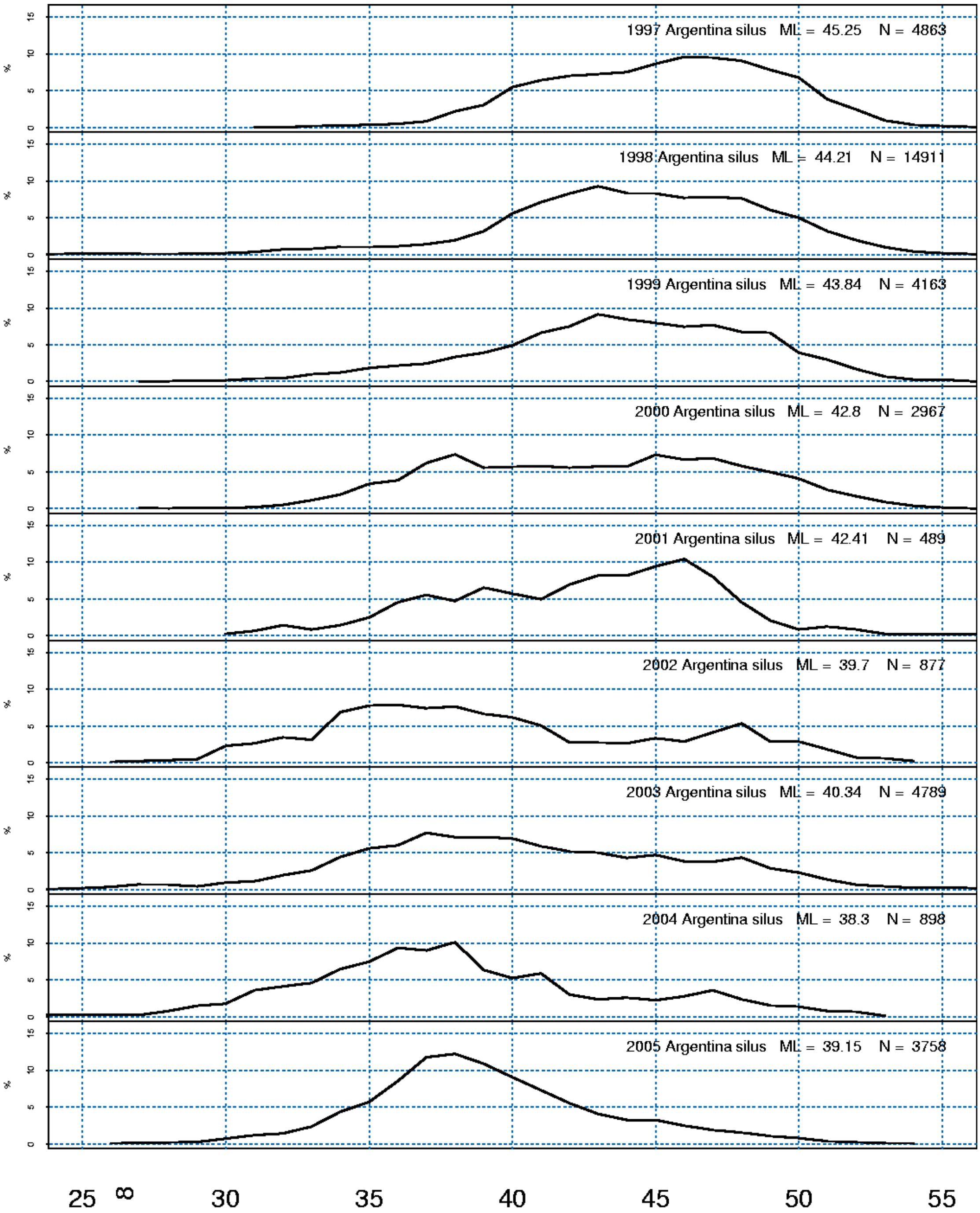

Figure 4.5.2. Length distribution of greater silver smelt in the Icelandic catches since 1996. The number of measured fishes and mean length is also given.

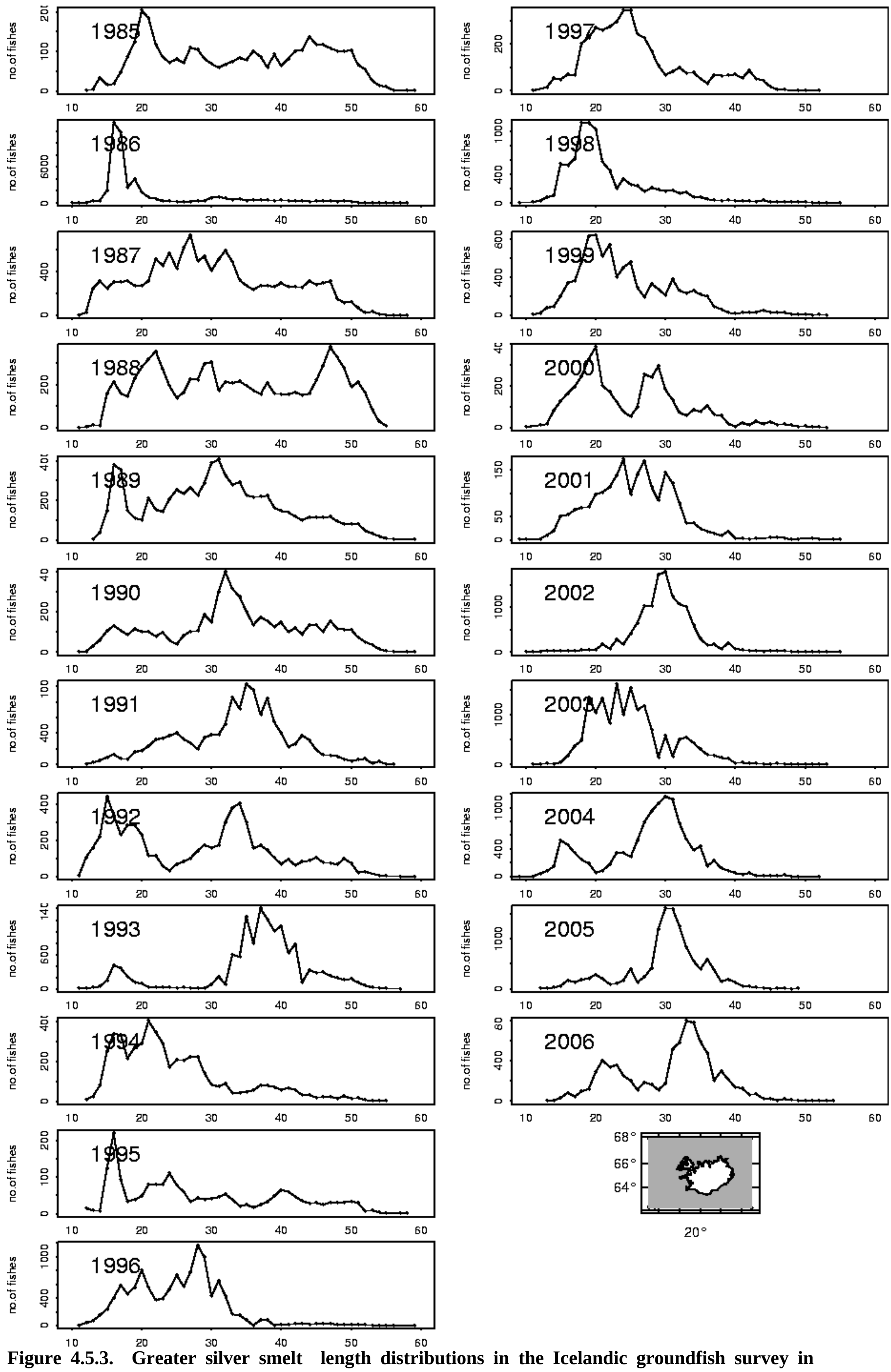

Figure 4.5.3. Greater silver smelt length distributions in the Icelandic groundfish survey in March 1985-2006.

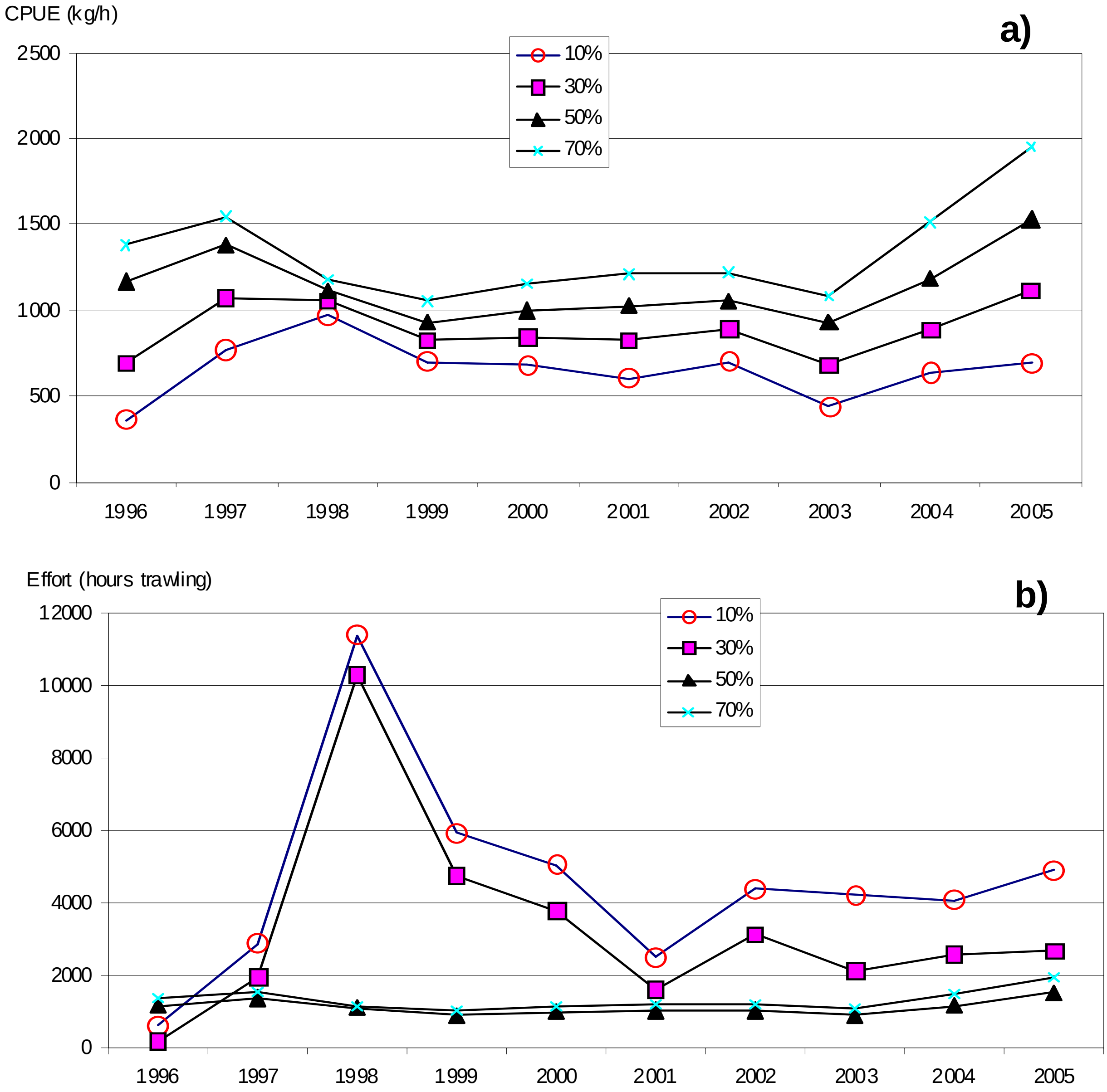

Figure 4.5.4. Greater silver smelt catch per unit of effort (a) and effort (b) calculated from the Icelandic trawler fishery. The lines corresponds to cpue calculated where total catch of greater silver smelt in each haul is 10, 30,50 or 70% of the total catch in each haul.

5 Stocks and fisheries of the Barents Sea and Norwegian Sea

5.1 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 5.1.1). 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 39 in 2005 (Table 5.1.2). 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 an 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.

5.1.1 Trends in fisheries

Landing statistics for sub-areas I and II for the period 1988-2005 are given in Table 5.1.1.

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 contrast, the landings of ling have remained stable at between 7000 and 8000 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 2005 (Figure 5.1.2).

Greater silver smelt

During the period 1988-2000 there was a slight downwards trend in the landed catches. In 2000, 2004 and 2005 this trend shifted and there was a doubling in the landed catches to about 16 000 tons (Figure 5.1.2).

5.1.2 Technical interactions

Table 5.1.3 shows landings by gear and by species.

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.

5.1.3 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.

5.1.4 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 5.1.1. 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
ALFONSINOS (Beryx spp.)																		
ARGENTINES (Argentina silus)	11351	8390	9120	7741	8234	7913	6807	6775	6604	4463	8261	7163	6293	14369	7407	8917	16158	15698
BLUE LING (Molva dypterigia)	3537	2058	1412	1479	1039	1020	422	364	267	292	279	292	252	209	150	148	174	172
BLACK SCABBARDFISH (Aphanopus carbo)																		
BLUEMOUTH (Helicolenus dactylopterus)																		
GREATER FORKBEARD (Phycis blennoides)			23	39	33	1								8	318	155	75	51
LING (Molva molva)	6126	7368	7628	7793	6521	7093	6322	5954	6346	5409	9200	7651	5964	4957	7132	6157	6560	6303
MORIDAE																		
ORANGE ROUGHY (Hoplostethus atlanticus)																		
RABBITFISHES (Chimaerids)												1	6	5	15	57	21	64
ROUGHHEAD GRENADIER (Macrourus berglax)			589	829	424	136				17	55		48	94	29	77	79	67
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)		22	49	72	52	15	15	7	2	106	100	46		2	12	4	27	10
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	7025
WRECKFISH (Polyprion americanus)																		

Table 5.1.2. Number of vessels exceeding 21 m in the Norwegian long liner fleet during the period 1995-2005.

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

Table 5.1.3. Technical interactions in Sub-Areas I & II.

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

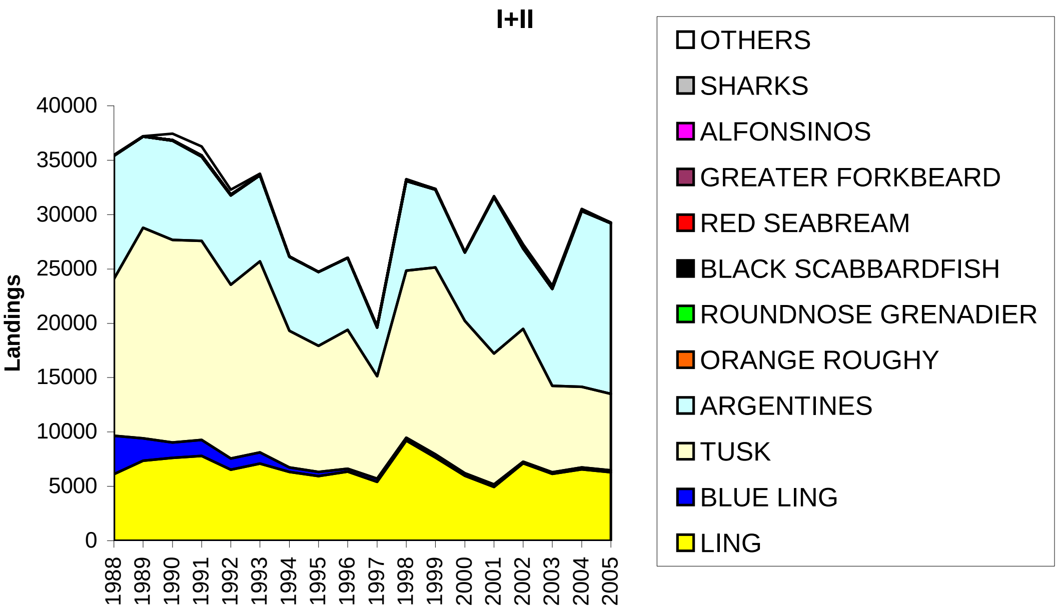

Figure 5.1.1. Trends in the landings in subareas I and II during the period 1988 through 2005.

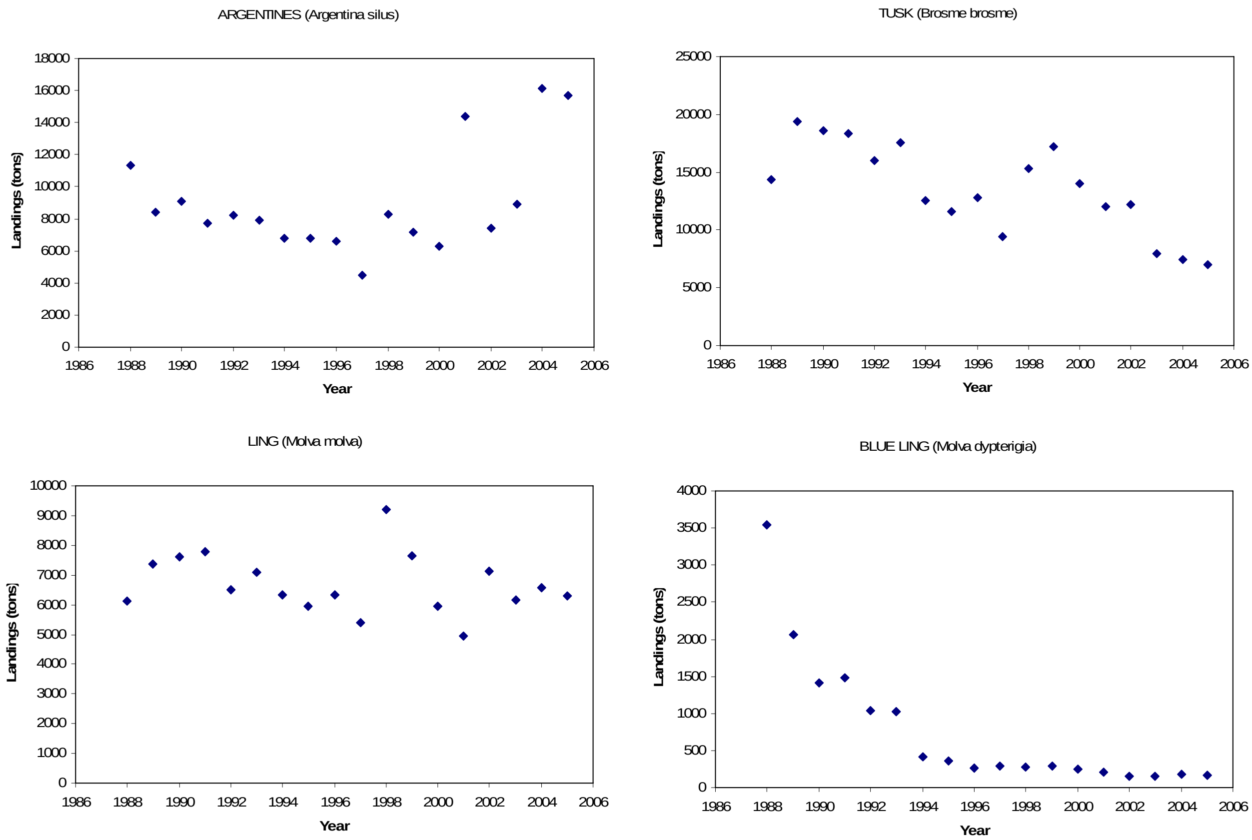

Figure 5.1.2. Trends in the total landings of argentines, tusk, ling and blue ling in areas I and II during the period 1988 through 2005.

5.2 Ling (*Molva Molva*) in Sub-Areas I & II

5.2.1 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.

5.2.1.1 Landings trends

Landing statistics by nation in the period 1988-2005 are given in Tables 5.2.0a-5.2.0d. Since 2000 the landings varied between 6,000 and 7,000 tonnes, at about the same level as in the preceding decade. The preliminary landing for 2005 is 6303 t.

5.2.1.2 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.*

5.2.1.3 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.

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 previously that Subarea I and II has a stock separate from other Subareas.

Ling in Subarea I and II is included in an ongoing 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 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.

5.2.3.2 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 *et al*. (WD 4, 2006). In this period, when the ling has been fully or heavily exploited, the mean length has varied without any clear trend.

5.2.3.3 Age compositions

No new age compositions were available.

5.2.3.4 Weight at age

No new data were presented.

5.2.3.5 Maturity and natural mortality

No new data were presented.

5.2.3.6 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. The utility of the reference fleet data is being investigated (WD 3 and 4). 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 2000-2005. 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.

A first analyses based on these two sources of data was presented in a WD by Helle (WD 3, 2006).

5.2.4 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 (WD3, 2006). The number of longliners has declined in recent years (Table 5.2.1), from 72 to 39 in the period 2000-2005. However, the number of fishing days with ling catch has increased in the same period (Table 5.2.2). The number of hooks set per day and the total set per year has remained rather stable in Subareas I and II (Table 5.2.3 and 5.2.4).

Table 5.2.5 gives estimates of CPUE based on the Norwegian official logbooks and the reference vessels, and the same results are shown in Figure 5.2.1. In Figure 5.2.2 the data for 2000-2005 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 2000-2005 period. There is an apparent increase in the most recent years, but estimates from 2004 and 2005 must be interpreted with caution since they are based on few logbooks.

5.2.5 Comments on the assessment

The CPUE series of the main fleet landing ling suggest that the abundance has remained at a reduced level after the decline in the 1970s to 1990s.

5.2.6 Management considerations

It is unlikely that current management has effectively reduced effort in the main fleet, i.e. longliners compared with the level in 1998 (ref. ICES advice from 2004). Despite that the number of vessels has declined, the number of hooks set per year has remained constant or increased in recent years. Management is thus not in accordance with ICES advice from 2004. Based on the current perception of status and trends in the stock, there is no basis to suggest amendment of the advice statement from 2004.

Reference points that were previously assigned to ling were:

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

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

where U is a smoothed relative abundance index. If the CPUE from Norwegian long liners is accepted as a valid abundance index, an evaluation in relation to reference points may be proposed. The CPUE estimates from the 1970s were very variable, but the average CPUE was probably around 80kg/1000 hooks. By comparison, the 2000-2005 mean CPUE is 34.0kg/1000 hooks, thus below $U_{pa,}$ but above U_{lim}. Considering that ling in I and II was fully exploited or probably overexploited prior to 1970, this assessment is probably reasonable.

Table 5.2.0a. 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*	114				**114**

*Preliminary

Table 5.2.0b. 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*	4	4	6	6071	2		2	**6089**

*Preliminary

Table 5.2.0c. 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*	100		**100**

*Preliminary

Table 5.2.0d. Ling I & II. Total landings by Sub-areas or Division

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*	114	6089	100	6303

*Preliminary.

Table 5.2.1. Summary statistics for the Norwegian long liner fleet during the period 1995-2005 (vessels exceeding 21m). This list only include 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

Table 5.2.2. 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 2000-2005.

All species	2000	2001	2002	2003	2004	2005
I	6	5	10	13	14	8
IIa	42	68	70	63	67	90
IIb	2	8	2	2	7	8

Table 5.2.3. Estimated number of hooks that the Norwegian long liners set per day in Subarea I and II in the period 2000-2005. n= the total number of days with hook information contained in the logbooks.

All	2000		2001		2002		2003		2004		2005	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
I	32953	193	31974	153	35340	293	35172	383	35737	137	34196	56
IIa	31512	1438	30719	2234	33459	2023	34712	1815	34540	667	33306	628
IIb	36354	65	34779	280	34756	45	34776	67	34086	70	34707	58

Table 5.2.4. 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
I	13468	9636	20709	24155	21053	10669
IIa	95960	135173	135375	112970	99064	116533
IIb	5004	19181	3128	4178	10260	11215

Table 5.2.5. 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		
	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	45	305	1.8	57.3	481	1.7

Reference vessels:

	2001			2002			2003			2004			2005		
	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

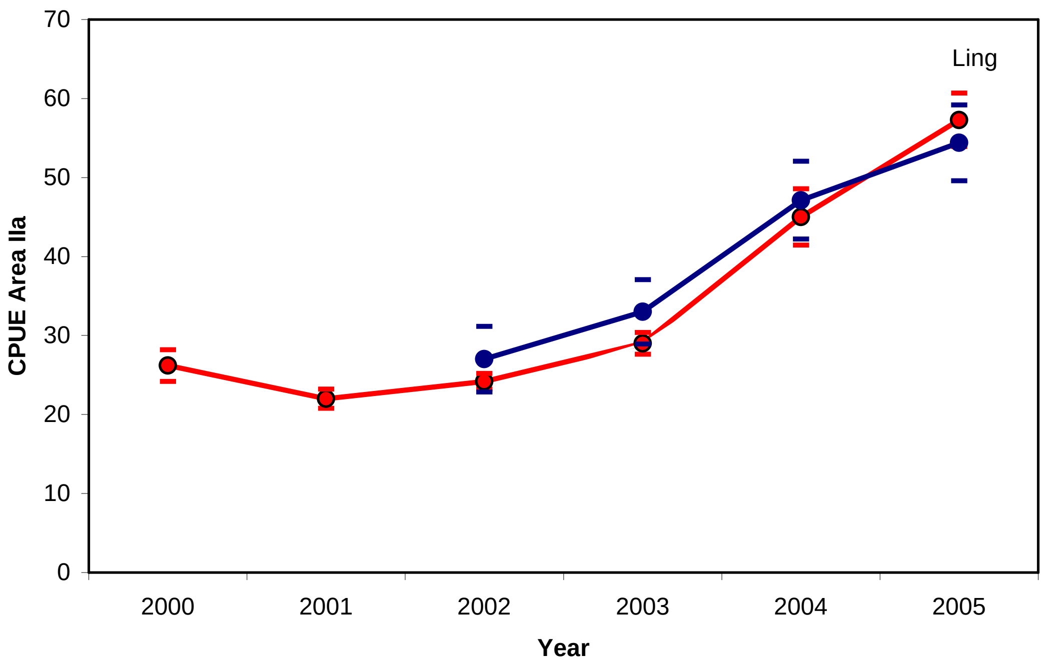

Figure 5.2.1. Ling in IIa. Estimated mean CPUE ([kg/hook]x1000) based on logbook data (red line) and the reference fleet data (blue line). The bars denote the 95% confidence intervals.

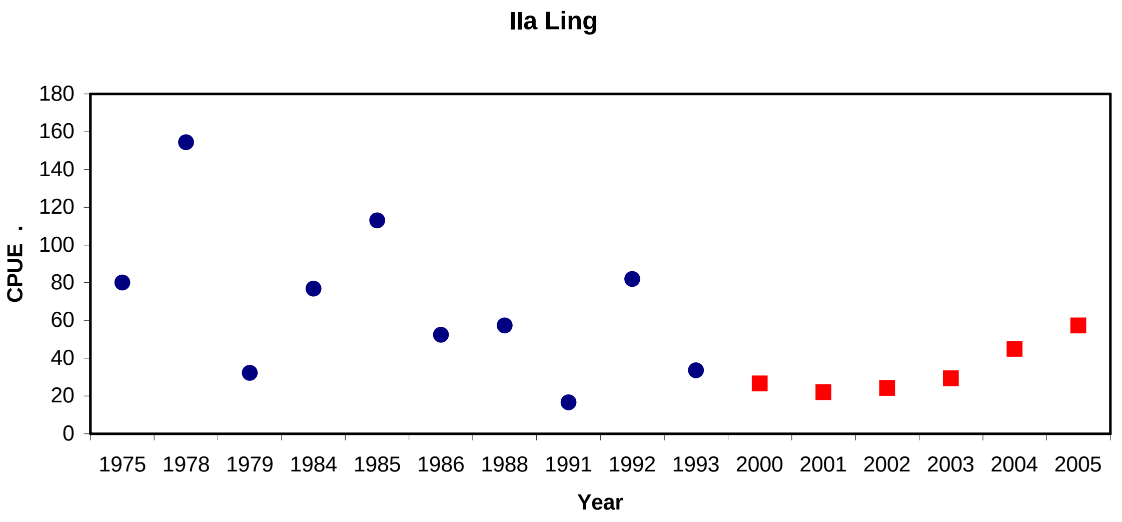

Figure 5.2.2. Ling in IIa. Estimates of CPUE (kg/1000 hooks) based on skipper's logbooks (pre-2000, blue dots) and official logbooks (post 2000, red squares). Combination of data from Bergstad and Hareide (1996) and WD3 by Helle (2006).

5.3 TUSK (*BROSME BROSME*) IN SUB-AREAS I & II

5.3.1 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 (53 tonnes) from Sub-Divisions IIa2 and IIb2 in 2005 were mainly taken as by-catch in long-line fisheries. In Subarea I, 0.4 t was taken.

5.3.1.1 Landings trends

Landing statistics by nation in the period 1988-2005 are given in Table 5.3.0a-5.3.0d. Compared with the pre-2000 landings level, recent landings were about halved. The preliminary 2005 landing of 7,025 tonnes is the lowest in the series.

5.3.1.2 ICES advice

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

5.3.1.3 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. Section 5.1). 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)

5.3.1.4 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 are forthcoming that appear to show geographical heterogeneity within the ICES area at a scale that may require a revision of the current perception of population structure.

5.3.2 Data available

5.3.2.1 Landings and discards

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

5.3.2.2 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 *et al*. (WD4, 2006). In this period, when the tusk has been fully or heavily exploited, the mean length has varied around 50cm without any clear trend.

5.3.2.3 Age compositions

No new age compositions were available.

5.3.2.4 Weight at age

No new data were presented.

5.3.2.5 Maturity and natural mortality

No new data were presented.

5.3.2.6 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 2000-2005. 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.

A first analysis based on these two sources of data was presented in a WD by Helle (WD3, 2006).

5.3.3 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 (WD3, 2006). The number of longliners has declined in recent years (Table 5.3.1), from 72 to 39 in the period 2000-2005. However, the number of fishing days with tusk catch has increased in the same period (Table 5.3.2). The number of hooks set per day and the total set per year has remained rather stable in Subareas I and II (Tables 5.3.3 and 5.3.4).

Table 5.3.5 gives estimates of CPUE based on the Norwegian official logbooks and the reference vessels, and the same results are shown in Figure 5.3.1. In Figure 5.3.2 the data for 2000-2005 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 2000-2005 period. There is an apparent increase in 2005, but this must be interpreted with caution since it is based on few logbooks.

5.3.4 Comments on the assessment

The CPUE series of the main fleet landing tusk suggest that the abundance has remained at a reduced level after a probable decline in the 1970s to 1990s. Between 2000 and 2004 there was a continued decline, followed by an unexplained sharp increase in 2005. The estimate for 2005 was based on input from few logbooks and is unreliable.

5.3.5 Management considerations

It is unlikely that current management has effectively reduced effort in the main fleet, i.e. longliners, compared with the level in 1998 (ref. ICES advice from 2004). Despite that the number of vessels has declined, the number of hooks set per year has remained constant or increased in recent years. Management is thus not in accordance with ICES advice from 2004. Based on the current perception of status and trends in the stock, there is no basis to suggest amendment of the advice statement from 2004.

Reference points that were previously assigned to tusk were:

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

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

where U is a smoothed relative abundance index. If the CPUE from Norwegian long liners is accepted as a valid abundance index, an evaluation in relation to reference points may be proposed. The CPUE estimates from the 1970s were few and very variable, but the average CPUE was probably around 80kg/1000 hooks. By comparison, the 2000-2005 mean CPUE is around 40kg/1000 hooks, thus at about $U_{pa,}$. Considering that tusk in I and II was fully exploited or probably overexploited prior to 1970, this assessment is probably reasonable yet uncertain.

Table 5.3.0a. 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

*Preliminary

Table 5.3.0b. 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*	15	6			6238			37	3	6299

(1)Includes IIb.

*Preliminary

Table 5.3.0c. 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

*Preliminary

Table 5.3.0d. Tusk I & II. WG estimates of total landings by Sub-areas or Division

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	6299	164	7025

*Preliminary

Table 5.3.1. Summary statistics for the Norwegian long liner fleet during the period 1995-2005 (vessels exceeding 21m). This list only include 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

Table 5.3.2. 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 2000-2005.

	2000	2001	2002	2003	2004	2005
I	3	1	4	5	6	1
IIa	34	58	62	50	53	80
IIb	1				1	1

Table 5.3.3. Estimated number of hooks that the Norwegian long liners set per day in Subarea I and II in the period 2000-2005. n= the total number of days with hook information contained in the logbooks.

ALL	2000		2001		2002		2003		2004		2005	
	Average	n	Average	n	Average	n	Average	n	Average	n	Average	n
I	32953	193	31974	153	35340	293	35172	383	35737	137	34196	56
IIa	31512	1438	30719	2234	33459	2023	34712	1815	34540	667	33306	628
IIb	36354	65	34779	280	34756	45	34776	67	34086	70	34707	58

Table 5.3.4. 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.

	2000	2001	2002	2003	2004	2005
I	13468	9636	20709	24155	21053	10669
IIa	95960	135173	135375	112970	99064	116533
IIb	5004	19181	3128	4178	10260	11215

Table 5.3.5. 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		
	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	1.9	63	3.8	3.2	8	13.2
IIa	62	1172	0.9	53.2	1903	0.6	47.14	1806	0.5	40.3	1453	0.5	33.3	528	1.3	60.6	562	1.6
IIb	48.7	17	8	2.5	1	29.4				5.3	5	8.6	1.7	9	10.0	3.3	6	15.2

Reference vessels:

	2001			2002			2003			2004			2005		
	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
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
IIb										8.74	2	23.26	0.55	4	19.42

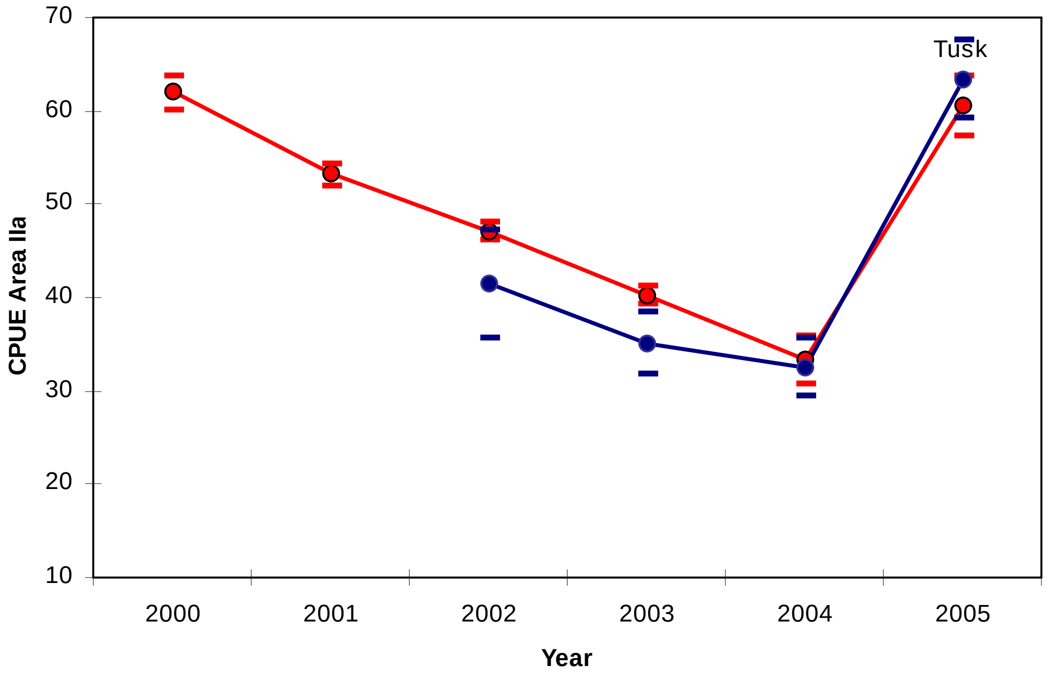

Figure 5.3.1. Tusk in IIa. Estimated mean CPUE ([kg/hook]x1000) based on logbook data (red line) and the reference fleet data (blue line). The bars denote the 95% confidence intervals. From WD3 by Helle (2006).

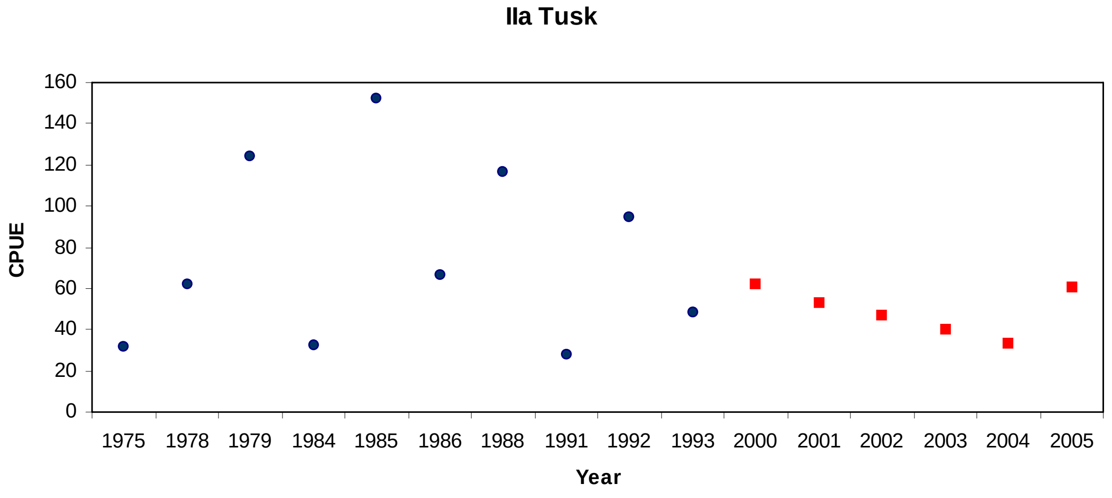

Figure 5.3.2. Estimates of CPUE (kg/1000 hooks) of tusk based on skipper's logbooks (pre-2000, dots) and official logbooks (post 2000, squares). Combination of data from Bergstad and Hareide (1996) and WD3 by Helle (2006). Note interruption in time series in the period 1993-2000.

6 Stocks and fisheries of the Faroes

6.1 Fisheries overview

The fishery around the Faroe Islands has for centuries been an almost free international fishery involving several countries. Apart from a local fishery with small wooden boats, the Faroese offshore fishery started in the late 19th century. The Faroese fleet had to compete with other fleets, especially from the United Kingdom with the result that a large part of the Faroese fishing fleet became specialised in fishing in other areas. So except for a small local fleet most of the Faroese fleet were fishing around Iceland, at Rockall, in the North Sea and in more distant waters like the Grand Bank, Flemish Cap, Greenland, the Barents Sea and Svalbard. Up to 1959, all vessels were allowed to fish around the Faroes outside the 3 nm zone. During the 1960s, the fisheries zone was gradually expanded, and in 1977 an EEZ of 200 nm was introduced in the Faroe area. The demersal fishery by foreign nations has since decreased and Faroese vessels now take most of the catches. The main fisheries in Faroese waters are mixed-species, demersal fisheries and single-species, pelagic fisheries. The demersal fisheries are mainly conducted by Faroese vessels, whereas the major part of the pelagic fisheries are conducted by foreign vessels licensed through bilateral and multilateral fisheries agreements.

6.1.1 Trends in fisheries

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

The main deepwater fleet consist of about 10 otterboard trawlers with engines larger han 2000 Hp. They have traditionally targeted saithe, redfish *(Sebastes spp.)*, Greenland halibut, blue ling and to a lesser degree black scabbardfish *(Aphanopus carbo)* and roundnose grenadier *(Coryphaenoides rupestris)*. There has been an increased effort in recent years in Faroese waters as the deepwater fleet has reduced it's effort in other areas. This has resulted in increased effort on black scabbardfish, roundnose grenadier and blue ling in Vb with a corresponding increase in the landings of these species.

The traditional longline fleet fishing ling, tusk and blueling consist of 19 longliners larger than 100 GRT; they are mainly targeting cod and haddock and in years where the availability of these species is high and market conditions satisfactory, they spend very little effort in deep water. Recently, a directed longline fishery with one vessel on deepwater sharks (*Centroscymnus coelolepis* and *Centrophorus squamosus*) was initiated; however, there has been no such fishery in 2002 and 2003 this fishery was been re-established in 2004.

In the 1990s, a gill net fishery directed at monkfish *(Lophius piscatorius)* and Greenland halibut *(Reinhardtius hippoglossoides)* developed in Vb and is now well established; by-catches in this fishery are among others deep-sea redcrab and blue ling. More recently exploratory trap fisheries for deep-sea red crab have been performed but not on a regular basis.

A trawl fishery for greater silver smelt (*Argentina silus*) has been expanding rapidly in recent years. Three pair trawlers, which otherwise mainly target saithe (*Pollachius virens*), hold licences to this fishery that mainly takes place in late spring and summer. 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.

Landings of the Faroese fleets have been given in Table 6.1.1 and Figure 6.1.1.

6.1.2 Technical interaction

Landings by gear and by species are given in Table 6.1.2.

In an effort management regime with a limited numbers of fishing days, it is expected that vessels will try to increase their efficiency (catchability) as much as possible in order to optimise the catch and its value within the number of days allocated. "Technological creeping" should therefore be monitored closely in such a system. However, catchability of the fleets can change for other reasons, e.g. availability of the fish to the gears. For cod and haddock there seems to be a negative relationship between catchability and individual growth (ICES 2005), probably because hungry fish prefer longline baits. The feeding conditions for species distributed mainly shallower than 200 m are believed to be influenced by the primary production on the Faroe Shelf (Steingrund and Gaard, 2005), but it may not apply to species occupying deeper waters, e.g. tusk and ling.

6.1.3 Ecosystem considerations

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

Existing and former areas of *Lophelia* coral have been mapped around the Faroes through questionnaires to fishermen (Frederiksen *et al*. 1992; Jákupsstova *et al*. 2002). An estimated 11 000km^2 of living coral are found in Faroese waters, although this is estimated to be a significant reduction from earlier times (ICES, 2005).

6.1.4 Management measures

During the 1980s and 1990s the Faroese authorities have regulated the fishery and the investment in fishing vessels. In 1987 a system of fishing licences was introduced. The demersal fishery at the Faroe Islands has been regulated by technical measures (minimum mesh sizes and closed areas). In order to protect juveniles and young fish, fishing is temporarily prohibited in areas where the number of small cod, haddock and saithe exceeds 30% in the catches; after 1–2 weeks the areas are again opened for fishing.

A reduction of effort has been attempted through banning of new licences and buy-back of old licences. A new quota system, based on individual quotas, was introduced in 1994. The fishing year started on 1 September and ended on 31 August the following year. The aim of the quota system was, through restrictive TACs for the period 1994–1998, to increase the SSBs of Faroe Plateau cod and haddock to 52 000 t and 40 000 t, respectively. The TAC for saithe was set higher than recommended scientifically. It should be noted that cod, haddock and saithe are caught in a mixed fishery and any management measure should account for this. Species under the quota system were Faroe Plateau cod, haddock, saithe, redfish and Faroe

Bank cod. The catch quota management system introduced in the Faroese fisheries in 1994 was met with considerable criticism and resulted in discarding and in misreporting of substantial portions of the catches. Reorganization of enforcement and control did not solve the problems. As a result of the dissatisfaction with the catch quota management system, the Faroese Parliament discontinued the system as from 31 May 1996. In close cooperation with the fishing industry, the Faroese government has developed a new system based on individual transferable effort quotas in days within fleet categories. The new system entered into force on 1 June 1996. The fishing year from 1 September to 31 August, as introduced under the catch quota system, has been maintained.

The individual transferable effort quotas apply to 1) the longliners less than 100 GRT, the jiggers, and the single trawlers less than 400 HP, 2) the pair trawlers and 3) the longliners greater than 100 GRT. The single trawlers greater than 400 HP do not have effort limitations, but they are not allowed to fish within the 12 nautical mile limit and the areas closed to them, as well as to the pair trawlers, have increased in area and time. Their catch of cod and haddock is limited by maximum by-catch allocation. The single trawlers less than 400 HP are given special licences to fish inside 12 nautical miles with a by-catch allocation of 30% cod and 10% haddock.

In addition, they are obliged to use sorting devices in their trawls. One fishing day by longliners less than 100 GRT is considered equivalent to two fishing days for jiggers in the same gear category. Longliners less than 100 GRT could therefore double their allocation by converting to jigging. Holders of individual transferable effort quotas who fish outside this line can fish for 3 days for each day allocated inside the line. Trawlers are generally not allowed to fish inside the 12 nautical mile limit. Inside the innermost thick line only longliners less than 100 GRT and jiggers less than 100 GRT are allowed to fish. The Faroe Bank shallower than 200 m is closed to trawling.

The effort quotas are transferable within gear categories. In addition to the number of days allocated in the law, it is also stated in the law what percentage of total catches of cod, haddock, saithe and redfish, each fleet category on average is allowed to fish.

Technical measures such as area closures during the spawning periods, to protect juveniles and young fish and mesh size regulations as mentioned above are still in effect.

Table 6.1.1. 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
	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	6978
	BLUE LING (Molva dypterigia)	9526	5264	4799	2962	4702	2836	1644	2440	1602	2798	2584	2932	2524	2119	2020	3815	2699	2259
	BLACK SCABBARDFISH (Aphanopus carbo)		166	419	152	33	287	160	424	186	68	180	172	311	795	1751	1633	862	502
	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
	MORIDAE				5								1		100	19	2		1
	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
	ROUGHHEAD GRENADIER (Macrourus berglax)											9	58	1	4	3	15	9	6
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	1	258	1549	2311	3817	1681	668	1223	1078	1112	1667	1996	1791	2016	1025	1532	1579	1316
	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
	WRECKFISH (Polyprion americanus)																		

Table 6.1.2. Technical interactions in Division Vb.

year	2005

Sum of Kg		species											
main gear	ICES area	ALF	ARU	BLI	BSF	FOR	LIN	ORY	RNG	SBR	USK	ZZZ	SKH
bottom trav	Vb		59000	97275	10871		90559		18015		12009	4817	
	Vb2			299000	55000	2000		9000	649000			39000	68000
gill nets	Vb			34912		2378	18211				691		
lines	Vb			353									
	Vb1			14813		40463	1553416		610		1397913		
	Vb2			13636		2650	647322				359843	4010	
pel trawls	Vb										65		

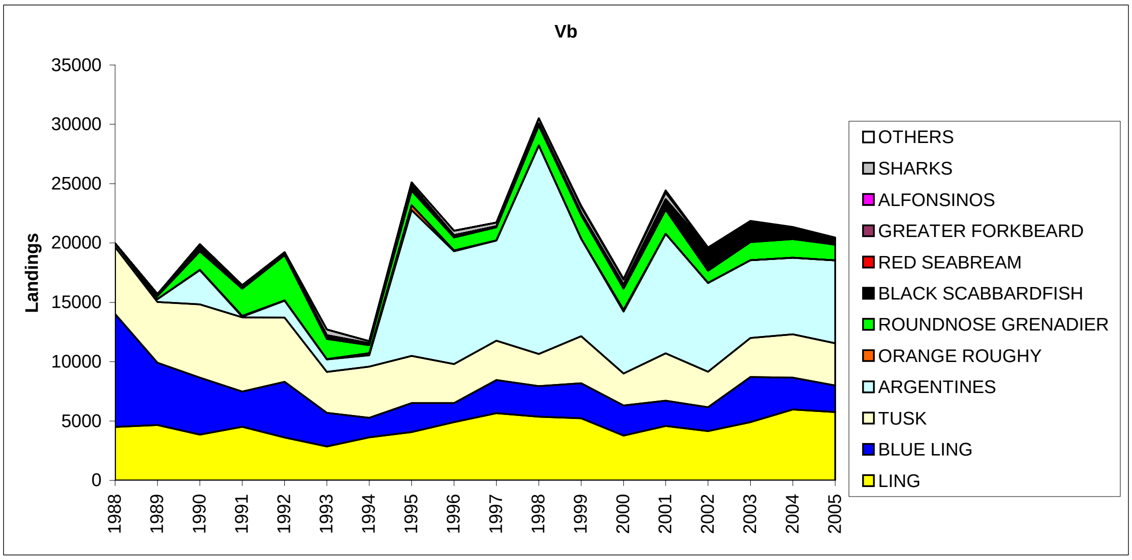

Figure 6.1.1. Landings in Division Vb.

6.2 LING (*MOLVA MOLVA*) IN DIVISION Vb

6.2.1 The fishery

6.2.1.1 Landings trends

Landing statistics for ling by nation in the period 1988-2005 are given in Tables 6.2.0a-6.2.0c. Landings in Sub-Divisions Vb1 and Vb2 have varied between about 4 000 and 6 000 tonnes since 1980, except low landings in 1993 (about 3000 tonnes) (Figure 6.2.1). The preliminary landings of ling in 2005 are 5 700 tonnes.

The Norwegian longliners have been taken about 2 100 tonnes in Faroese waters in 2004-2005. The rest is mainly taken by Faroese longliners (about 60%), trawlers (about 30%) and the remainder by various boats.

6.2.1.2 ICES advice

ACFM autumn 2004: For Division Vb, effort should not be allowed to increase compared with the present level.

6.2.1.3 Management

There is no species-specific management of ling in Vb, only minimum landing size (60 cm). Details on management measures in Faroese waters are in section 4.1.6.4.

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 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.

6.2.3 Data available

There are data on length, weights and age available for ling from the Faroese landings and an overview of the sampling intensity is in Table 6.2.1. There are also data from logbooks from the Faroese longliners and pair trawler, and from the Faroese groundfish survey for cod, haddock and saithe (WD 2, Ofstad, 2006). There are also data available from Norwegian longliners fishing in Faroese waters (WD 3, Helle, 2006; WD4, Helle & Pennington, 2006).

6.2.3.1 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.

6.2.3.2 Length compositions

Length distributions are available for Faroese commercial landings (Figure 6.2.2) and two Faroese groundfish surveys in Division Vb. There are also length distributions from the Norwegian longliners “reference fleet” for the period 2003-2005 (Figure 6.2.2) (WD4, Helle & Pennington, 2006). The length distributions for the Norwegian longliners fishing in Faroese waters, in the period 2003-2005, are almost the same as for the Faroese longliners. The trawlers have a slightly higher length distribution.

6.2.3.3 Age compositions

The age distributions of ling caught by longliners and pair trawlers are very similar (Figure 6.2.3). Fish aged six to nine dominates the catches.

Catch-at-age data were provided for Faroese landings in Vb 1996-2005 to use as an input file to the assessment. Due to the limited number of samples, samples from longliners and trawlers, respectively, were disaggregated by half-year periods and then raised by the catch proportions to give the annual catch-at-age in numbers for each fleet. Catches of some minor fleets were presumed to have the same relative catch-at-age in numbers as the sum of the longliners and trawlers. No catch-at-age data were available from other nations fishing in Vb. Therefore, catches by France, Germany and UK trawlers were assumed to have the same age composition as those from Faroese trawlers. The Norwegian longliners were assumed to catch the same age distribution as the Faroese longliners. In a few years a small number of 3 year old ling have been caught and these were excluded from the analysis. By inspecting the catch-at-age matrix it was decided to treat age 12 and older as a plus group. The resulting total catch-at-age in numbers is given in Table 6.2.2.

There are some uncertainties about the catch-at-age matrix because of the small sample size in some years. The fish at age 4 and 5 have a mean length of about 55 and 60 cm, and the length distribution shows that the catches are mostly of fish longer than 65 cm (Figure 6.2.2). The minimum landing size is 60 cm, the average size of age 5 fish, so there are also few samples for ages 4 and 5. A further investigation of the age distribution of catches by longliners and trawlers would improve the annual catch-at-age in number.

6.2.3.4 Weight at age

Mean weight-at-age data are provided for the Faroese fishery (Table 6.2.3). The mean weights at age for ages 4-11 are presented in Figure 6.2.4. Except for the youngest and oldest ages, they seem to be consistent showing small fluctuations throughout the period.

The mean weight-at-age data were used as input to catch weight at age, and it was also assumed for the stock weight-at-age.

6.2.3.5 Maturity and natural mortality

Ling become mature at ages 5-7 (60-75 cm lengths) in most areas, with males maturing at a slightly lower age than females (Magnusson *et al.*, 1997). Some observations have been made on maturity stages, but it is difficult to state the age and length for onset of maturity due to inconsistent data. This can partly be explained by sampling outside the spawning season.

No annual measurements of maturity at age were available and knife-edge maturity for age 7 and older was assumed for the assessment.

A natural mortality of 0.2 was assumed for all ages.

6.2.3.6 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 (Figure 6.2.5-6.2.6). All the CPUE series show a small increasing trend in the last four years.

The Faroese CPUE data are from all available logbooks, for the period 1986-2005, from 8 pair trawlers (HP>1000) and 5 long liners (GRT>100). These data are stored in a database at the Faroese Fisheries Laboratory. The data are corrected and quality controlled. The effort obtained from the logbooks is estimated as number of fishing (trawling) hours from the trawlers, 1000 hooks from the longliners and the catch as kg stated in the logbooks. The third series is data from the Norwegian longliners "reference fleet".

Sets where the catch of ling and tusk combined represented more than 60% of the total catch and depth was >150 m were selected for the longliner CPUE series. The bycatch series for ling from the Faroese pair trawlers > 1000 HP is limited to hauls where the catch of saithe is more than 60 % of the total catch in the haul. It should be kept in mind that these data can be used as a CPUE series, but not used as measure of effort because there are only a selected number of sets/hauls.

Only the Faroese longliner series (directed effort measured as number of 1000 hooks) was used as a tuning series in the assessment (Figure 6.2.5, 6.2.7 and Table 6.2.4).

Fisheries independent CPUE series. CPUE estimates (kg/hour) for ling are available from two annual groundfish surveys for cod, haddock and saithe in Faroese waters. The spring survey shows a decreasing trend in the latest years and the summer survey shows an increasing trend from 2003 to 2004, but then a decrease in 2005 (Figure 6.2.8). Both surveys are restricted to the area within the 500 m contour of the Faroe Plateau and so do not cover the distribution area for ling. Thus this series should not be used as a tuning series.

The spring survey has been carried out in February-March since 1994 (100 fixed stations), and the summer survey in August-September since 1996 (200 fixed stations).

6.2.4 Data analyses

As in the last WGDEEP report an analytical assessment exercise on ling in Vb was attempted. Although the assessment data series is only nine years and there is assumed that ling in Vb can be treated as one stock unit, although such a status never has been scientifically verified.

6.2.4.1 Exploratory analysis 1

A **Separable analysis** was first run as in the 2004 report (age 10 for unit selection 10, terminal F of 0.4 and S of 1) in order to test the catch data set for outliers (Table 6.2.5). Obviously the data are noisy with many high residuals, especially for young fishes (Figure 6.2.9). There are uncertainties on level of catches on age 3-5 regarded to minimum landing size.

6.2.4.2 Exploratory analysis 2

A **Laurec-Shepherd** *ad hoc* tuning was then carried out without shrinkage (Table 6.2.6) and the log catchability residuals plotted (Figure 6.2.10) in order to screen the Faroese longliner as a tuning fleet. It can be seen that the data are noisy with year and age effects, and standard errors are high. Year effects may derive from the fact that this fleet mainly targets cod and haddock when availability and market conditions for these species are favourable. When this is not the case they move into deeper waters for ling, blue ling and tusk.

6.2.4.3 Exploratory analysis 3

Although the quality of the input data can be questioned, a few **XSA** runs were performed, with different settings (tapering weighting, shrinkage, Q plateau). For all the runs, the diagnostics from the XSA showed that the data are noisy with year and age effects, and standard errors are high.

6.2.4.4 Conclusions drawn from the exploratory analyses

The separable analysis showed that the catch number-at-age data are noisy with many high residuals, especially for young and old fishes. The tuning fleet was investigated using a Laurec-Shepherd *ad hoc* tuning and the log catchability residuals showed that the data are noisy with year and age effects, and standard errors are high. A few XSA runs were done, but of course the diagnostics from the XSA showed that the data are noisy with year and age effects, and standard errors are high. The conclusion is that no analytical assessment of ling will be done this time.

6.2.4.5 Final assessment

No final analytical assessment was achieved, due to noisy data.

The only information on abundance trends can be derived from the CPUE data from the Faroese longliners, Faroese pair trawlers and Norwegian longliners (Figure 6.2.5-6.2.6). The Norwegian CPUE series (extracted from WD3 by Helle, 2006) extends back to the 1970s and shows that the current level remains low compared with the level in the 1970s and 80s. Norwegian and Faroese longliners are comparable and both have ling as a target species. Pair trawlers have ling as a by catch. The overall evaluation is that the recent CPUE level is low, but it should be noted that all fleets show an increase in CPUE in the last years 3-4 years.

6.2.5 Comments on the assessment

The only analytical assessment that could be attempted was based on Faroese data. The input data to the analytical assessment is very short, 9 years only. The sampling is representative of only approximately half of the landings. The present exploratory assessment is highly uncertain and mainly presented here to illustrate some of the work done on ling in Vb. The present assessment only covers a very short period in the history of this fishery for which landings have been reported back to 1904 (Table 6.2.0a-c).

As the input data on catch number at age are few in younger and older ages, and are noisy, alternative methods not requiring age-structured data should be considered. The ACFM suggested trying stock production models such as ASPIC, but due to lack of time, this was not accomplished. Another model that could be useful is Catch-Survey Analysis (CSA), potentially providing estimates of absolute abundance. Both these methods need a time series of catches and relative abundance indices.

There is a need for full time series for fishing effort data, in order to investigate changes in effort.

6.2.6 Management consideration

CPUE series suggest that the current abundance is at a low level compared with the historical records from the 1970s-80s, but that there is also a possible improvement in the most recent years. The analytical assessments that were attempted could not be used to evaluate the reliability of these trends.

The ACFM recommended in 2004 that the effort should not be allowed to increase compared with “present level” (presumably level in 2002-2003). Information on total effort in Subarea Vb is not available. The effort series for Faroese longliners represent five out of 19 vessels and the Faroese pair trawlers effort represent 8 out of 31 vessels in the fleet. Another important fleet is the Norwegian longliners that target ling in Vb. It was shown in WD3 by Helle (2006) that except for 2004 when the total number of hooks set by the Norwegian fleet was exceptionally high, a rather invariable number was set each year in the period 2000-2005. The Norwegian longliners catch about 40-50% of the total ling landings in area Vb. It is at present not possible to determine if the Faroese and Norwegian fleets together have increased or decreased the effort compared with the 2002-2003 level.

There is no clear evidence to suggest that the state of the ling stocks has changed since the assessments in 1998 and 2000. The only possibility to evaluate present stock abundance in relation to reference points is to use CPUE series. If the historical CPUE series can be used as an abundance index, then the recent level is about 70kg/1000 hooks (2000-2004) compared with about 150kg/1000 hooks in the 1970s. This would suggest that the current abundance is near and perhaps below U_{pa} i.e. 50% of the historical maximum. Considering that ling in Vb was fully exploited or probably overexploited prior to 1970, this assessment is probably reasonable.

It is uncertain if current management is in accordance with ICES advice from 2004. Based on the current perception of status and trends in the stock, amendment of the advice statement from 2004 should be considered, including a recommendation for a reduction in exploitation. An approach that would be consistent with that chosen for other ling stocks would be to recommend reduction in effort by 30% compared with the 1998 level.

Table 6.2.0a. Ling in Vb1. Nominal landings (1988-2005) (* preliminary data).

Year	Denmark	Faroes[4]	France[2]	Germany	Norway	E&W[1]	Scotland[1]	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	1047	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		2008	9	1	1305	2	61		3386
2001		2489	17	3	1496	5	99		4109
2002		1788	9	2	1640	3	239		3681
2003		2203	17	2	1526	3	215		3966
2004		3727	10	1	1799	3	178	2	5720
2005*		3461	10		1553	3	70		5097

Table 6.2.0b. Ling in Vb2. Nominal landings (1988-2005) (* 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		399	399
2001		497	497
2002		457	457
2003		927	927
2004		247	247
2005*		647	647

*Preliminary. [1] Included in Vb_1.

Table 6.2.0c. Ling in Vb. Nominal landings (1988-2005) (* preliminary data).

Year	Vb1	Vb2	All
1988	2372	2116	4488
1989	2962	1690	4652
1990	3062	795	3857
1991	3465	1047	4512
1992	2400	1214	3614
1993	2242	614	2856
1994	2657	965	3622
1995	3286	784	4070
1996	3996	900	4896
1997	4733	924	5657
1998	4029	1330	5359
1999	4576	662	5238
2000	3386	399	3785
2001	4091	497	4588
2002	3681	457	4138
2003	3966	927	4893
2004	5720	247	5967
2005*	5097	647	5744

*Preliminary.

Table 6.2.1. Ling in Vb. Overview of the sampling intensity in the commercial landings.

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

Table 6.2.2. Ling in Vb. Catch at age in numbers (‘1000).

	Year									
Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
4	90	1	1	18	45	20	61	39	149	37
5	232	219	59	25	123	88	68	65	145	102
6	329	298	159	9	110	310	417	322	194	260
7	324	490	284	167	57	594	448	438	435	260
8	213	411	335	399	113	194	210	382	441	325
9	106	266	369	349	177	111	62	195	221	225
10	61	126	180	176	107	80	80	59	90	124
11	28	41	70	84	57	23	2	19	53	50
12	12	27	33	53	43	27	2	22	18	24
13	7	8	1	33	12	10	1	25	15	33
14	3	6	27	1	2	1	2	0	5	35

Table 6.2.3. Ling in Vb. Catch weight at age.

	Year									
Age	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
4	1.053	0.603	1.157	1.067	1.321	1.061	1.202	0.999	1.046	1.012
5	1.842	1.147	1.203	1.088	1.826	1.122	1.512	1.190	1.460	1.231
6	2.559	1.782	1.799	2.216	2.617	1.921	1.959	2.088	2.048	1.802
7	3.380	2.404	2.437	2.366	3.139	2.604	2.887	2.724	2.683	2.577
8	4.026	3.221	3.132	3.118	4.055	3.638	3.872	3.502	3.528	3.620
9	5.181	4.058	4.024	4.083	5.056	5.168	5.474	4.044	4.689	4.772
10	7.521	5.156	5.018	5.480	6.281	6.587	8.242	5.482	6.269	6.445
11	9.514	7.062	6.451	6.227	7.604	7.521	5.198	6.219	8.177	7.457
12	10.676	8.216	7.186	8.203	9.931	9.443	9.600	8.761	9.865	9.000
13	10.033	9.764	8.582	7.930	11.678	11.990	11.777	11.145	11.329	10.400
14	8.516	11.993	10.229	10.466	9.314	9.542	12.506	11.145	11.148	13.558

Table 6.2.4. Ling in Vb. Longliner tuning fleet data.

	Year									
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Effort	593	2661	2308	3020	2157	2111	557	843	1679	2834
Age										
4	258	48	11	433	692	310	241	255	2425	568
5	663	7123	1174	585	1897	1378	267	420	2230	1768
6	943	9715	3182	221	1700	4866	1649	2089	2893	6061
7	928	15949	5685	3983	887	9324	1771	2841	6307	5882
8	609	13371	6700	9485	1744	3050	832	2476	6001	7680
9	304	8673	7390	8300	2731	1737	245	1264	2867	5506
10	174	4109	3612	4180	1654	1251	318	380	1165	3159
11	80	1325	1403	1988	872	365	6	121	727	1253

Table 6.2.5. Ling in Vb. Results from separable analysis.

Title : FAROE LING (ICES DIVISION Vb) LIN_IND

At 7/05/2006 23:09

Separable analysis
from 1996 to 2005 on ages 4 to 11
with Terminal F of .400 on age 10 and Terminal S of 1.000

Initial sum of squared residuals was 113.993 and
final sum of squared residuals is 50.514 after 78 iterations

Matrix of Residuals

Years,	1996/97,	1997/98,	1998/99,	1999/**,	2000/**,	2001/**,	2002/**,	2003/**,	2004/**,	TOT,	WTS,
4/ 5,	.152,	-3.214,	-2.331,	-1.262,	.562,	-1.043,	.619,	-.739,	.613,	.005,	.159,
5/ 6,	1.348,	1.737,	3.319,	-.267,	.847,	-.818,	-.310,	.048,	.227,	.001,	.170,
6/ 7,	.592,	.846,	.761,	-1.253,	-.569,	-.255,	.601,	.260,	-.041,	-.002,	.313,
7/ 8,	.161,	.564,	-.158,	.359,	-.766,	.510,	.232,	-.003,	.023,	-.003,	.544,
8/ 9,	-.254,	-.168,	-.334,	.305,	-.023,	.098,	-.275,	.152,	.044,	-.003,	1.000,
9/10,	-.235,	.047,	.353,	.596,	.596,	-.812,	-.292,	.428,	.076,	-.003,	.468,
10/11,	-.561,	-.728,	-.623,	-.496,	.358,	1.350,	.172,	-1.128,	-.752,	-.002,	.288,
TOT ,	.000,	-.001,	-.002,	-.002,	-.001,	-.001,	-.001,	-.002,	-.001,	-.753,	
WTS ,	.001,	.001,	.001,	.001,	1.000,	1.000,	1.000,	1.000,	1.000,		

Fishing Mortalities (F)

,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,
F-values,	.9026,	1.1521,	1.2325,	1.3533,	1.1820,	1.8371,	.9935,	.8846,	.7058,	.4000,

Selection-at-age (S)

,	4,	5,	6,	7,	8,	9,	10,	11,
S-values,	.0048,	.0131,	.0646,	.1903,	.3602,	.5226,	1.0000,	1.0000,

1

Run title : FAROE LING (ICES DIVISION Vb) LIN_IND

At 7/05/2006 23:09

Traditional vpa Terminal populations from weighted Separable populations

Fishing mortality residuals

YEAR,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,
AGE										
4,	.0464,	-.0047,	-.0056,	-.0023,	.0018,	-.0057,	.0034,	-.0015,	.0012,	.0000,
5,	.0919,	.1524,	.0429,	-.0076,	.0200,	-.0059,	-.0001,	-.0008,	.0032,	-.0014,
6,	.0919,	.1134,	.0967,	-.0760,	-.0202,	-.0011,	.0477,	.0207,	-.0053,	.0021,
7,	.0186,	.1287,	.0401,	.0261,	-.1321,	.1260,	.0591,	-.0037,	.0090,	-.0065,
8,	-.0814,	-.0236,	-.0176,	.2848,	-.1099,	-.1480,	-.0517,	.0280,	-.0061,	.0074,
9,	-.1495,	-.0592,	.0947,	.3990,	.3734,	-.3736,	-.2140,	.0566,	-.0225,	-.0158,
10,	-.2580,	-.3589,	-.3348,	-.3474,	.2207,	.6379,	.1954,	-.3515,	-.2219,	-.0663,
11,	-.0139,	.1767,	.4312,	.3537,	-.0283,	-.2155,	-.5742,	.2043,	.7285,	.1480,

1

Table 6.2.6. Ling in Vb. Results from Laurec-Shepherd *ad hoc* analysis.

Lowestoft VPA Version 3.1

7/05/2006 23:33

FAROE LING (ICES DIVISION Vb) LIN_IND

CPUE data from file LL_06.dat

Catch data for 10 years. 1996 to 2005. Ages 4 to 12.

Fleet,	First, year,	Last, year,	First, age ,	Last age
5LongLiners>100GRT (,	1996,	2005,	4,	11

Disaggregated Qs
Log transformation
No trend in Q (mean used)

Terminal Fs derived using L/S (without F shrinkage)

Tuning converged after 9 iterations

Regression weights
, .751, .820, .877, .921, .954, .976, .990, .997, 1.000, 1.000

Oldest age F = 1.000*average of 3 younger ages.
1

Fishing mortalities

Age,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005
4,	.047,	.001,	.000,	.005,	.010,	.005,	.019,	.007,	.030,	.005
5,	.104,	.155,	.046,	.010,	.040,	.025,	.020,	.025,	.031,	.026
6,	.149,	.188,	.161,	.009,	.054,	.133,	.155,	.123,	.097,	.071
7,	.186,	.344,	.275,	.253,	.071,	.448,	.288,	.242,	.242,	.183
8,	.225,	.380,	.420,	.772,	.272,	.363,	.281,	.426,	.410,	.287
9,	.246,	.484,	.701,	1.071,	.989,	.468,	.188,	.456,	.470,	.380
10,	.372,	.517,	.719,	.890,	1.260,	2.446,	.740,	.275,	.395,	.528
11,	.281,	.460,	.613,	.911,	.840,	1.092,	.403,	.386,	.425,	.398

Log catchability residuals

Fleet : 5LongLiners>100GRT (

Age ,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005
4 ,	1.52,	-1.58,	-3.46,	-.35,	.69,	-.28,	1.10,	.37,	1.67,	.00
5 ,	.54,	1.80,	.33,	-1.41,	.29,	-.38,	-.62,	-.08,	-.09,	.00
6 ,	-.09,	1.00,	.60,	-2.44,	-.40,	.32,	.45,	.52,	.07,	.00
7 ,	-.81,	.66,	.19,	-.06,	-1.06,	.59,	.12,	.25,	.03,	.00
8 ,	-1.08,	.30,	.16,	.59,	-.17,	-.07,	-.36,	.36,	.11,	.00
9 ,	-1.26,	.27,	.39,	.64,	.84,	-.10,	-1.04,	.15,	-.03,	.00
10 ,	-1.19,	.00,	.09,	.13,	.75,	1.22,	.01,	-.69,	-.54,	.00

1

SUMMARY STATISTICS FOR AGE 4

Fleet,	Pred. log q ,	se (log q) ,	Partial, F ,	Raised, F ,	Slope ,	se Slope ,	Intrcpt,	se Intrcpt
1 ,	-11.59 ,	1.531 ,	.0863 ,	.0045,	.209E+00,	.164E+00,	-11.592,	.477

Fbar,	Sigma(int.),	Sigma(ext.),	Sigma(overall),	Variance ratio,
.005,	1.53 ,	0.000,	1.53 ,	0.000

Table 6.2.6. (cont.)

```
                          SUMMARY STATISTICS FOR AGE  5
  Fleet, Pred.  ,    se     ,Partial, Raised,   Slope  ,      se   ,Intrcpt,  se
       , log q  ,  (log q)  ,   F   ,   F   ,          ,     Slope ,       ,Intrcpt
    1  , -9.83  ,  .816     , .5045 , .0262,  -.102E+00,   .887E-01, -9.827,   .254

   Fbar,     Sigma(int.),   Sigma(ext.),   Sigma(overall), Variance ratio,
   .026,           .816    ,      0.000,        .816    ,     0.000


                          SUMMARY STATISTICS FOR AGE  6
  Fleet, Pred.  ,    se     ,Partial, Raised,   Slope  ,      se   ,Intrcpt,  se
       , log q  ,  (log q)  ,   F   ,   F   ,          ,     Slope ,       ,Intrcpt
    1  , -8.84  ,  .952     ,1.3595 , .0707,   .276E-01,   .111E+00, -8.835,   .297

   Fbar,     Sigma(int.),   Sigma(ext.),   Sigma(overall), Variance ratio,
   .071,           .952    ,      0.000,        .952    ,     0.000


                          SUMMARY STATISTICS FOR AGE  7
  Fleet, Pred.  ,    se     ,Partial, Raised,   Slope  ,      se   ,Intrcpt,  se
       , log q  ,  (log q)  ,   F   ,   F   ,          ,     Slope ,       ,Intrcpt
    1  , -7.89  ,  .540     ,3.5096 , .1826,   .307E-01,   .624E-01, -7.887,   .168

   Fbar,     Sigma(int.),   Sigma(ext.),   Sigma(overall), Variance ratio,
   .183,           .540    ,      0.000,        .540    ,     0.000


                          SUMMARY STATISTICS FOR AGE  8
  Fleet, Pred.  ,    se     ,Partial, Raised,   Slope  ,      se   ,Intrcpt,  se
       , log q  ,  (log q)  ,   F   ,   F   ,          ,     Slope ,       ,Intrcpt
    1  , -7.43  ,  .443     ,5.5205 , .2870,   .327E-01,   .507E-01, -7.434,   .138

   Fbar,     Sigma(int.),   Sigma(ext.),   Sigma(overall), Variance ratio,
   .287,           .443    ,      0.000,        .443    ,     0.000


                          SUMMARY STATISTICS FOR AGE  9
  Fleet, Pred.  ,    se     ,Partial, Raised,   Slope  ,      se   ,Intrcpt,  se
       , log q  ,  (log q)  ,   F   ,   F   ,          ,     Slope ,       ,Intrcpt
    1  , -7.16  ,  .660     ,7.2915 , .3801,   .388E-03,   .775E-01, -7.156,   .206

   Fbar,     Sigma(int.),   Sigma(ext.),   Sigma(overall), Variance ratio,
   .380,           .660    ,      0.000,        .660    ,     0.000


                          SUMMARY STATISTICS FOR AGE 10
  Fleet, Pred.  ,    se     ,Partial, Raised,   Slope  ,      se   ,Intrcpt,  se
       , log q  ,  (log q)  ,   F   ,   F   ,          ,     Slope ,       ,Intrcpt
    1  , -6.83  ,  .687     ,****** , .5282,   .398E-02,   .807E-01, -6.826,   .214

   Fbar,     Sigma(int.),   Sigma(ext.),   Sigma(overall), Variance ratio,
   .528,           .687    ,      0.000,        .687    ,     0.000
1
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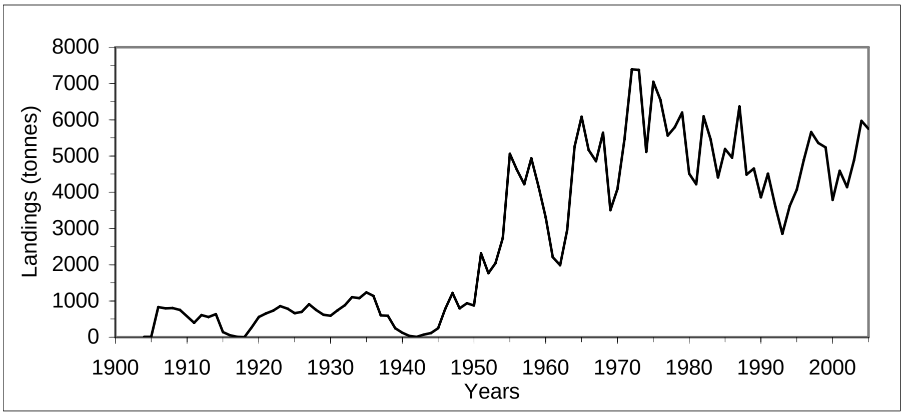


Figure 6.2.1. Ling in Vb. Nominal landings (thousand tonnes) 1904-2005.

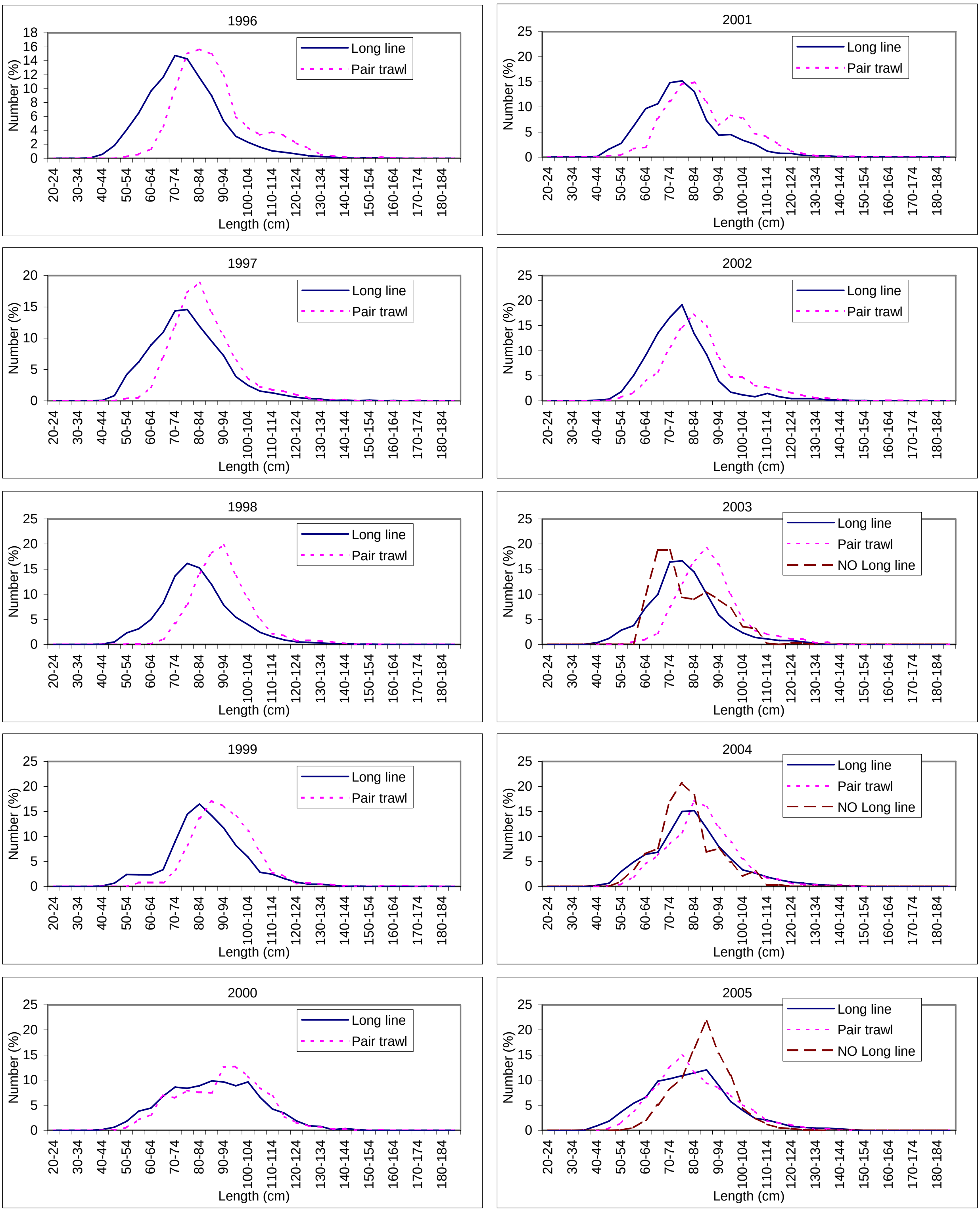


Figure 6.2.2. Ling in Vb. Length distribution in landings for Faroese longliners, Faroese pair trawlers and Norwegian (NO) longliners.

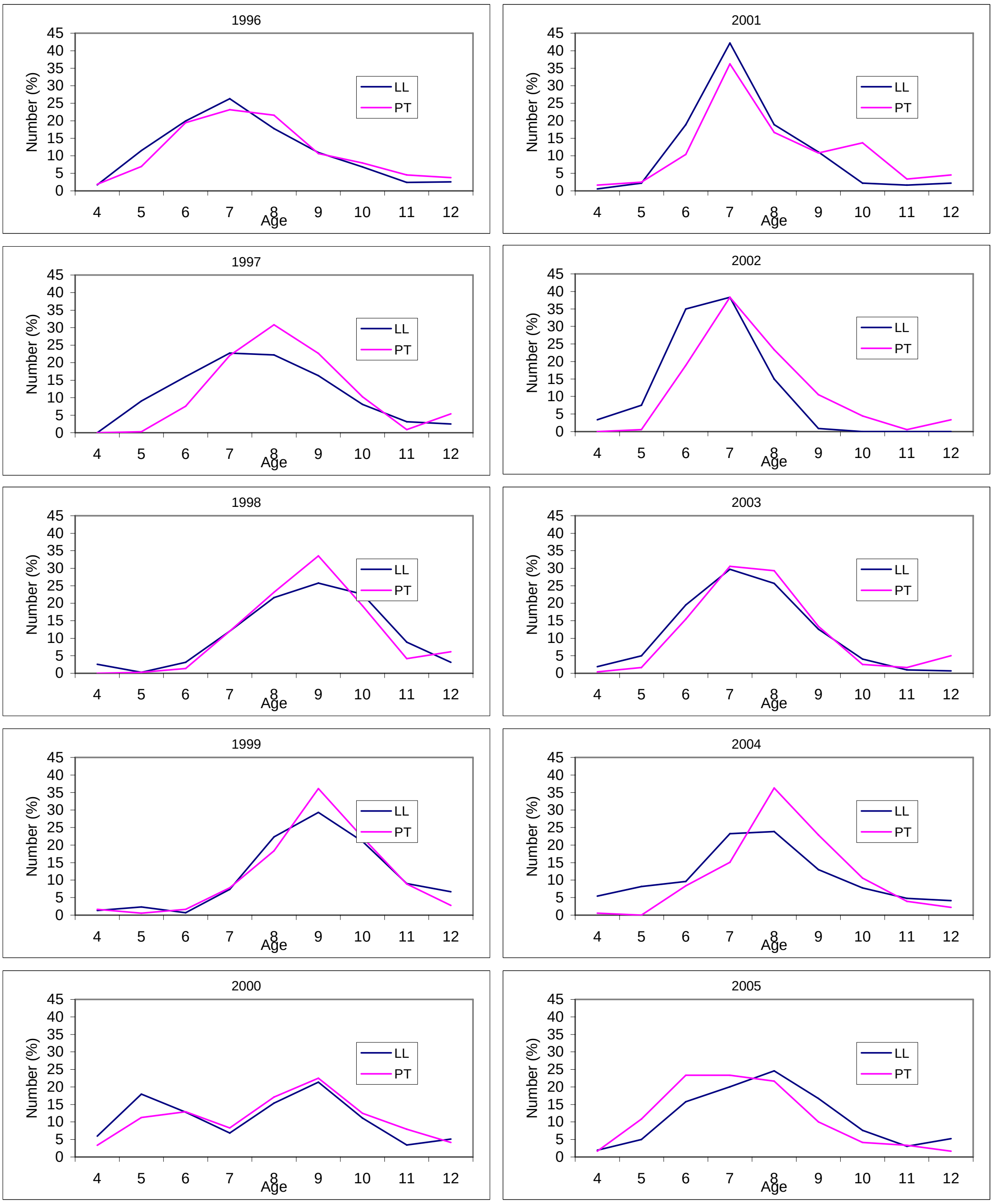


Figure 6.2.3. Ling in Vb. Age distribution in the landings from Faroese longliners (LL) and Faroese pair trawlers (PT) in the period 1996-2005.

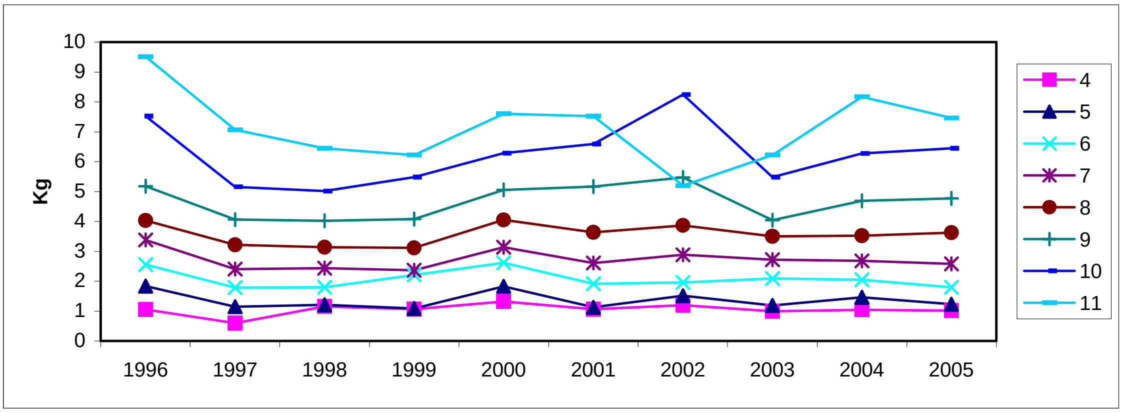


Figure 6.2.4. Ling in Vb. Mean weight at age from the landings.

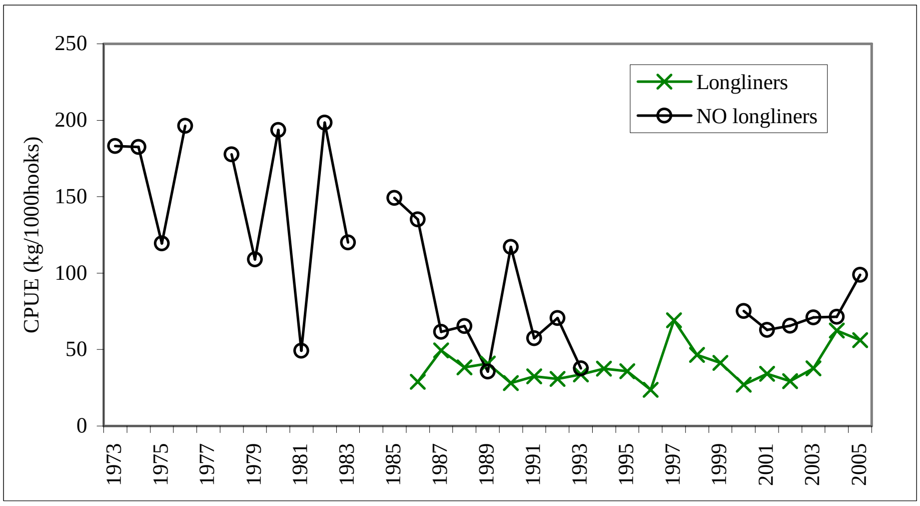


Figure 6.2.5. Ling in Vb. CPUE (kg/1000 hooks) from commercial Faroese longliners >100 GRT and Norwegian longliners (NO).

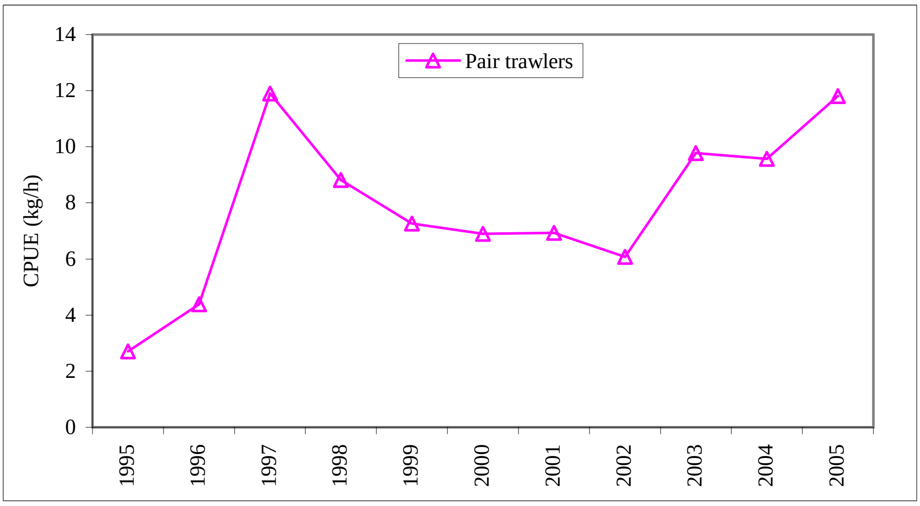


Figure 6.2.6. Ling in Vb. CPUE (kg/h) from commercial Faroese pair trawlers >1000 HP.

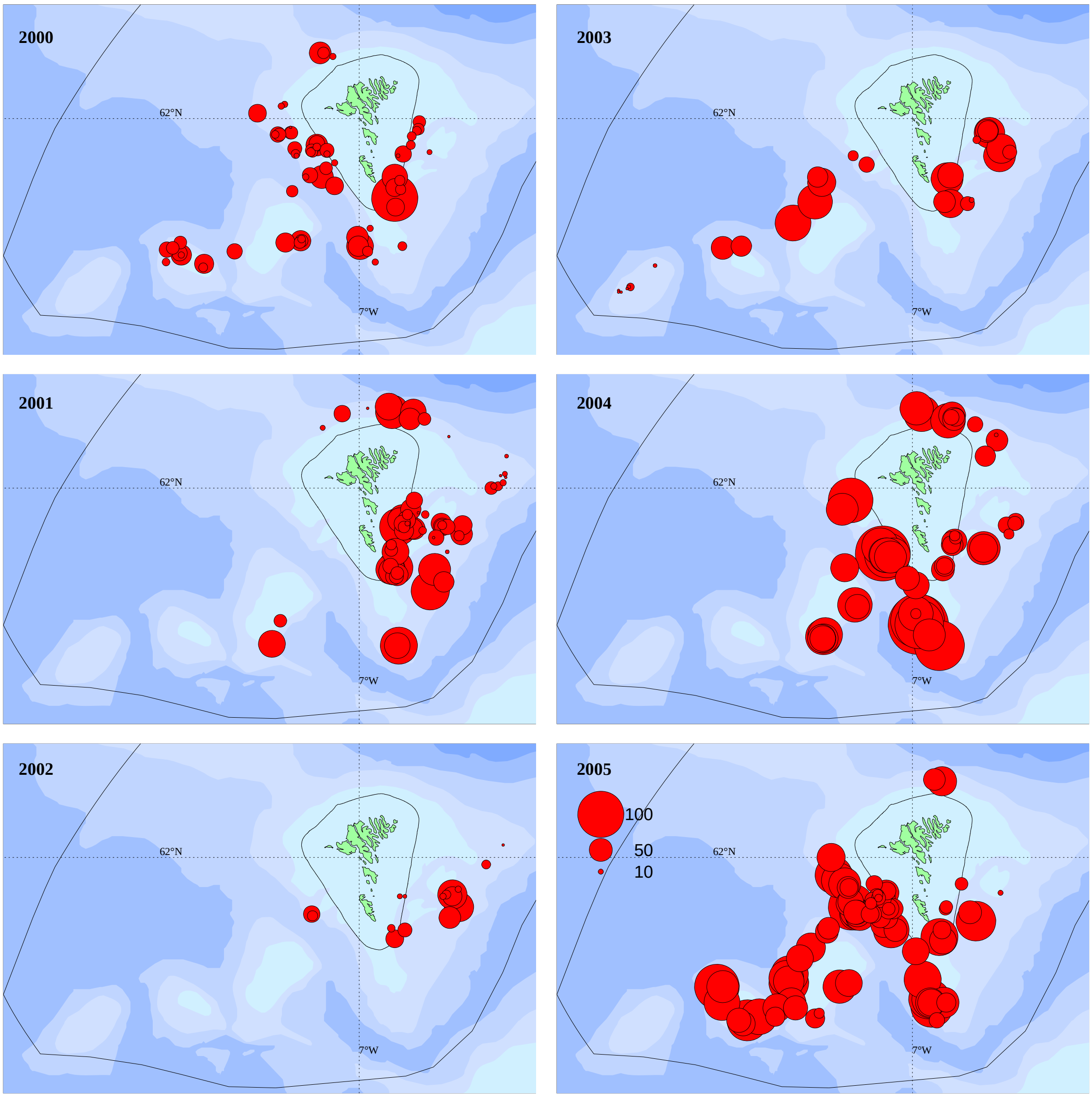


Figure 6.2.7. Ling in Vb. CPUE (kg/1000hooks) from longliners >100 GRT.

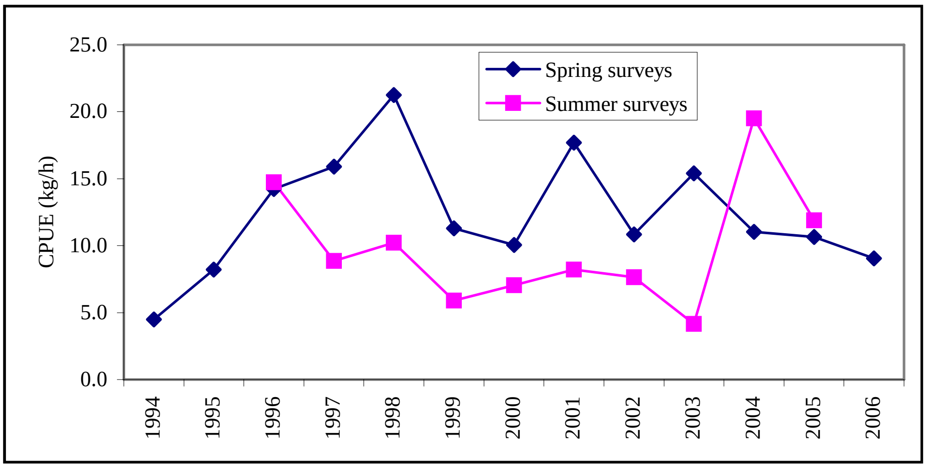


Figure 6.2.8. Ling in Vb. CPUE (kg/h) in the Faroese groundfish surveys for cod, haddock and saithe.

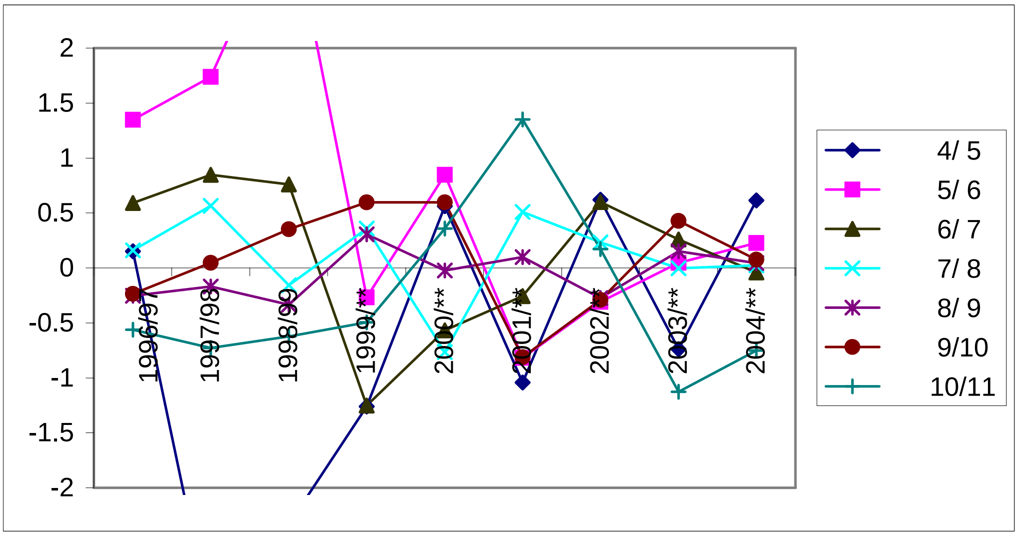


Figure 6.2.9. Ling in Vb. Matrix of residuals from separable vpa analysis.

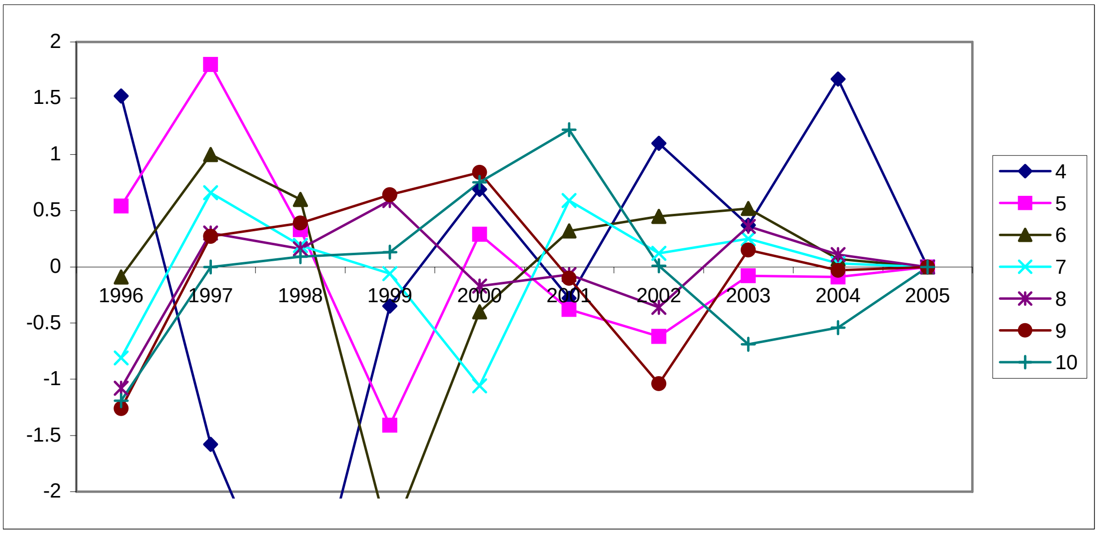


Figure 6.2.10. Ling in Vb. Log q residuals at age for longliner tuning fleet.

7 Stocks and fisheries of the Celtic Seas

7.1 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.

During 2005, 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.

7.1.1 Trends in fisheries

Landings of deepwater species from areas VI and VI and from area XII are given in Table 7.1.1. and Figure 7.1.1.

Landings of the main deepwater species in sub-areas VI, VII and XIIb have decreased since 2002 as a result of quota restrictions and this has been reflected in declining numbers vessels operating in the fisheries. Since 2000, there is evidence that the French fishery has increased targeting of black scabbardfish in preference to roundnose grenadier and has diverted some of its effort away from the continental slope towards the offshore banks. The Irish deepwater fishery commenced in 2000 with 10 boats fishing on the west and north of the Porcupine Bank. In 2005 the number of boats exploiting deepwater species has been reduced. A decline in deepwater landings has been evident since 2003 and this trend continued in 2005. Landings for most species are lower than 2004. This is in line with what would be expected given the new restrictions, which were put into place at the start of 2005.

Reduction of quotas for the traditionally important species has led to increased retention of other species that were formerly discarded; this can be seen in the increased landings of rabbitfish (*Chimaera monstrosa* and *Hydrolagus spp*) and smoothhead (*Alepocephalus spp*). Although many of the fisheries in this area are regarded as mixed, vessels may preferentially target certain species within the mixed fishery by changing fishing depth. There is evidence that this has occurred in the Spanish fishery at Hatton Bank where since the start of the fishery, vessels appear to have changed fishing depth to increase targeting of smoothheads and other deep-sea species.

From January 1st 2005 no directed orange roughy fishing was permitted under council regulation No 2270/2004 in area VII and a small quota allocated in area VI. The quota allocated for many other deepwater species is exclusively for bycatch.

7.1.2 Technical interactions

Table 7.1.2 shows landings by gear, fishing area and species.

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.

7.1.3 Ecosystem considerations

The Rockall Trough lies in Sub-area VI to the west of Scotland and Ireland which is bounded to the North by the by the Wyville Ridge at a depth of about 500m. This is a major faunal barrier and there is little similarity between the fish assemblages on either side of the ridge (Bergstad *et al*. 1999; Gordon, 2001). To the west and north-west, the Rockall Trough is separated from the Icelandic basin by the Rockall Plateau and a chain of northern banks including the Rosemary, Bill Bailey and Hatton. To the south there is a gradual increase in depth onto the abyssal plain. To the west of Ireland the slope on the western edge of the Porcupine Bank is steep, whilst to the south, the Porcupine Seabight, has more gentle slopes. The fish populations have been relatively well described in this region compared to other deep-water areas (e.g. Gordon and Duncan, 1985a and b; Gordon, 1986, Gordon and Bergstad, 1992). At depths between about 400 and 1500 m there may be between 40 and 50 demersal species present in depending on gear type. Maximum species diversity occurs between 1000-1500n before declining markedly with depth. Deep water species, are typically slow growing, long lived, late maturing and have low fecundity. Fishing has a greater effect on species with such life history traits (Jennings *et al.* 1998; Jennings *et al*., 1999), making them particularly vulnerable to over-exploitation. This applies to both the target and non-target species. A large proportion of deep-water trawl catches (upwards of 50%) can consist of unpalatable species and numerous small species, including juveniles of the target species, which are usually discarded (Allain et al, 2003). The survival of these discards is unknown, but believed to be virtually zero due to fragility of these species and the effects of pressure changes during retrieval (Gordon, 2001). Therefore such fisheries tend to deplete the whole fish community biomass. Depletion of dominant species can induce major changes to fish communities through removing key predatory or forage species. A study of the impacts of deepwater fishing to the West of Britain using historical survey data found some evidence for changes in size spectra and a decline in species diversity between pre- and post-exploitation data, but the scarse and unbalanced nature of the time series hampered firm conclusions (Basson et al 2001). A presence/absence analyses indicated a very likely decline in the abundance of the Portuguese dogfish since the 1980s, which was consistent with assessments for this species. Deepwater sharks, which show a greater diversity on the slope compared to continental shelf are important predators and their removal through targeted fisheries and by-catch in trawl fisheries for other species such as roundnose grenadiers is likely to have a major impact on the eco-system. Despite historical studies of stomach contents, a full understanding of the food web dynamics of most deep-water eco-systems is still lacking and more studies are required. Recent Spanish and Russian Research Surveys have provided new information on the diet of *Coryphaenoides rupestris* and other species on Hatton Bank and other areas (Gonzàlez et al, 2006 WD 17; Vinnichenko & Bokhanov, 2006 WD7).

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

The effects of fishing on the benthic habitat relate to the physical disturbance by the gear used. This includes the removal of physical features, reduction in complexity of habitat structure and resuspension of sediment. Benthic fauna in deep waters are understood to be diverse but of low productivity. Little information is available on the effects of trawling on deep-sea soft-sediment habitats. Cryer et al (2001) used suite of multivariate analyses to infer that trawling probably changes benthic community structure and reduces biodiversity over broad spatial scales on the continental slope in a similar fashion to coastal systems. More attention has been paid to biogenic habitat that occurs along the slope, mainly the cold-water corals, which, in the Northeast Atlantic include the azooxanthellate scleractinarian corals *Lophelia pertusa*, *Madrepora oculata*, *Solenosmilia variabilis*, *Desmophyllum cristagalli,* and *Enallopsammia rostrata*. The main reef building species is *L. pertusa*. The other coral species often occur in association with *Lophelia pertusa* and none has been found forming reefs without *L. pertusa* being present. No exhaustive description of the distribution of *L. pertusa* exists, but it is found on the continental slopes off Norway, Iceland, Faeroes, the UK, France, Spain and Portugal as well as the Mid Atlantic Ridge (ICES, 2003, 2004 and 2005; Rogers, 1999). The extent of individual reefs varies, with some reported as up to 200m high, and several km long (Rogers, 1999; Freiwald, A. *et al.* 1999). A dense and diverse range of megafauna are associated to *Lophelia* reefs. This includes fixed (anthipatarians, gorgonians, sponges) and mobile invertebrates (echinoderms, crustaceans). The species richness of macrofauna associated to coral reefs has been found to be up to three times higher than on surrounding sedimentary seabed (Mortensen et al., 1995). Several species of deepwater fish occur associated with corals, some in more abundance than in surrounding non-coral areas, but the functional links between fish and coral are still to be fully elucidated (Husebø et al., 2002). However, it is accepted that generally, structurally complex habitats, such as corals, offer a greater diversity of food and physical shelter to fish and other macrofauna. Other deep-water biogenic habitats with structures that stand proud of the seabed include sponge and xenophyophore fields, seafans and seapens (octocorals). Any long-lived sessile organisms that stand proud of the seabed will be highly vulnerable to destruction by towed demersal fishing gear. There are a number of documented reports of damage to *Lophelia* reefs in various parts of the Northeast Atlantic by trawl gear where trawl scars and coral rubble have been observed (e.g. Hall-Spencer, et al, 2002). Damage can also be caused on a smaller scale by static gears such as gill nets and long lines (Grehan et al 2003). The degree of this damage depends on fishing effort (ICES, 2005). The recovery rates for damaged coral are likely to be extremely slow (Risk, 2002).

In Divisions VI, VII and XIIb there are a number of known areas of cold-water corals. These include the shelf break to the west and north of Scotland, Rockall Bank, Hatton Bank and the Porcupine Bank. The best known site is the Darwin Mounds, located at 1000m to the south of the Wyville Thompson Ridge. Some of these areas have been heavily impacted by deep-water trawling activities (Hall-Spencer, 2002, Grehan et al, 2004). In 2005, WGDEC recommended a number of areas on Rockall that would be appropriate for closure to protect cold-water corals from trawling activity. The choice of these sites was based on examination of scientific and anecdotal fishermen’s records of coral occurrence and VMS data indicating where fishing activity occurred.

Seamounts are widely recognized to be areas of high productivity where dense aggregations of fish can occur. The special hydrographic conditions and good availability of hard bottom are favourable for sessile suspension feeders which often dominate the community on seamounts (Genin et al. 1986). Morato et al (2004) found significant differences in longevity and age at maturity among seamount, non-seamount and seamount-aggregating fishes. The longevity of seamount fishes was significantly higher than non-seamount fishes (median = 25 years and 12 years respectively). Within ICES area VI there are three documented seamounts; Rosemary, Anton Dohrn and Hebrides Terrace. The first two of these have summits above the daytime depth of the deep scattering layer. All three have been heavily targeted by fishing vessels since the 1990s, probably associated with the orange roughy fishery.

7.1.4 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.

Table 7.1.1. Overview of landings in VI and VII.

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
ALFONSINOS (Beryx spp.)		12	8		3	1	5	3	178	25	81	75	133	186	94	82	62	69
ARGENTINES (Argentina silus)	10438	25559	7294	5197	5906	1577	5707	7546	5863	7301	5555	8856	13863	19050	15985	2444	4462	3554
BLUE LING (Molva dypterigia)	9285	9434	6396	7319	6697	5471	4309	4892	6928	7361	8004	9472	8525	9534	6252	3605	3466	2905
BLACK SCABBARDFISH (Aphanopus carbo)		154	1060	2759	3436	3529	3101	3278	3689	2995	1967	2166	3712	4623	6327	3458	2956	2667
BLUEMOUTH (Helicolenus dactylopterus)		127	100	128	159	152	117	71	87	88	145	354	332	279	196	397	433	307
DEEP WATER CARDINAL FISH (Epigonus telescopus)						30	217	91	45	49	115	258	287	385	974	1075	869	684
GREATER FORKBEARD (Phycis blennoides)	1898	1815	1921	1574	1640	1462	1571	2138	3590	2335	3040	3430	4919	4349	3352	3257	2447	2011
LING (Molva molva)	28092	20545	15766	14684	12671	13763	17439	20856	20838	16668	19863	15087	14613	11528	10435	8321	8049	7583
MORIDAE				1	25							20	146	190	158	327	71	45
ORANGE ROUGHY (Hoplostethus atlanticus)		8	17	4908	4523	2097	1901	947	995	1039	1071	1337	1158	3692	5788	622	523	300
RABBITFISHES (Chimaerids)							2					236	355	722	573	474	433	493
ROUGHHEAD GRENADIER (Macrourus berglax)						18	5	4	13	12	10	34	10	44	19	12	13	2575
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	32	2440	5730	7793	8338	10121	7860	7767	7095	7070	6364	6538	9845	15456	11777	7134	6548	4618
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)	252	189	134	123	40	22	10	11	29	56	17	23	20	51	25	38	31	10
SHARKS, VARIOUS	85	40	43	254	639	1392	1864	2099	2176	3240	3023	1791	8		1			
SILVER SCABBARDFISH (Lepidopus caudatus)						2						18	15		1			
SMOOTHHEADS (Alepocephalidae)				31	17								978	5305	260	393	1765	5465
TUSK (Brosme brosme)	3002	4086	3216	2719	2817	2378	3233	3085	2417	1832	2240	1647	4504	2688	1794	1719	1391	1732
WRECKFISH (Polyprion americanus)	7		2	10	15				83		12	14	14	17	9	2	2	

Table 7.1.2. Techical interactions in Sub-Areas VI & VII.

year	2005

Sum of Kg		species											
main gear	ICES area	ALF	ARU	BLI	BSF	FOR	LIN	ORY	RNG	SBR	USK	ZZZ	SKH
bottom trav	VI	63	0	135077		49895	56542	0	489	0	15946	42023	
	VIa		61192	2322002	2382573	395073	1093091	32905	1852573		107657	402224	523000
	VIb	210	4000	840163	77362	336374	241124	5720	227176	23630	90459	40413	18000
	VII	2503	0	16960		699347	171407	20	0	330	471	138146	
	VIIa			30	0	234	421440						
	VIIb			11087	4335	134931	612131	230	6380	2870	11113	27950	
	VIIc	5528	1527	59791	52416	492237	663872	19215	35444	3650	2348	354984	
	VIId			16		27	64303			4			
	VIIe			194		5333	1044971			1400			
	VIIf			45		5277	545428			5			
	VIIg		73	16	0	10950	606649					2614	
	VIIh			18436		15260	1703755						
comb_all	VIa					256	61446						
	VIIa				2	32	257119						
	VIId						3194						
	VIIe						22776			18			
	VIIf						9187			1			
	VIIg						11493						
	VIIh						1116						
gill nets	VI	0		0		0	0	0	0	0	0	0	
	VIa	8371		55527		112781	1171699	1313	7	928	13440	11317	
	VIb			151365		112766	593326				11580	142	
	VII	2091		1475		10218	13360	0	0	625	180	3344	
	VIIa			8		15	98952				72		
	VIIb	180		15784		31889	424341	2223			9810	2933	
	VIIc			69712		65475	302579	11779		3353	2898	4181	
	VIId						2197						
	VIIe					586	3833906			46			
	VIIf					1847	2467624			1			
	VIIg					7538	1987225				793		
	VIIh					52086	3822224			24	196	41	
lines	VI	0	0	63		1216	4382			0	0	0	
	VIa			34685	16	128076	1991430		155		705916	5837	
	VIb			1432		24946	976663				639368	611	
	VII	50112	15	6742		180012	299255			3226	8	39485	
	VIIa						13467						
	VIIb			49	27	6898	44185				2507		
	VIIc			2051	41	3566	55909				648		
	VIIe					38	127717			50			
	VIIf						1605						
	VIIg					4290	97283			34			
	VIIh			77	38	1272	556753				111		
net&line	VIIa						33489						
	VIIb						504						
	VIIc						942						
	VIId						95						
	VIIe					835	590827			27			
	VIIf					722	417117			1			
	VIIg					1112	511467						
	VIIh					97	299474						
other gear	VI	0	0	0			0			0			
	VII	0	0	0			0			0			
pel trawls	VIa		64380	258		282	58327				242		
	VIb						905						
	VIIa						228766				56		
	VIIb			129		89	984				60		
	VIIc			549		3292	19763				12131		
	VIId									104			
	VIIe									119			
	VIIf						78						
	VIIg						1544						
	VIIh						7114						
seines	VIa						508						
	VIIa						524						
	VIIf						360						
	VIIg						19520						

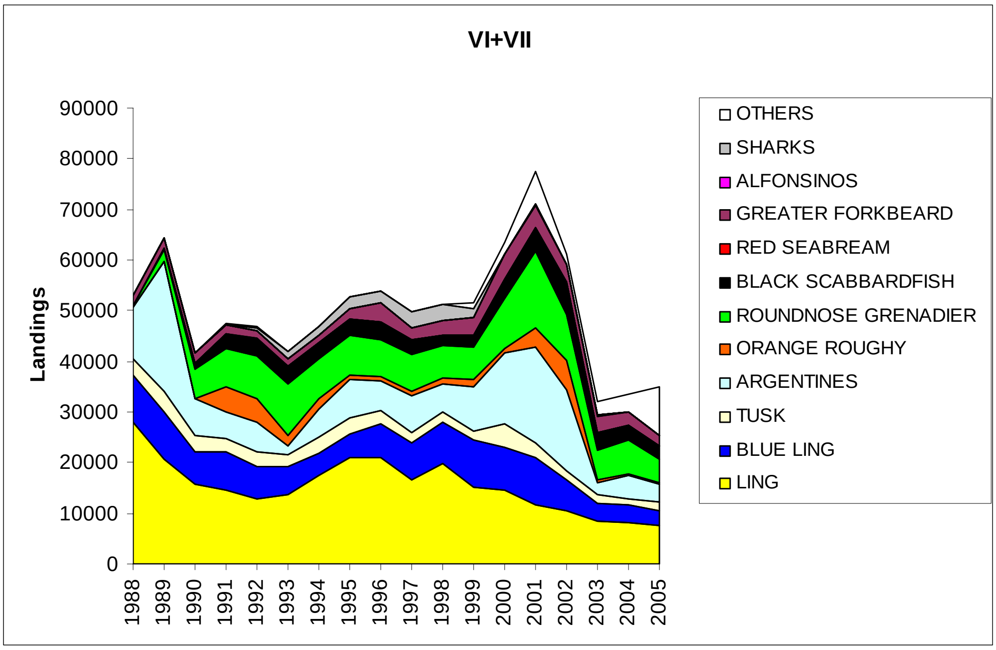


Figure 7.1.1. Overview of landings in Sub-Areas VI and VII over 1988-2005 (tonnes). Deep-sea sharks landings data have not been consistently compiled by the WG since 2000.

7.2 BLUE LING (*MOLVA DYPTERYGIA*) IN DIVISION Vb, SUB-AREAS VI & VII

7.2.1 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.

7.2.1.1 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 (Tables 7.2.0a-i).

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).

7.2.1.2 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.

7.2.1.3 Management

In 2005 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 These TACs are set biennially and remain unchanged in 2006. The TAC in VI and VII in 2005 was not fully taken and the TAC in II, IV V may have been substantially exceeded by landings from Vb alone (although quota swops have not been taken into consideration) (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)
VI and VII	3137	2867
II, IV and V	119	757 (Vb only)

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

7.2.2 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 one in Sub-area XIV and Division Va with a small component in Vb, and a southern one 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 must be that the 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. Sub-area VI comprises part of Hatton Bank and for future assessments it is suggested that this stock area be expanded to include the remainder of Hatton Bank (new ICES area XIIb). This will require the collation of historical landings data for this new area.

7.2.3 Data availability

7.2.3.1 Landings and discards

Landings data are given in Tables 7.2.0a-7.2.0i. There is no information available on discards.

7.2.3.2 Length compositions

Length compositions of landings by Faroese otter trawlers fishing in Vb are shown in Figure 7.2.1. Trends in annual mean length in time cannot be evaluated because sampling levels were very low in recent years. Blue ling is also taken as a by-catch in a Faroese trawl survey for cod, haddock and saithe in Vb. However, catch numbers are very low and annual mean length data are very noisy and are therefore not shown.

Time-series data (1988-2005) of the raised length composition of French trawl landings of blue ling in VIb, VI and VII are given in Figure 7.2.2.

Time-series data (2002-2005) of the raised length composition of Spanish trawl landings of blue ling from Hatton Bank are given in Figure 7.2.4. Annual mean length data are not available.

In 2005, the IEO and Spanish fishing industry carried two co-operative exploratory surveys on the Hatton Bank and adjacent waters. A three month survey was carried out by a polyvalent freezer longliner (186 TRB). Sampling was conducted on the Hatton bank, Rockall and adjacent waters in a very wide geographical and bathymetrical range (ICES Divs. XIIb, VIb and VIa), using bottom automatic and manually baited bottom long-lines. A total of 230 valid hauls were carried out and length composition data are shown in Figure 7.2.5. A four month trawl survey was carried out with one Spanish commercial bottom trawler (1393 GT). A total of 239 valid hauls (6 hours mean duration) were carried out. Sampling was conducted on the Hatton bank and adjacent waters in a very wide geographical and bathymetrical range (ICES Divs. VIb1 and XIIb+XIIa1). Length data for blue ling are not available at present.

Length composition data for 2005 are also available from Russian exploratory surveys on the Hatton Bank (Division XIIb, Subdivision VIb1) and in Vb, however these data are not presented because catch numbers were small (often less than 10 fish).

7.2.3.3 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.

7.2.3.4 Weight at age

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

7.2.3.5 Maturity and natural mortality

Apart from observations of individual fish on Hatton Bank during Russian exploratory surveys (see above), no new data on maturity were available. Existing data are not presented because of difficulty with ageing.

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 Faroese and French age readings, it is reasonable to assume the maximum age for blue ling is around 30 years. Given this and the relationship above, M may be in the order of 0.15.

7.2.3.6 Catch, effort and RV data

Catch, effort and CPUE data from Faroese trawl surveys are shown in Table 7.2.1 and Figure 7.2.6. 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 the surveys are targeted at cod, haddock and saithe.

CPUE data are also available from Faroese trawlers in Sub-area Vb (Figures 7.2.7 and 7.2.8), 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.

7.2.4 Data analyses

Mean length data for French trawl landings (Figure 7.2.3) show a gradual decline until 1998 and this is considered to reflect the depletion of larger fish and also possibly increased recruitment. Mean length data are not available for 1999, but data for 2000-2005, which are consistently lower than the early years in this series, probably give the best indication of the effects of exploitation on this stock in terms of reduction in mean length.

7.2.4.1 Exploratory stock assessment using Catch Survey Analysis (CSA)

A full description of the CSA method is given in Section 3.2.

Data for CSA

Blue ling is taken in low numbers in available survey data and available data are very noisy. Thus, a CSA was attempted using abundance data from the French commercial trawl fleet. The data used were for the period 1989 to 2005 and comprised total international catch numbers, French trawl CPUE in numbers in reference rectangles in Vb,VI and VII (see section 3.1), and mean fish weight in French trawl landings. These three data series were disaggregated into ‘recruits’ and ‘fully recruited’ components by assuming the former comprised fish less then 80 cm in length i.e. the lefthand tail of commercial landings compositions (Figure 7.2.2). On the basis of data available it was not possible to identify a single yearclass as a recruit index. Available growth curves indicated these ‘recruits’ probably comprised at least two yearclasses and, on average, about 15% of annual total catches. Trends in French trawl CPUE for the recruit and fully recruited components are shown in Figure

7.2.8. The latter show a strong, persistent decline to a low level in recent years. Natural mortality was assumed in the model to be 0.15 in all years.

Exploratory results from CSA

The model was run on the assumption that catches were taken in the middle of the year. An estimate of the catchability ratio (*s*) of recruits and fully recruited components in the survey (in this analysis – the commercial French trawl CPUE) is required by the model. This can be determined either by profiling the SSQ of the model fit (the model scans a specified range of *s* factors and automatically uses the value that gives the smallest SSQ) or by carrying out manual iterations of the model to select the value of *s* giving the lowest SSQ. The former approach gave values very dependent on the choice of the specified range of *s* (Table 7.2.2). Setting the upper limit of *s* to 1.0 and 2.0 gave estimates very close to the upper limits. This can be a failing of the minimization procedure used in the model so it was decided to carry out some manual iterations between a range of 1.2 and 1.4. An inverted bell –shaped distribution was expected but with this dataset SSQ was reduced until a value of 1.36 at which point the model became highly unstable and the SSQ increased by several orders of magnitude. Furthermore, inspection of results for estimated fishing mortality for *s* values above 1.34 indicated values of F into single figures and also other indications of model instability.

Conclusions drawn from the exploratory analyses

The problems encountered in determining an estimate of *s* may be related to a number of factors. It is recommended that CSA is run using a recruit series based on a single yearclass and in this analysis recruits comprised of at least two yearclasses have been used. It is also recommended that survey indices are used rather than indices derived from commercial catch and effort, because the latter may be confounded by changes in selectivity, catchability and background noise.

Exploratory development work on CSA indicates that estimates of absolute stock size are very sensitive to the choice of *s*, however trends in relative biomass can be qualitatively similar under various assumptions for *s* (within a reasonable range). It was therefore decided to use a value of 1.34 in the final assessment and to focus on the results for trends in stock size rather than absolute values.

7.2.4.2 Final assessment

Total stock biomass is estimated by CSA to have declined by around 65% between 1989 (193 kt) and 2005 (69kt) (Figure 7.2.10). Fishing mortality is estimated to have increased from 0.08 in the early 1990s to a peak of 0.2 in 2001 and then declined thereafter (Figure 7.2.11). However, examination of the log-residuals (Figures 7.2.12 and 7.2.13) show a marked pattern with time for both recruits and fully recruited population estimates. Estimates of total population and recruit numbers also show a marked retrospective pattern in that they are consistently underestimated (Figures 7.2.14 and 7.2.15). There is also a lack of convergence of total population estimates back in time. These results may be further indications that the abundance data used in the analysis may not be appropriate for the CSA model.

7.2.5 Comments on assessment

The results from this exploratory assessment should be treated with considerable caution because the abundance data are derived from commercial catch and effort and the recruit index comprises more than one yearclass Notwithstanding, the trends in stock biomass and F obtained from CSA are broadly similar to those obtained by WGDEEP in 2004 using a stock reduction model (Figures 7.2.15 and 7.2.16). This is to be expected to some extent given that the latter also relied on abundance data from the French trawl fleet, but the inclusion of recruit variability in the CSA model appears to have had little effect on the resultant trends in population biomass and F. Absolute estimates of biomass and F are not in agreement but this is to be expected given the problems estimating *s* in the CSA model. It should be noted that the stock reduction model is capable of estimating the trend in stock biomass in earlier years of the fishery when abundance data are not available.

7.2.6 Management considerations

The WG are aware that CPUE data for blue ling from commercial fishing vessels, which are derived largely from data from spawning aggregations, may not a reliable indicator of exploitable biomass for this species because of sequential depletion. However, the Group felt that the important issues were the large scale of the decline in CPUE and the fact that under the Precautionary Approach there is a responsibility to interpret the available data.

Using CPUE as an index of exploitable biomass (U), WGDEEP in 2004 concluded that that blue ling Vb,VI,VII was below Ulim (20% of virgin biomass). There is no new evidence to suggest that this has changed. It seems reasonable to assume, therefore, that current U remains below Ulim. The results from a CSA stock model support the view that that there this been a strong decline in stock over the period analysed (1989 to 2005), broadly similar to that observed over the same period using stock reduction.

The length distributions from French commercial landings indicate that the mean length in landings in recent years is substantially lower than observed in the early 1990s.

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

It should be noted that landings reported from the southern parts of Subarea VII southwards as blue ling (*Molva dypterygia*) may comprise a related species *Molva macrophthalma*.

Table 7.2.0a. Blue ling Vb1. WG estimates of landings.

Year	Faroes	France(3)	Germany(2)	Norway	E&W(2)	Scot.(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*	904	750		15	1				1670

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

Table 7.2.0b. Blue ling Vb1. WG estimates of landings.

Year	Faroes	Norway	Scot. (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*	569	14	6		589

*Preliminary. (1) Includes Vb1.

Table 7.2.0c. Blue ling VIa. WG estimates of landings.

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	1957		2	33	135		390	29	2534

*Preliminary. (1) Includes Vib

Table 7.2.0d. Blue ling VIb. WG estimates of landings.

Year	Poland	Russia	Faroes	France	Germany	Norway	E & W	Scotland	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	223		1	9	73				322

*Preliminary.

Table 7.2.0e. Blue ling VIIa. WG estimates of landings.

Year	France (1)	UK (Scot)	Total
1988			0
1989			0
1990			0
1991		1	1
1992			0
1993			0
1994			0
1995			0
1996			0
1997			0
1998			0
1999			0
2000			0
2001			0
2002			0
2003			0
2004			0
2005*			0

*Preliminary. (1) Included in Via

Table 7.2.0f. Blue ling VIIb-c. WG estimates of landings.

Year	France	Germany	Ireland	Norway	Spain (1)	E & W	Scotland	Total
1988	21	1						22
1989	269			2				271
1990	177							177
1991	157							157
1992	126			3			6	135
1993	106			2		11	28	147
1994	100		1	1		6	22	130
1995	95		3			3	11	112
1996	118			1		15	57	191
1997	113		0	2		36	3	154
1998	157			1		60	6	224
1999	37		3	1		24	7	72
2000	46	1	45	5		9	2	108
2001	37		169	5		16	3	230
2002	21		152			43	1	217
2003	6		12			2		20
2004	8		9				1	18
2005*	2		8					10

*Preliminary. (1) Included in VIIg-k

Table 7.2.0g. Blue ling VIId-e. WG estimates of landings.

Year	France	Total
1988		0
1989	1	1
1990	0	0
1991	10	10
1992	15	15
1993	3	3
1994	8	8
1995	4	4
1996	4	4
1997	1	1
1998	3	3
1999		
2000		
2001		
2002		
2003		
2004		
2005*		

*Preliminary.

Table 7.2.0h. Blue ling VIIg-k. WG estimates of landings.

Year	France	Germany	Spain (1)	E & W	Scotland	Ireland	Total
1988							0
1989	21						21
1990	46						46
1991	44						44
1992	256						256
1993	164			5	2		171
1994	190		4	3	4		201
1995	56		13	40	5		114
1996	67		21	42	40		170
1997	65	8	0	134	12	9	228
1998	92		22	223	24	10	371
1999	40	2	59	144	11	24	280
2000	39	1	65	22	15	30	172
2001	43	2	64	13	14	325	461
2002	17		42	33	54	120	266
2003	13	1	42	6	16	16	94
2004	12	1	15	4		8	40
2005*	11		25	1		2	39

*Preliminary. (1) Reported as VII.

Table 7.2.0i. Blue ling Vb, VI, VII. WG estimates of landings.

Year	Vb	VI	VII	Total
1988	9526	9263	22	18811
1989	5264	9141	293	14698
1990	4799	6173	223	11195
1991	2962	7107	212	10281
1992	4702	6291	406	11399
1993	2836	5150	321	8307
1994	1644	3970	339	5953
1995	2440	4662	230	7332
1996	1602	6563	365	8530
1997	2798	6978	383	10159
1998	2584	7406	598	10588
1999	2932	9120	352	12404
2000	2524	8245	280	11049
2001	2119	8843	691	11653
2002	2020	5769	483	8272
2003	3815	3491	114	7420
2004	2699	3408	58	6165
2005*	2259	2856	49	5164

*Preliminary

Table 7.2.1. Blue ling. Catch, effort and CPUE in the Faroese trawl surveys in Vb.

	Spring surveys			Summer surveys		
	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			

Table 7.2.2. Results for *s* from automatic profiling the SSQ of the model fit for a range of S limits.

Lower limit of *s*	Mid-value of *s*	Upper limit of *s*	Profiled *s* value with lowest SSQ
0.1	0.6	1.1	1.0986
0.1	1.0	2.0	1.9970
0.1	1.5	3.0	1.3425

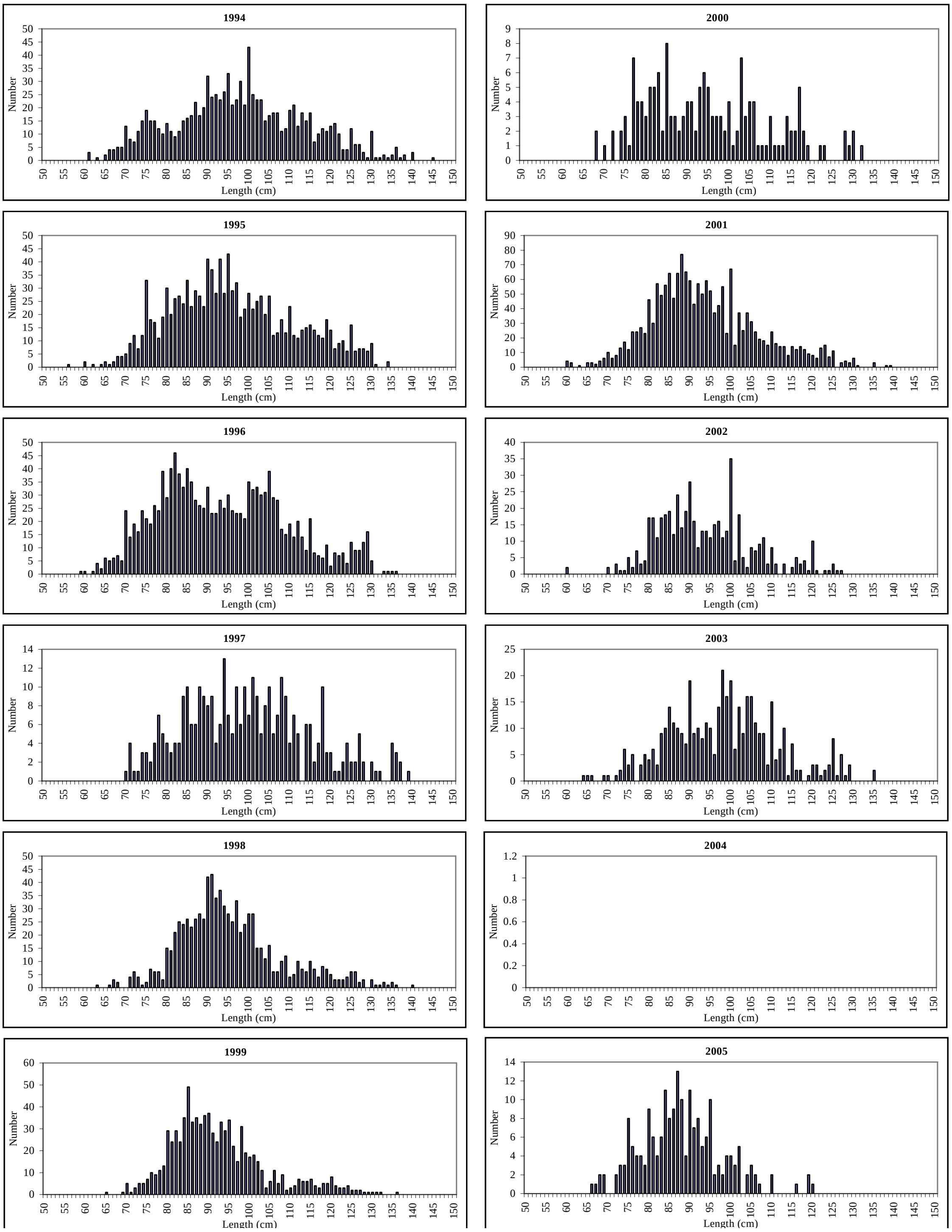


Figure 7.2.1. Length distribution in the landings of blue ling from Faroese otter trawlers >1000 HP fishing in Vb.

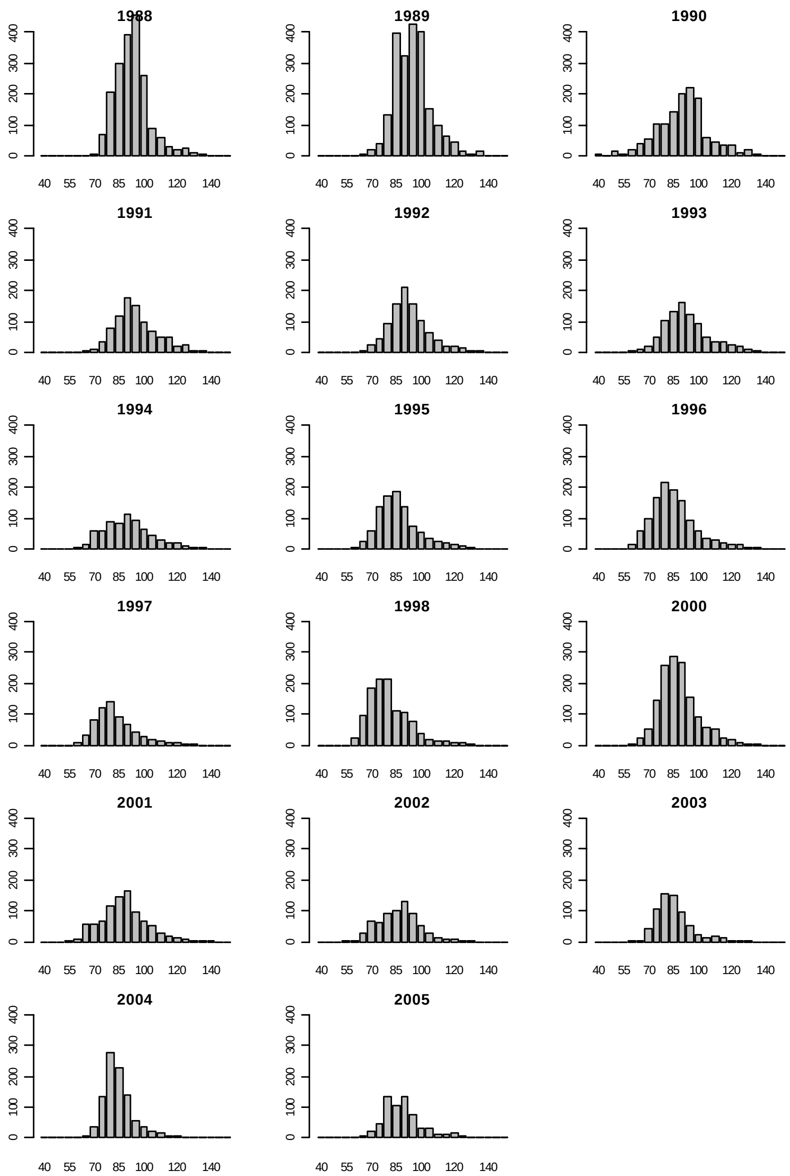


Figure 7.2.2. Length distribution in the landings of blue ling from French otter trawlers fishing in Vb, VI and VII.

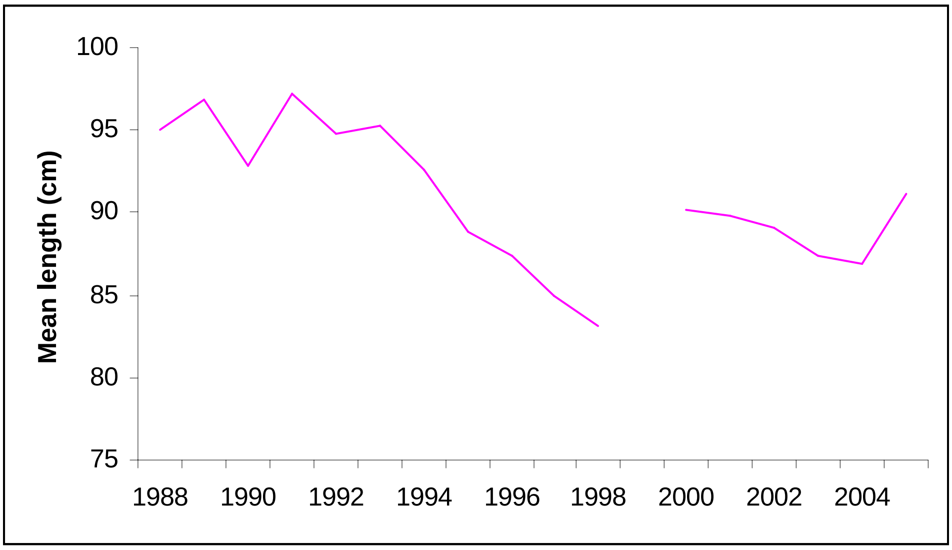


Figure 7.2.3. Mean length in French commercial trawl landings from Vb, VI and VII.

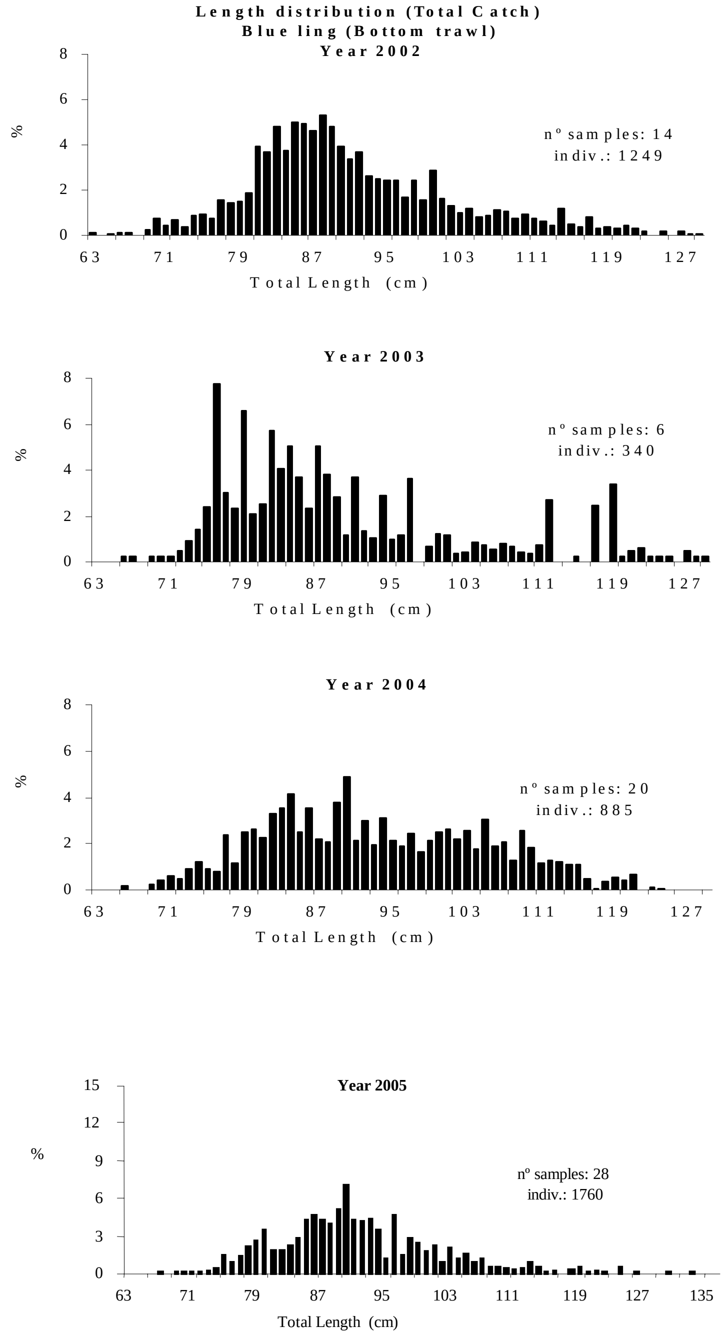
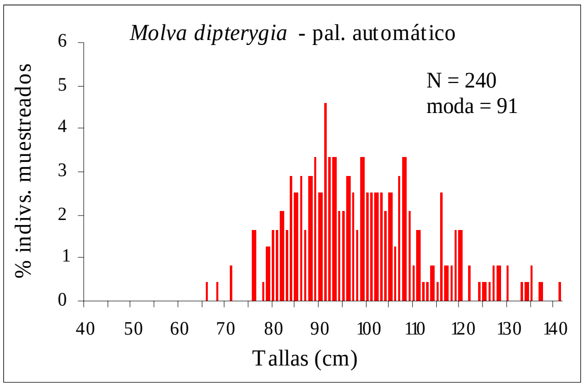


Figure 7.2.4. Length distributions of blue ling in the total catch by Spanish trawlers fishing on Hatton Bank



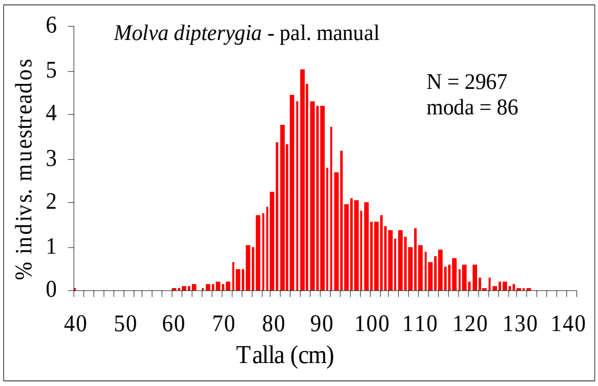


Figure 7.2.5 Length composition in automated and hand baited longline catches taken on a Spanish

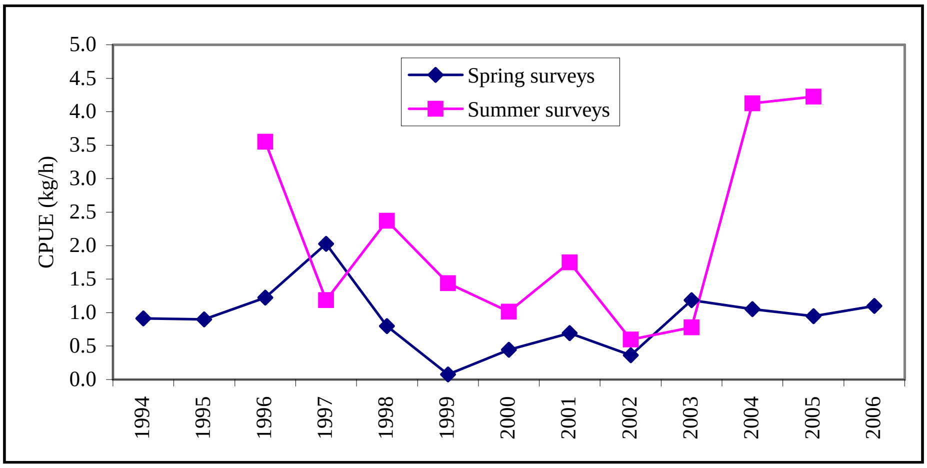


Figure 7.2.6. Blue ling CPUE series from Faroese trawl surveys in Vb.

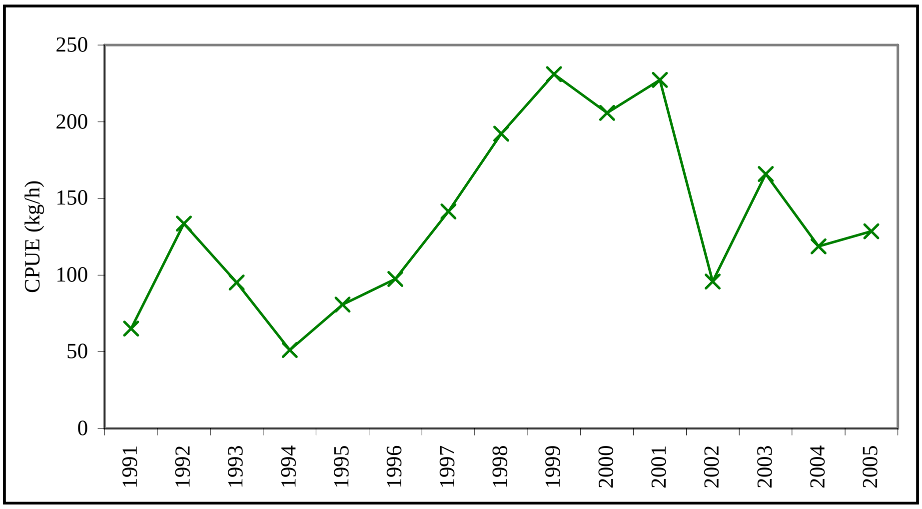


Figure 7.2.7. Blue ling CPUE in Vb from Faroese commercial otter trawlers >1000 HP.

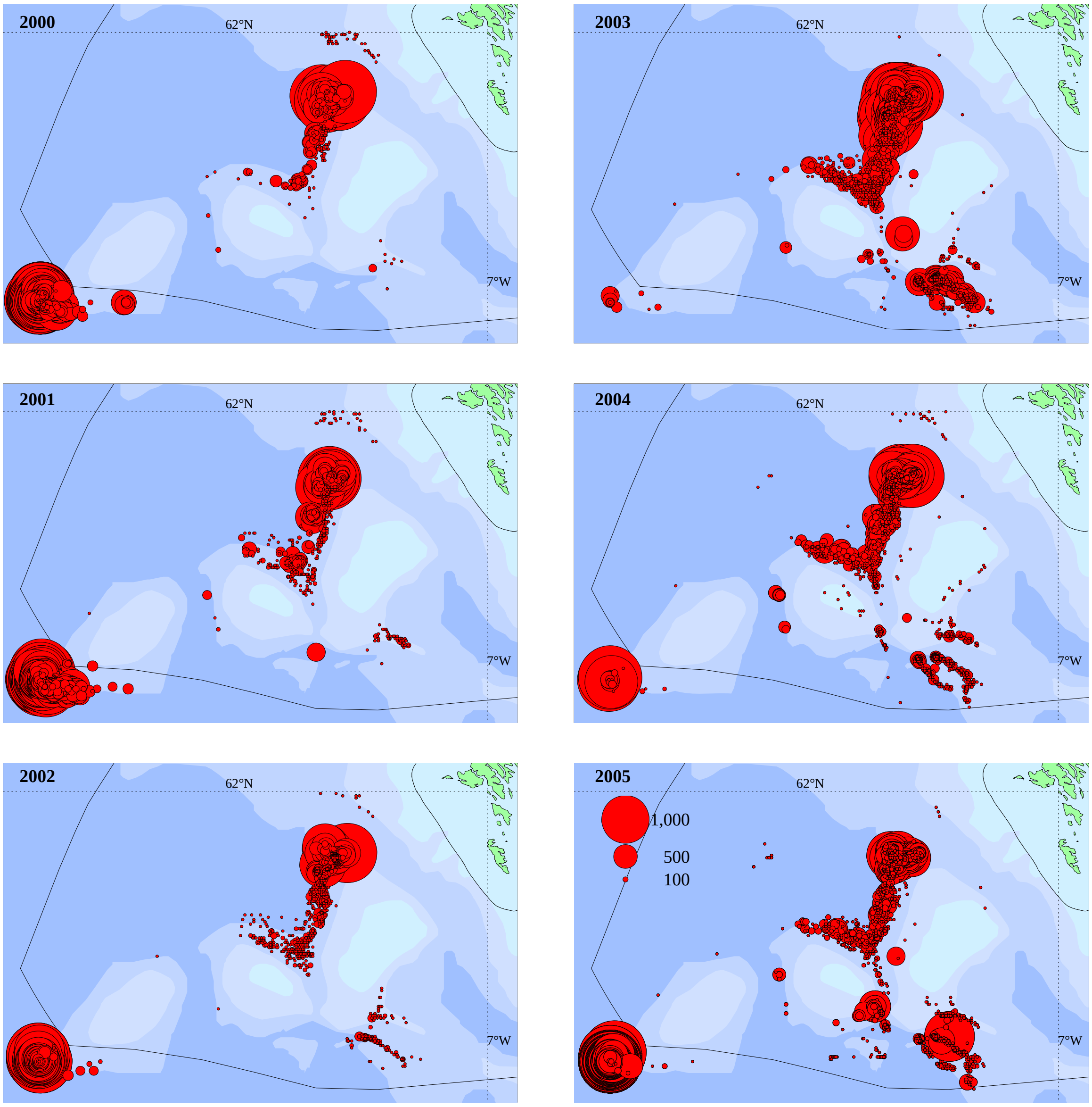


Figure 7.2.8. Blue ling in Vb. Faroese otter trawl CPUE (kg/h), 2000-2005.

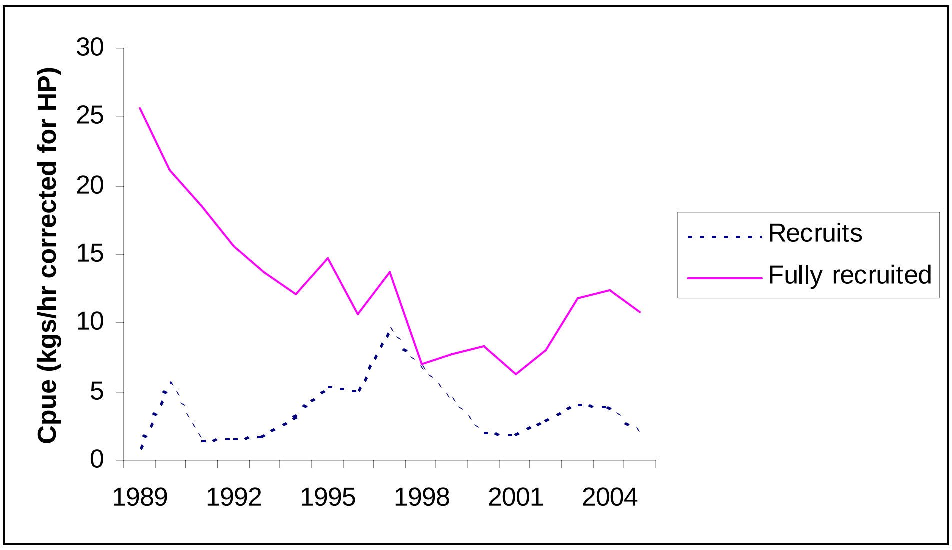


Figure 7.2.9. French trawl CPUE in reference rectangles in Vb, VI, VII

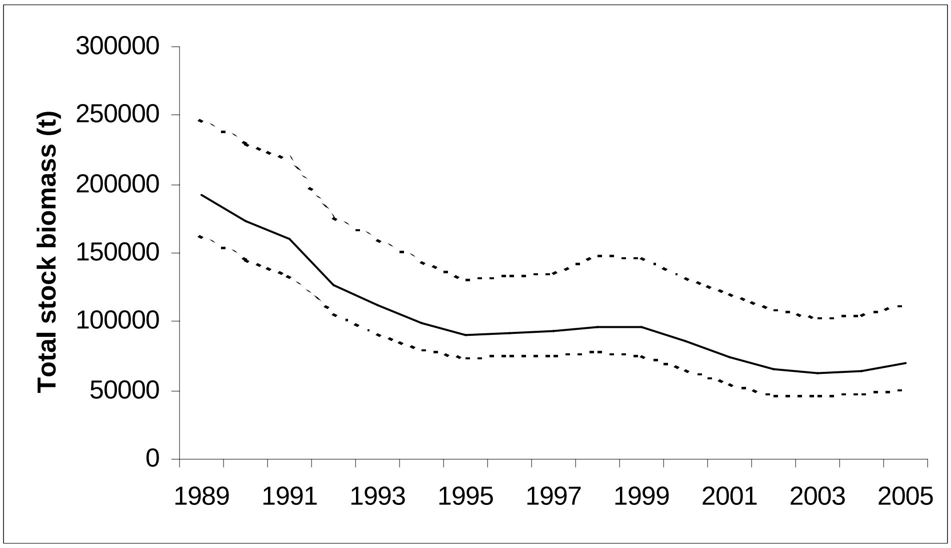


Figure 7.2.10. Trend in total stock biomass of blue ling in Vb,VI and VII, as estimated by CSA (5th and 95th percentiles are shown as dotted lines).

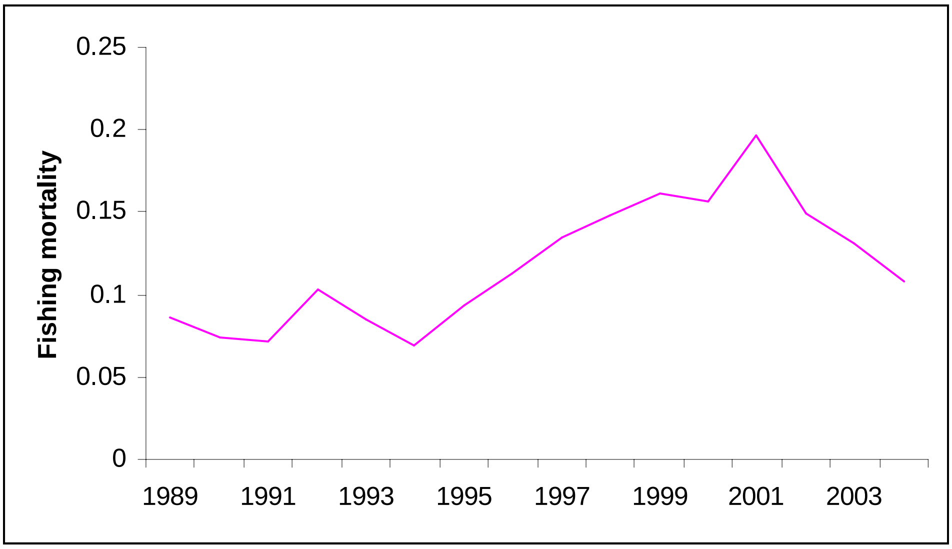


Figure 7.2.11. Trend in fishing mortality of blue ling in Vb,VI and VII, as estimated by CSA

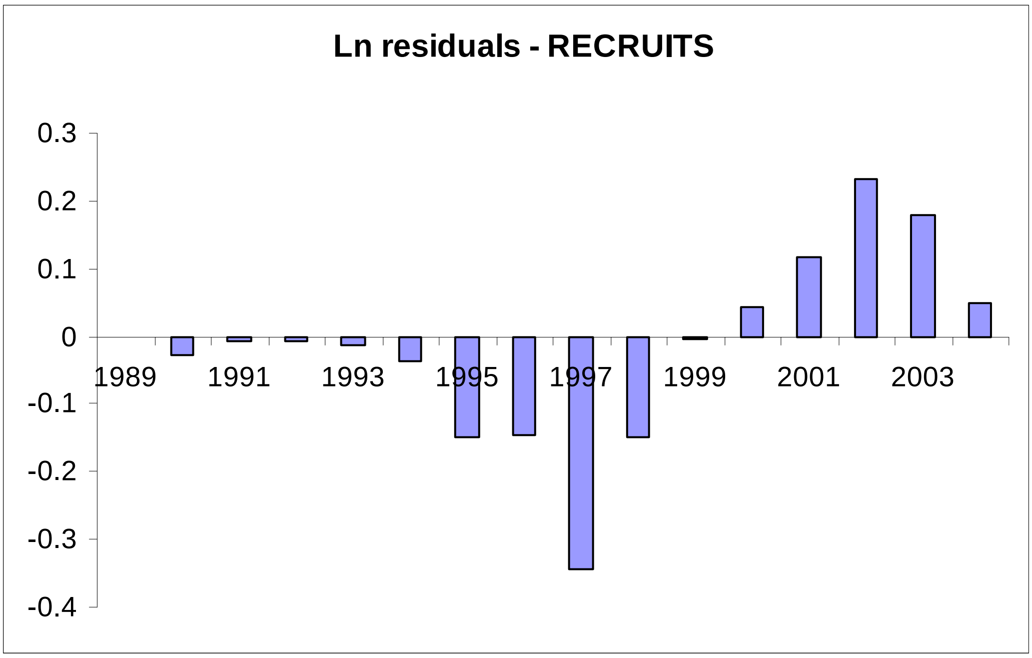


Figure 7.2.12. Log-residuals about recruit estimates from CSA

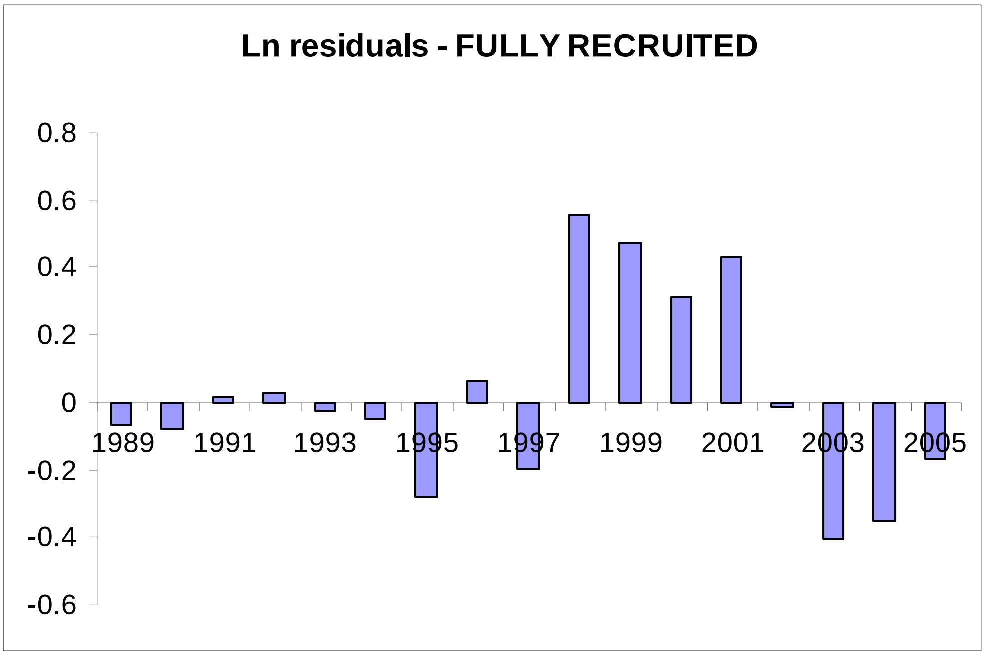


Figure 7.2.13. Log-residuals about estimates of 'fully recruited' from CSA

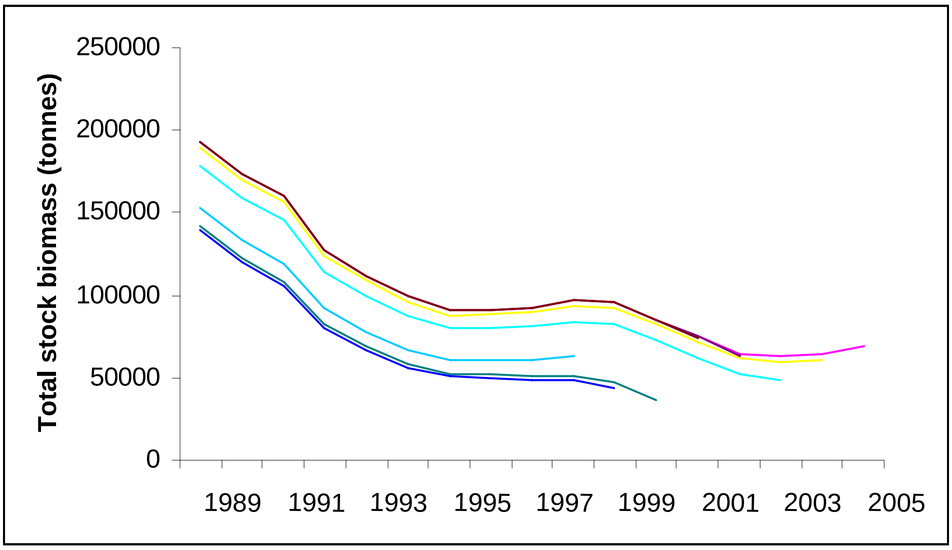


Figure 7.2.14. Retrospective analysis of estimates of total stock biomass from CSA.

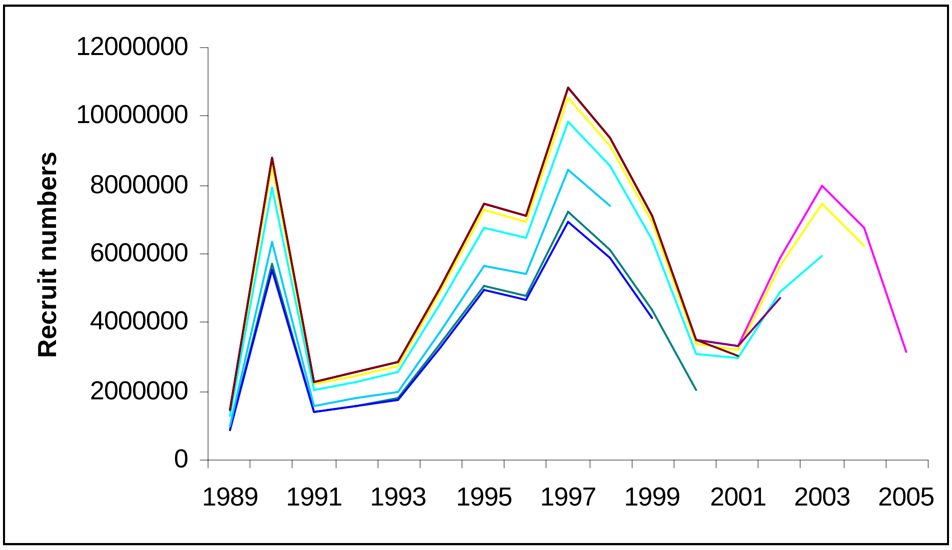


Figure 7.2.15. Retrospective analysis of estimates of recruit numbers from CSA.

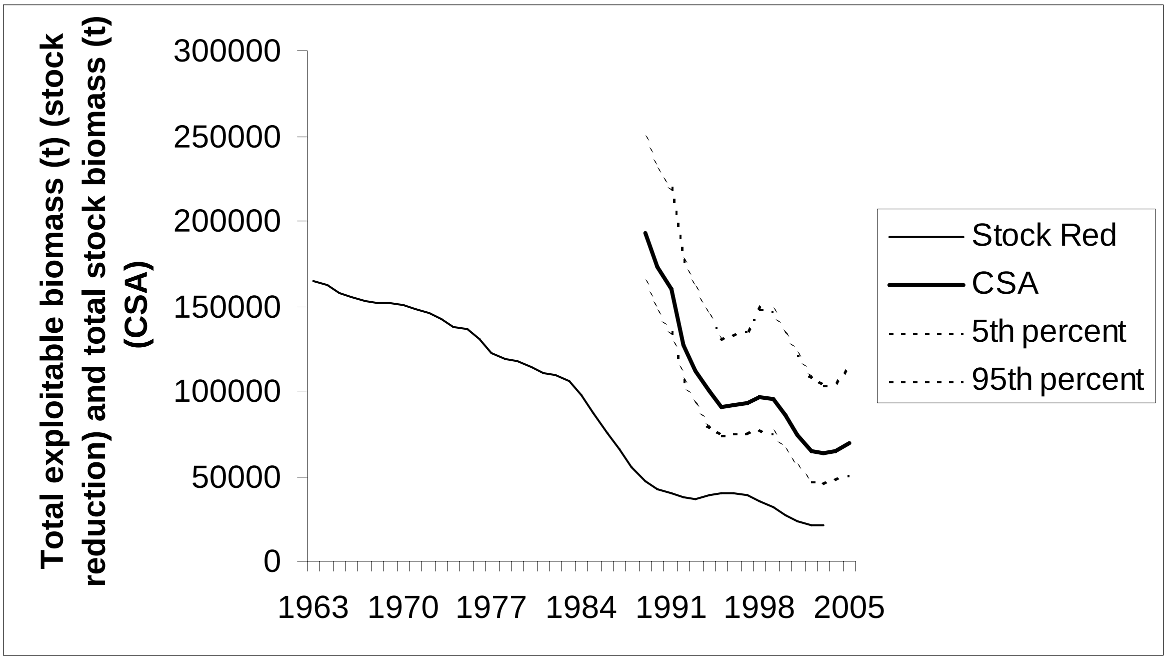


Figure 7.2.16. Comparison of population biomass estimates from CSA and stock reduction methods.

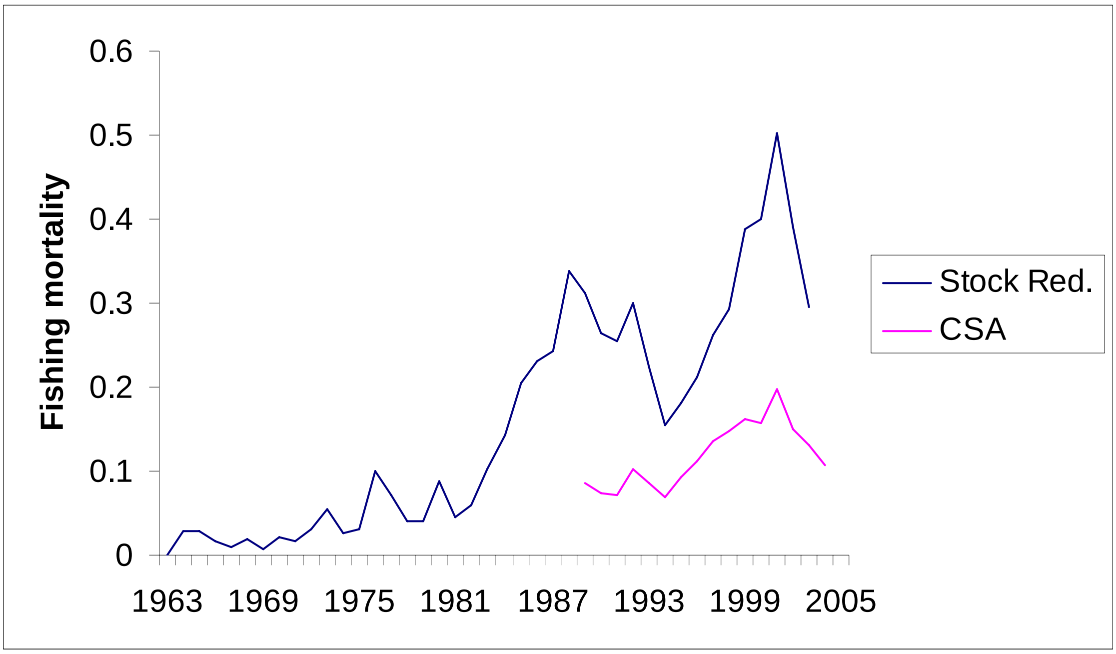


Figure 7.2.17. Comparison of fishing mortality estimates from CSA and stock reduction methods.

7.3 Orange Roughy (*Hoplostethus Atlanticus*) In Sub-Area VI

7.3.1 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.

7.3.1.1 Landings trends

Table 7.3.1 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. Preliminary catch data in 2005, suggests that the TAC was not exceeded.

7.3.1.2 ICES advice

The advice statement from 2004 was:

"Orange roughy stocks can only sustain very low rates of exploitation. ICES recommends catches be reduced and further efforts be made to assess the state of stock units in all areas. Fisheries for orange roughy should not be allowed to proceed unless there is adequate information to define sustainable exploitation levels."

7.3.1.3 Management

Since 2003, there has been a TAC of 88 t for EU vessels in EU and international waters. For by-catch in other fisheries, there is no quota. Landings in relation to TAC were as follows,

		Landing (t)	
Year	TAC (t)	EC vessels	Total
2003	88	81	81
2004	88	56	56
2005	88	45	45

7.3.2 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.

7.3.3 Data available

Landings were available for all fleets. A new French CPUE series is available.

7.3.3.1 Landings and discards

Landings are in Table 7.3.1.

7.3.3.2 Length compositions

No new data. See section 7.4 for older data that combines VI and VII data from observers.

7.3.3.3 Age compositions

No new data. See section 7.4 for older data that combines VI and VII data.

7.3.3.4 Weight at age

No data.

7.3.3.5 Maturity and natural mortality

No data.

7.3.3.6 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 7.3.2.

The previous French CPUE series (Anon., 2000; 2002) are shown in Figure 7.3.1. 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 7.3.2).

7.3.4 Data analyses

7.3.4.1 Exploratory analysis: CPUE

The BIM divisional CPUE data (Tables 7.3.2) were also presented as kg per haul, which is considered to be a more useful estimate of CPUE because even very short hauls can generate large catches and learning can result in less time spent "lining up" the trawl when fishing seamounts. It is considered that haul number, rather than haul duration is a better estimator of effort. These data are not directly comparable with French data, because the Irish fishery operated to a different pattern.

Declines in the previous French CPUE (based on all vessels combined) were documented (Anon., 2000; 2002), and the 2000 series formed the basis of an assessment by SGDEEP in that year (Figure 7.3.1). This assessment showed the depletion of a stock in VI, which has subsequently been identified as having resided on the Hebrides Terrace Seamount. However between 1995 and 1996, international catches appear to have stabilised at a low level and from 1996 onwards increased slightly. CPUE from all available series have displayed slight upward trends since 1997. It seems that this reflects the targeting of separate aggregation(s), though it may also reflect some re-targeting of the Hebrides Terrace Seamount or catches of orange roughy on "flat grounds". The increased catches in 2001 and 2002 may reflect over-reporting of the species as these year preceding the introduction of TAC's.

For the new French series (Figure 7.3.2), the smooth curve through the large vessel CPUE shows a steep initial decline that flattens out. The smaller vessels CPUE was steady (and low), and it may have declined in the last few years, but the last point is still not below the lowest recorded in 1995. It is likely that this decline indicates declining abundance, but not in a linear way. This decline in catch rates has also lead to a reduction in effort on this species by French vessels.

7.3.4.2 Conclusions drawn from the explanatory analyses

WGDEEP was not able to make a stock assessment in 2006. This is due to a number of factors. Firstly effort data are urgently required at the level of spatial resolution required for meaningful stock assessment. It is at least necessary to have access to catches by statistical rectangle, and observer data can be used to validate such information. Finally, total international removals by aggregation area are needed.

The stock assessment carried out in VIa (Anon. 2000) included total catch for all the Sub-area VI, though the effort likely related mainly to the Hebrides Terrace Seamount. It is now clear that other, smaller aggregations occur in this Sub-area, but there have not been sufficient data on total removals from those aggregations. In Sub-area VI, the initial stock size was estimated to be 6,000 t (95% CI's = 5,400 – 6,300 t) by SGDEEP (Anon., 2000). However cumulative catches from this Sub-area are now in excess of 7,000 t. Recent catches are probably higher because of the targeting of orange roughy in the south east slopes of the Rockall Trough, where a smaller aggregation exists. However there is evidence that this aggregation is smaller than that from the Hebrides Terrace Seamount, and consequently could not support even moderate catches. For the Hebrides Terrace, a MSY estimated from a production model to be around 300 t (Anon. 2000). A lower MCY yield was estimated using a stock reductions method to be something less than 100 t (WD 2002).

WGDEEP recommend that concerted efforts are essential to collate available data with which to assess the status of the individual stocks or aggregation areas. Furthermore, the current management units (essentially ICES Sub-areas) are completely inadequate for orange roughy. Experience from around the world shows that management units need to be small, as aggregations on topographical areas are usually considered to be discrete stocks. WGDEEP recommend that current information be used to define smaller and more meaningful management units. WGDEEP further recommend that where such information is lacking, in international waters for instance, the ICES statistical rectangle is a more meaningful spatial management unit.

In Division VIb, catch and effort data are urgently required, in order to assess the stocks. Given the experience of the declining CPUE in VII and depletion of the stock on the Hebrides Terrace Seamount. Therefore international waters fisheries for orange roughy should not be allowed to proceed until accurate assessments are available to advise on sustainable catch levels.

7.3.5 Comments on the assessment

No assessments were carried out.

7.3.6 Management considerations

WGDEEP considers that given the experience of fisheries in VI (Hebrides Terrace Seamount), high catch rates will not be sustainable. Furthermore, the other stocks that are fished in VI are almost certainly smaller than that from the Hebrides Terrace Seamount. The orange roughy in Division VIa, mainly distributed on the Hebrides Terrace Seamount is considered to be still below Upa.

The TAC appears to be unrestrictive in the past two years. WGDEEP considers that catch levels should not exceed the average level of the last three years.

Table 7.3.1. 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*	-	39	-	-	6	-	**45**

* Preliminary.

Table 7.3.2. 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

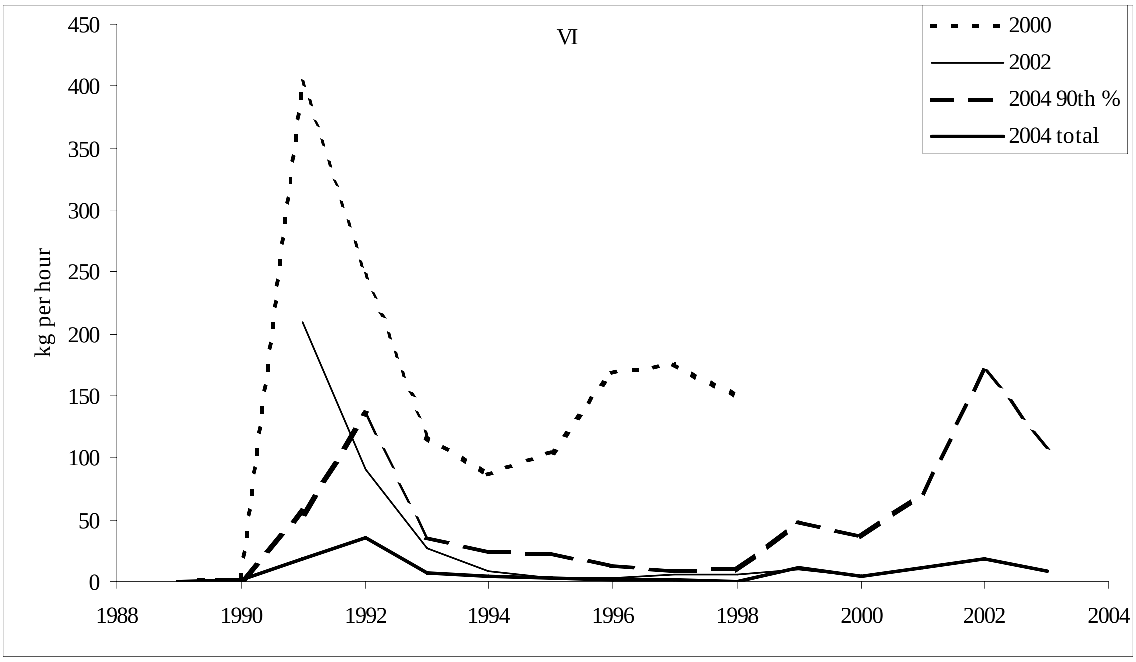


Figure 7.3.1. Comparison of four previous series of CPUE from French trawlers in Sub-areas VI.

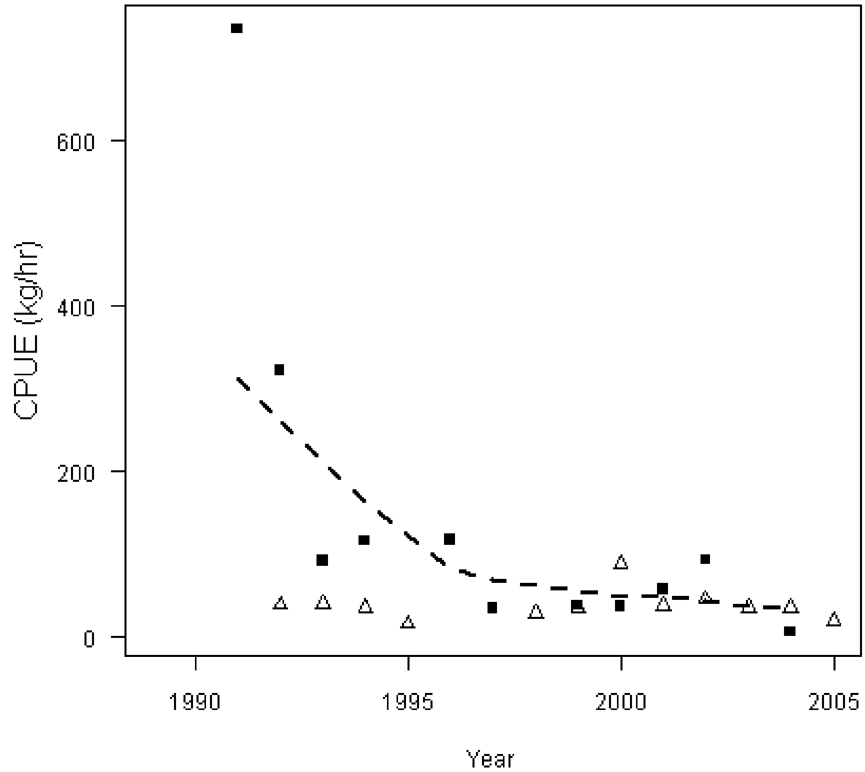


Figure 7.3.2. French 2006 CPUE series (VIa) for 400-600 kw power vessels (open triangles) and for 1400-1600 kw vessels (solid squares). The line is a smooth curve through the latter series.

7.4 Orange Roughy (*Hoplostethus Atlanticus*) In Sub-Area VII

7.4.1 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 since 2001, new Irish vessels have become involved. Orange roughy aggregations are mainly associated with seamounts, but they are also found close to other features. Initially, trawlers target 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 now new features is now unlikely. There is a small roughy bycatch from trawling on the "flats".

7.4.1.1 Landings trends

Table 7.4.1 shows the landings data for orange roughy as reported to ICES or as reported to the Working Group. The preliminary landing for 2005 is 255 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 10,140 t. The fishery takes place on several separate topographical features. Catch data from France are not currently available at a higher spatial resolution, and this prevents a meaningful examination of stock trends. However it can be seen that there have been 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 (1,349 t for 2003-04, 1,148 t for 2005).

7.4.1.2 ICES advice

The advice statement from 2004 was:

"Orange roughy stocks can only sustain very low rates of exploitation. ICES recommends catches be reduced and further efforts be made to assess the state of stock units in all areas. Fisheries for orange roughy should not be allowed to proceed unless there is adequate information to define sustainable exploitation levels."

7.4.1.3 Management

For EC flagged vessels, the TAC was 1,349 t in 2003 and 2004, reducing slightly to 1,149 for 2005 and 2006. For by-catch in other fisheries, there is a quota of 9 t. Landings in relation to TAC were as follows,

		Landing (t)	
Year	TAC (t)	EC vessels	Total
2003	1 349	541	541
2004	1 349	467	467
2005	1 149	255	255

7.4.2 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

7.4.3 Data available

Landings were available for all fleets. A new French CPUE series is available. A NDP strategic project (No. ST/02/04) project managed by University College Cork has finished and a final report written (WD 13c,d,&e). This project has assessed the potential of acoustic surveys as a stock assessment tool to provide scientific advice, and also collected and synthesised biological data. Included in this project was an acoustic survey by the Marine Institute and others from which there is an biomass estimate and a length frequency.

7.4.3.1 Landings and discards

Landings are in Table 7.4.1. There were two discard trips in 2004 and none in 2005. 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.

7.4.3.2 Length compositions

Updated length frequency information is only available from the 2005 acoustic survey (Figure 7.4.1).

Figure 7.4.2 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 7.4.3, 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 7.4.4 and 7.4.5 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:

$W = 0.022\ L^{2.95}$

7.4.3.3 Age compositions

New age data were collected at-sea on commercial trawlers operating on the Porcupine Bank during September 2003-April 2004 and February 2005 (WD13c). 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 7.4.6). 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.

7.4.3.4 Weight at age

No data.

7.4.3.5 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).

7.4.3.6 Catch, effort and research vessel data

Acoustic survey, 2005

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 7.4.2 and by area in Table 7.4.3.

The previous French CPUE series (Anon., 2000; 2002) are shown in Figure 7.4.8. 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 7.4.8).

7.4.4 Data analyses

7.4.4.1 Exploratory analysis 1: Acoustic survey

In the catch data, orange roughy were found in 84% of all hauls, including 100% of peak hauls and mature fish were mostly running ripe with about 10% spent (WD 13a).

For the survey, fishermen provided information on orange roughy fishing grounds and eight areas were selected to survey (Figure 7.4.7). Seven of these were surveyed and bad weather prohibited any fishing in area 2. A relative biomass estimate of 19,000 t was developed for orange roughy on the Porcupine Bank (WD 13a). This estimate had a coefficient of variation of 29% for a relative estimate and 60% for an absolute estimate. The larger value for the absolute estimate cv was from the target strength uncertainty since North Atlantic fish are larger than the fish used to estimate it. Concerning the apparent absence of the large single-species shoals of roughy found, it was suggested that a random stratified trawl survey might be more appropriate than acoustic methods for assessing the stock in this area (WD 13a, e).

7.4.4.2 Exploratory analysis 2: CPUE

The BIM divisional CPUE data (Tables 7.4.2 & 7.4.3) were also presented as kg per haul, which is considered to be a more useful estimate of CPUE because even very short hauls can generate large catches and learning can result in less time spent “lining up” the trawl when fishing seamounts. It is considered that haul number, rather than haul duration is a better estimator of effort. These data are not directly comparable with French data, because the Irish fishery operated to a different pattern.

For the previous French CPUE (Figure 7.4.8), the 90th percentile CPUE estimates are up to 5 times higher than the total catch and effort calculated CPUE. The trends in CPUE in this sub-area have been explained as sequential depletion of isolated aggregations. The catches of over 1,000 t taken in the early 1990’s were accompanied by declining CPUE in all the available series. However CPUE displayed an upward trend until 2000, excepting 1998 which has an artificially low value due to lack of data. This increase may be explained by changes in the fishing pattern, discovery of new aggregations, or increased experience of the skippers. It seems likely that only the most skilled skippers remain in the fishery.

For the new French series (Figure 7.4.8), the smooth curve through the large vessel CPUE shows a steady decline, whilst the smaller vessels CPUE was steady (and low), but declined in the last year. It is likely that this decline indicates declining abundance, but not in a linear way. This decline in catch rates has also lead to a reduction in effort on this species by French vessels.

The currently available CPUE are of limited use for stock assessments. It is known that the fishery in Sub-area VII takes place on several separate topographical features. Therefore, CPUE data are required for each individual area and ideally separate assessments would be run in each. It appears that there was depletion in the early 1990’s when catches dropped from a peak of 3,100 t in 1992. Older versions of CPUE declines from 1991 to 1995 probably reflect sequential depletion of the various stock units. From 1996 until 2001 most of the catches were taken by a single French vessel. The cumulative international catch at the end of 2000 was over 14,000 t. In this period, the trends in CPUE may be explained as targeting and depletion of separate aggregations. Another explanation is that the fishery stabilised because the fishery only landed a fixed amount of fish in order to avoid depressing the market price. It seems likely that efficiency of the fishery increased throughout the 1990’s as the skippers became better at catching orange roughy. This would suggest that this CPUE series would not be an accurate estimator of stock abundance. Since 2001, the single French vessel has ceased to be involved in the fishery, and may explain the declining trend from 2001 to 2003.

Anecdotal information from the Irish fishery suggests that catch rates have continually declined since 2002.

7.4.4.3 Conclusions drawn from the explanatory analyses

Acoustic survey

The survey did not give a robust estimate since only small and relatively light marks were seen. Species identification in marks requires a dedicated trawl vessel and this will be expensive since two vessels will have to be chartered given the TAC. That no large aggregation was seen, which were reputed to be present in 2001, indicates that the best time for this survey was 5 years ago or even further back.

This suggests that continued monitoring and assessment of this fishery may be more appropriately achieved by a random stratified trawl survey rather than further acoustic surveys.

CPUE

WGDEEP was not able to make a stock assessment in 2006. This is due to a number of factors. Firstly effort data are urgently required at the level of spatial resolution required for meaningful stock assessment. It is at least necessary to have access to catches by statistical rectangle, and observer data can be used to validate such information. Finally, total international removals by aggregation area are needed.

Despite these problems, it is possible to use the CPUE to describe trends in abundance in orange roughy, being aware of the problems with these data. Orange roughy is an aggregating species so CPUE trends are unlikely to be linear to biomass changes and declining CPUE trends are likely to under-estimate the biomass declines. Furthermore, it is possible to up date information used in previous assessments.

The lack of spatial resolution in the French CPUE precludes any meaningful assessment of the separate stocks in this area. However Irish data were made available at a higher spatial resolution, but only for two years. It seems clear from these Irish data that there is declining abundance in the aggregation areas, for which Irish data were made available at a better spatial resolution (Table 7.4.3). Note that the combined CPUE shows an increase (Table 7.4.2). No assessment has been possible of orange roughy in VII, to date. However it seems clear that recent catches are unsustainable.

WGDEEP recommend that concerted efforts are essential to collate available data with which to assess the status of the individual stocks or aggregation areas. Furthermore, the current management units (essentially ICES Sub-areas) are completely inadequate for orange roughy. Experience from around the world shows that management units need to be small, as aggregations on topographical areas are usually considered to be discrete stocks. WGDEEP recommend that current information be used to define smaller and more meaningful management units. WGDEEP further recommend that where such information is lacking, in international waters for instance, the specific typographical features is a more meaningful spatial management unit.

7.4.5 Comments on the assessment

No assessments were carried out.

7.4.6 Management considerations

The TAC is lower than the last unregulated landings in 2001 and 2002, although it is similar to the average landings in the period, 1994 to 1998. Declining CPUE is a cause for concern.

The individual stock units in VII are most likely smaller than that from the Hebrides Terrace Seamount, and thus sustainable yield for each stock unit or aggregation area will be lower than 100, or perhaps 300 t. Current catches are likely to be unsustainable and the stock units in this area probably already much depleted. Declining catch rates appear to have lead to reduced effort and the TAC to be unrestrictive.

It seems unlikely that there are any areas that have yet to be discovered in VII. It is to be hoped that the issues of confidentiality that have led to lack of spatial resolution in the data will now be resolved given that the fleets involved in the fishery in VII have access to the information that is available.

An approach to yields is using a MCY (Maximum Constant Yield), which is the maximum sustainable constant yield that can be applied forever such that the mature population does not go below 20% virgin biomass more than 10% of the time. MCY have been used in the past for orange roughy in VI in 2002 (Anon. 2000) and also on blue ling in 2004 (Anom. 2004).

For New Zealand stocks, MCY is about 1.5 % of virgin biomass. A very conservative estimate of a sustainable yield is to apply this fraction to the 2005 acoustic estimate assuming that it is absolute. This gives 285 t for MCY. An indicative mature virgin biomass from the acoustic estimate would be about 40 000 t (Doonan pers. comm.), so that the MCY would then be 600 t. This MCY estimate is very uncertain, but there is no analytic method to base a TAC. If the current TAC is considered as a MCY, then the implied virgin biomass is 77 000 t which is above the implied indicative virgin biomass, 64 000 t, based on the upper 95% level for the acoustic biomass estimate of 50 000 t assuming that it has a lognormal distribution (Doonan pers. comm.).

The above MCY is around 600 t and it is about the same level of catch in the last 3 years. WGDEEP considers that the current catch level should not be exceeded and so, therefore, the TAC should be set closer to the level of the last three years.

Table 7.4.1. 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**

*Preliminary.

Table 7.4.2. 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 7.4.3. 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

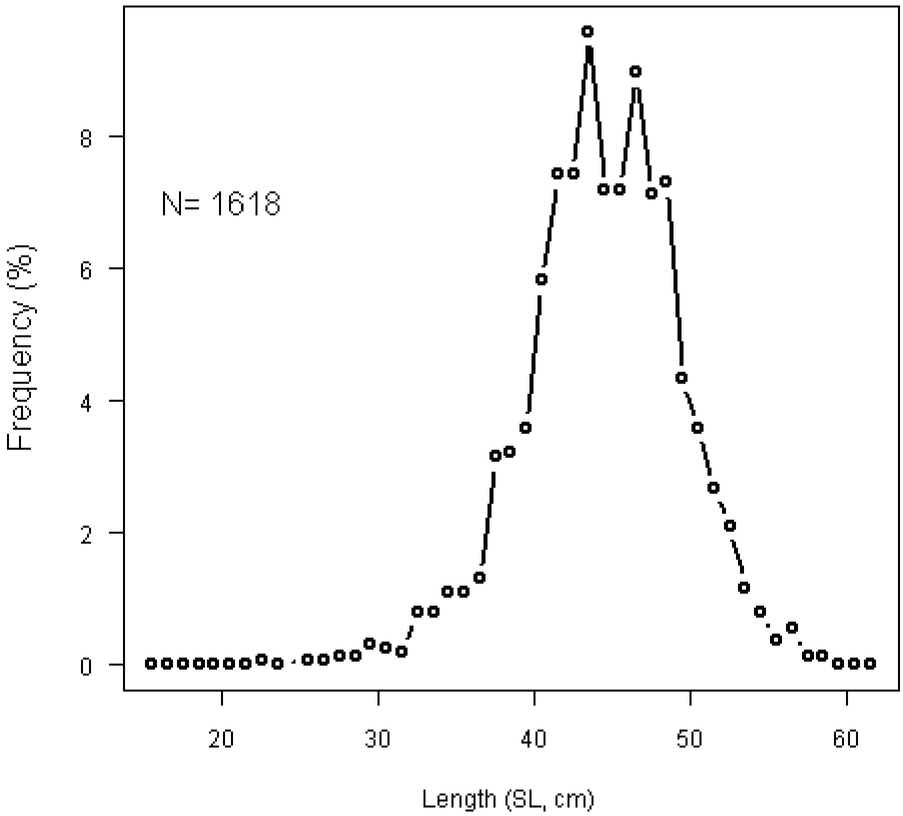


Figure 7.4.1. Length frequency from seamount trawl data sampled on the 2005 acoustic survey, VII.

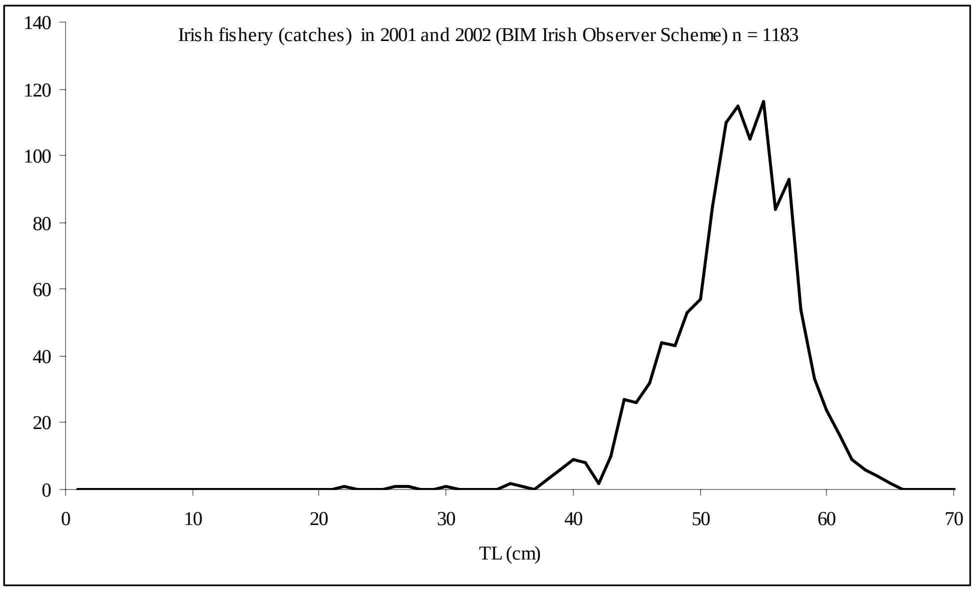


Figure 7.4.2. Length frequencies from Irish fisheries in 2001 and 2002, data from Irish Sea Fisheries Board observer scheme (BIM, WD 2002). VI and VII data.

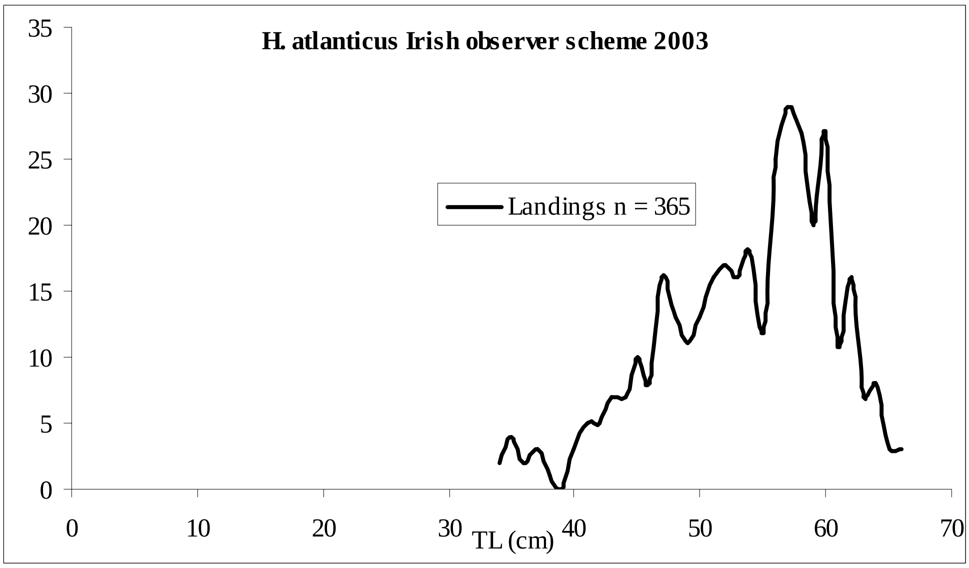


Figure 7.4.3. Length frequencies from Irish fishery in 2003 (VI and VII) from Irish Marine Institute observer scheme.

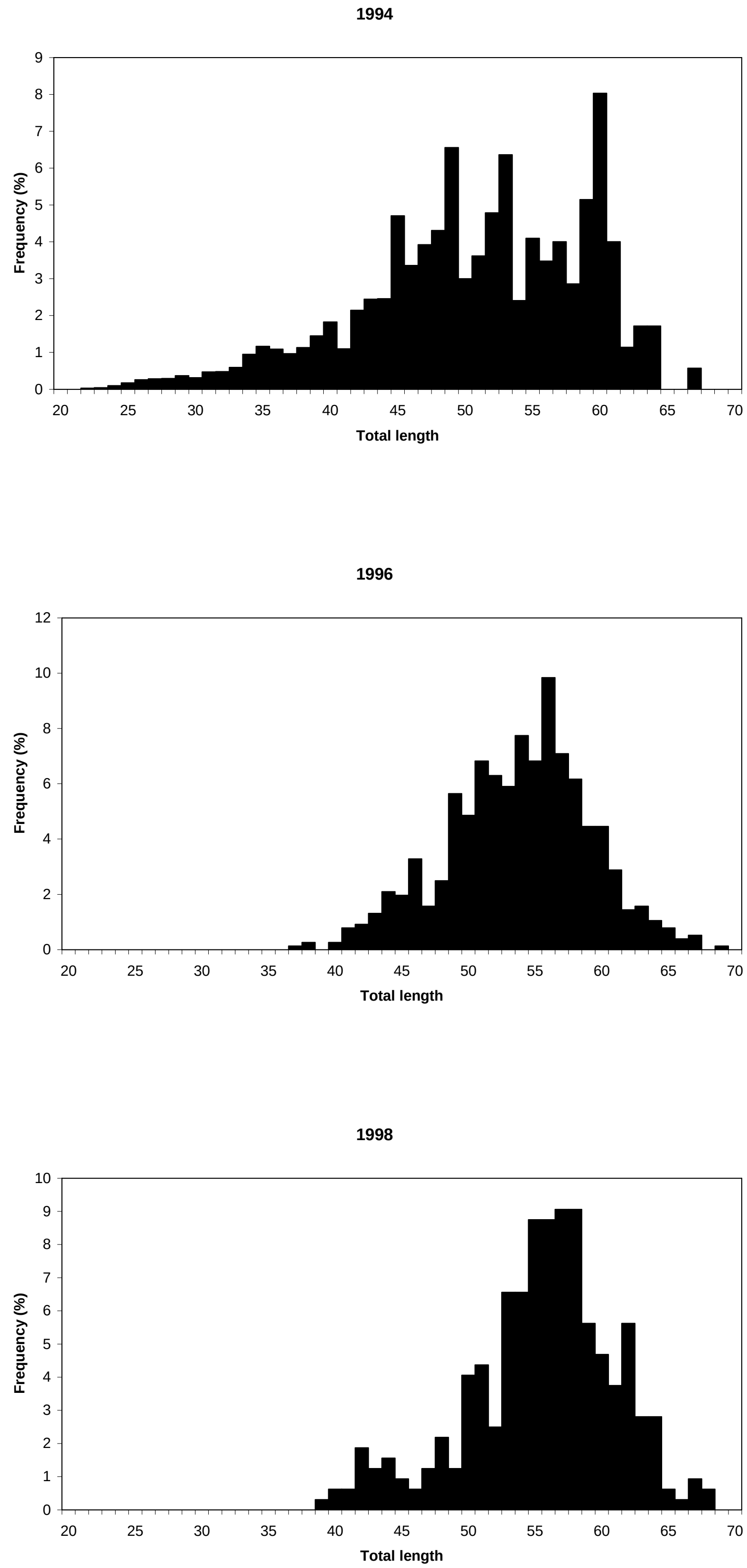


Figure 7.4.4. Length distribution of French landings of orange roughy from 1994 to 1998.

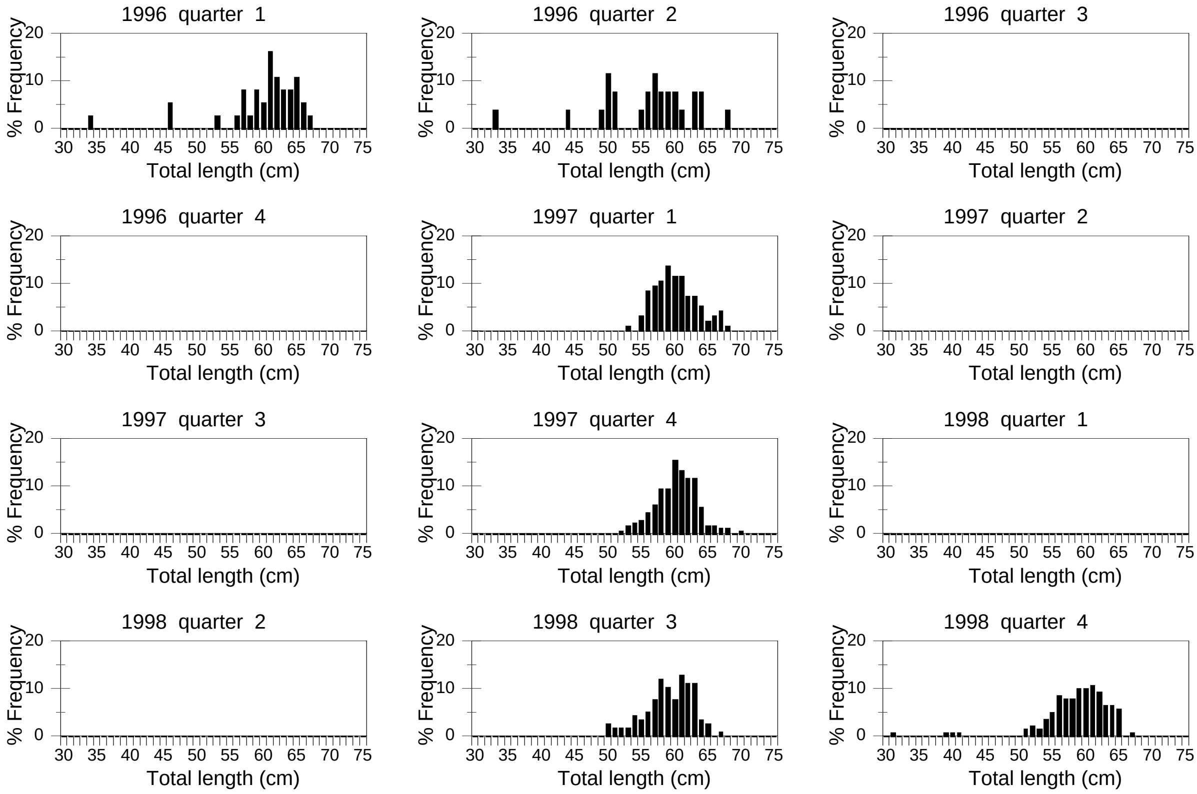


Figure 7.4.5 Orange roughy, quarterly landings from French vessels landing in Scotland (FRS data) (EC FAIR 1999)

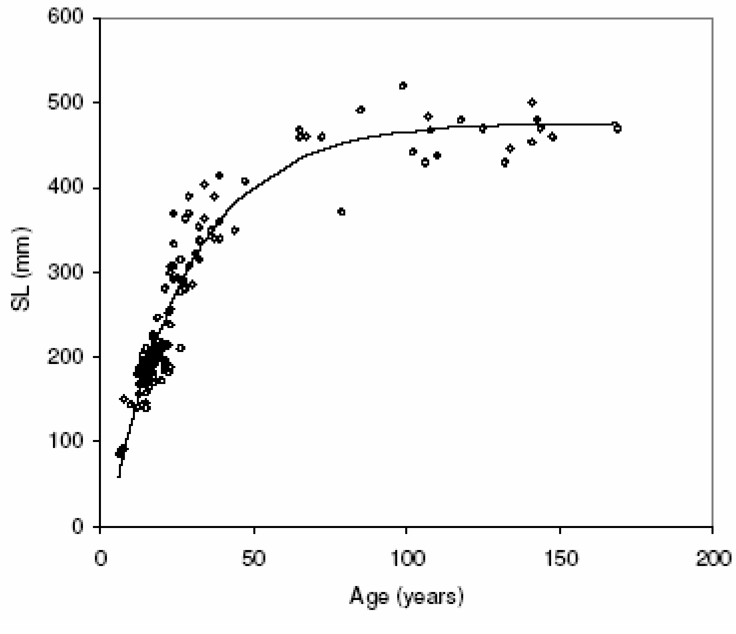


Figure 7.4.6. Age estimates and the estimated Von Bertalanffy growth curve (WD 13c).

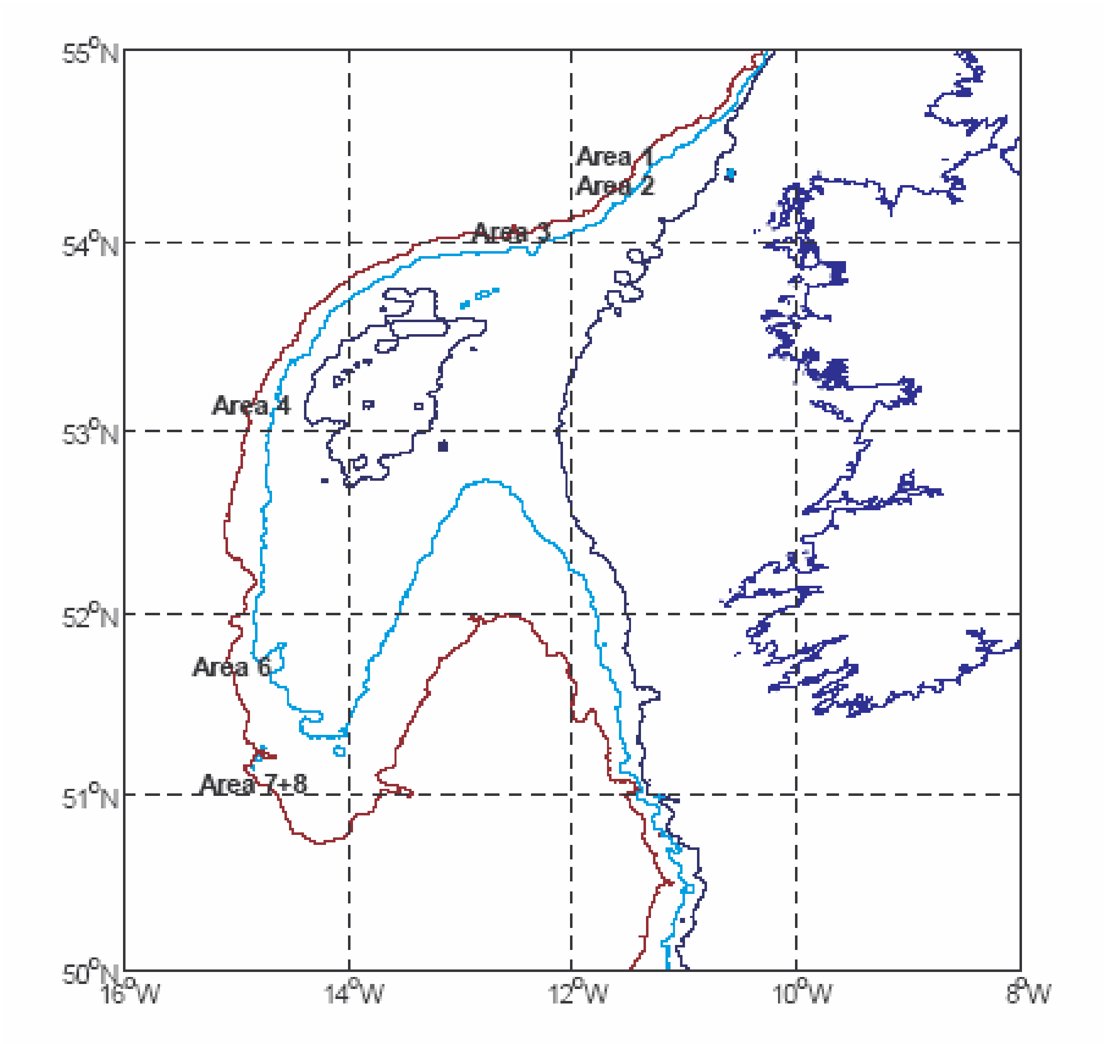


Figure 7.4.7. Acoustic survey of VII, 2005. Survey sub-areas.

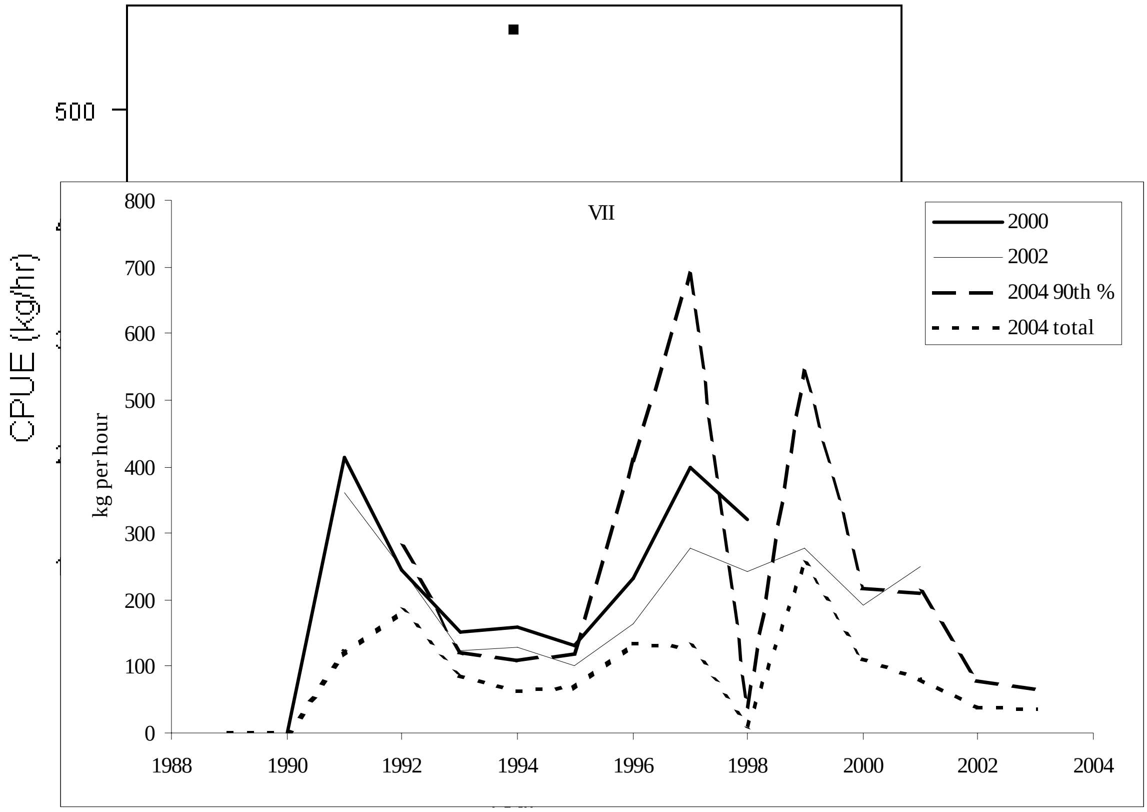


Figure 7.4.8. Top: Comparison of four old series of CPUE from French trawlers in Sub-areas VII. Note that there in no data in 1988 so that point is spurious in the plot. Bottom: 2006 CPUE series for 400-600 kw power vessels (open triangles) and for 1400-1600 kw vessels (solid squares). The line is a smooth curve through the latter series excluding the high 1997 point.

7.5 Roundnose Grenadier (*Coryphaenoides Rupestris*) In Division Vb & XIIb, Sub-Areas Vi & VII

7.5.1 The fishery

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

7.5.1.1 Landings trends

Over the full assessment zone (division Vb, XIIb and subareas VI and VII), the fishery is mainly conducted by France and Spain.

In division Vb over the last ten years, the catch varied from about 1000 to 2000 tonnes taken by France and Faroes. In sub-area VI a maximum in the catch was observed in 2001 at more than 14000 t. It has decreased since then to less than 4500 t in 2005. About 2/3 of the landings in sub-area VI are caught by France. In sub-area VII, catches close to 2000 t were recorded in the mid-1990s, current catches are much lower at less than 200 t in 2005.

The situation for sub-area XIIb is more complex as most countries did not report catches by new ICES areas. In the whole sub-area XII, the catch has varied over the all time series. High catches in 1988-89 were from former Soviet Union that was the only country reporting landings from the sub-area XII at that time. Then the catches decreased up to the mid-1990. Then landings from France, Spain and Russia began. These countries were the 3 main one reporting roundnose grenadier landings in sub-area XII during the last 10 years. In addition to these, Poland reported high catches in some years (see overview).

Allocation of catch in sub-area XII to Hatton Bank (division XIIb) and Mid-Atlantic Ridge (division XIIa1 and XIIc).

The Spanish fishery is not known to operate on the Middle Atlantic Ridge (MAR) so that for assessment purposes all the time series of Spanish catches reported in XII was allocated to the new ICES area XIIb (western Hatton Bank) together will small catches from a few other countries (Ireland, Uk and Norway).

On the contrary, Russian catches reported in the old ICES area XII were considered to have been caught on the MAR.

As a result of this allocation, 85% of the catches in the assessment area Vb, VI, VII and XIIb is caught by French and Spanish trawlers. Lithuania and Faroes contributed to about 10 and 5% of the 2005 catch respectively.

The catch taken into account for the new assessment area (Vb, XIIb, VI and VII) is then much higher than that taken into account for the assessment area formerly used (Vb, VI and VII).

The total catch in the assessment area is given in tables 7.5.0 (Vb, VI, VII, XII) and 7.5.1 (Vb, VI, VII, XIIb).

Due to doubt with the catch data in sub-area XIIb that were clarified only on the last day, the assessment was carried out for Vb, VI and VII. This is likely to have an effect only on the level of the estimated biomass as there was not length and age data for the catch in sub-area XIIb.

7.5.1.2 ICES advice

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".

7.5.1.3 Management

TACs for EU vessels for deepwater species has been set since year 2003. These TACs are revised every second year and for roundose grenadier in the area Vb, VI and VII, they were set at 5106 t 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) account for 912 tonnes in the current 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. The EU TAC and national quotas from member countries apply to all vessels in EU EEZ and to EU vessels in international waters.

Further management measures fro EU vessels are a licensing system, fishing effort limits, the obligation to land the fish in designated harbours, a regulation for on-board observations.

	Vb, VI, VII		VIII, IX, X, XII, XIV	
	EU TAC	Catch	EU TAC	Catch XIIb
2002	No	13623	No	10 712
2003	5106	8718	No	10 231
2004	5106	8153	No	10 134
2005	5253	5934	7190	4706
2006	5253		7190	

After the introduction of a TAC in 2003, the catch decreased in division Vb and sub-areas VI and VII, decreasing the total landings in the assessment area from more than 24 000 t to about 19 000 t. The preliminary data for 2005 give a total catch of 10 600 t (Table 7.5.1).

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.

7.5.2 Stock identity

No new data on stock identity was available to the working group. According to current knowledge the working group agreed to consider the divisions Vb and XIIb and sub-area VI and VII as an assessment unit. Investigations on the stock identity of the Hatton Bank area are on-going. Other areas where significant roundnose grenadier density occur in the North East Atlantic are the MAR and the Skagerrak both separated from the western European slope and bank by large distance and significant bathymetric and hydrographic features so that they are considered as independent fish populations units.

7.5.3 Data available

7.5.3.1 Landings and discards

Landings time series data per ICES areas are presented in Tables 7.5.0 and 7.5.1.

Landings data by new ICES areas was available from France for year 2005. The landings statistic databases from France allow to reconstruct the time series of landings by new ICES areas back to 1989. However, for the older years, a significant part of the landings was not reported by statistical rectangle so that a part of the landings could not be allocated to new areas.

No other country provided data by new ICES area. This is particularly a trouble for roundnose grenadier assessment as catches in the former ICES sub-area XII include the MAR and the western Hatton bank. However, crude allocation of landings by country could be done as is does not seem that any national fleet operates both on the MAR and the western Hatton bank.

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 2004-2005.

Discard data (quantities and length distribution) were also available from the on-board observation of the French fishery (2004-05) from Scottish observers on-board of French vessels, 1997-2001 (Table 7.5.6).

Based on EU observer program 2004-05, about 30% of the catch in weight of roundnose grenadier is discarded, due to small size (Figure 7.5.5). 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. For this year, the group considered there was not enough data to include it the assessment.

No clear trends was seen is the length distribution of discards. In both year 2004 and 2005 and at all depths the mode of the length distribution was 13 cm and few fish of more than 15 cm were discarded. Under the hypothesis that the observed hauls are representative of the whole fishing activity of the deepwater fleet. Aggregating all the observed discarded length distribution provides an estimate of the length distribution of discards in the French fishery. As there seem to be little difference in the length distribution of discards and by year, this estimate might be robust (Figure 7.5.2).

Compared to previous data available on discards (Allain, 2003), the main discarded lengths seem to have remained the same (12-13 cm pre anal length). The right side of the length distribution have become steeper suggesting that the sorting of landed and discarded fish is made more accurately (Figure 7.5.6).

7.5.3.2 Length composition

Size frequency data (and corresponding weight data) for roundnose grenadier were available for French catches landed in France,1990-2005 (Figure 7.5.1), French catches sampled on board by Scottish observers (1997-2005). Discard data (amount of discards and length distribution) were available from the on-board observation of the French fishery (2004-05) and from Scottish observation on-board of French vessels.

The length distribution of French discards was sampled on-board in the observer program (Figure 7.5.2, see also data analysis section).

Length distribution of the discards was raised to the number of fish discarded by depth and by year during observed hauls. Since the start of Hatton bank bottom trawl commercial fishery, monitoring was carried out by Spanish independent scientific observers on board, under the management of the IEO-Vigo. The observers provide data and samples according to IEO protocol. During 2005, 7.4 % of the total fishing days were sampled. Time-series data (2002-2005) of the raised length composition of the total catch and of the discards for roundnose grenadier , are presented in Figures 7.5.3 and 7.5.4.

7.5.3.3 Age composition

Age estimates were available from France. Age composition of the French landings have been routinely estimated since 2001. Formerly age length key were derived from a cruise in 1999 and from sampling on-board of commercial trawler in 1996-97 (Lorance et al., 2001,2003). Preliminary analysis of the length at age data showed that age length key (ALK) are very stable over years. ALK for years 99 and 2001-04 were very similar, the ALK for 2005 appeared different and the change was ascribed to a change of the reader.

Age data were prepared using to methods : method 1 (as for WGDEEP 2004) and method 2 (based on otoliths weights).

Method 1: the data from WGDEEP 2004 were completed with catch at age in 2004 in 2005. This data is based upon Age Length Keys from age estimates in 1996, 1999 and 2002-2005. Otoliths from 1996 and 1999 were collected respectively on board of commercial trawlers and during a scientific cruise; otoliths for 2002-05 were routinely sampled from the landings. This data set may be heterogeneous, because 3 different readers estimated the age over these different years and also because measuring the fish on-board may lead to different age-length relationship than measuring the landed fish that may have lost water for some days in ice.

Method 2: based on on-going studies about relationship between otolith weight and fish age. The otolith weight-age relationship observed in 2002-2004, was used to compute an age length key.

The two catch at age tables are presented in tables 7.5.6 and 7.5.7. In both the age landed in highest numbers are 20 to 30 years old. The catch at age table derived from method 2 is more consistent from year to year and the changes only represent those observed in the length distribution of the landings.

The method 1 catch at age was analysed together with weights at age estimated in each year. The method 2 catch at age was analysed with the same weights at age taken for all years (which seems reasonable for roundnose grenadier).

One major difference was the range of age in the data as little fish younger that 18 have appeared in the sampling of the landings in recent years. The catch of age from method 1 covers age from 15 to 39 (+ group), the catch at age from method 2 covers ages from 18 to 39. For recent years there is no fish younger that 18 in both catch at age tables.

7.5.3.4 Weight at age

As roundnose grenadier is landed gutted and with the tail cut, full weights cannot be collected from the landings. Weights at length data were collected on some cruises and were used where appropriate to calculated weights at age. Weights in the stocks and in the catch were set equal.

7.5.3.5 Maturity and natural mortality

A few studies provide estimates of maturity of roundnose grenadier. The age at first maturity for this assessment area was estimated to be 14 year (Allain, 2001).

No new data on maturity and natural mortality was collected in recent years. Natural mortality was previously estimated from catch curves (Lorance et al. 2001) and an estimated M=0.1 was used by the working group in 2004 and this year. It should be kept in mind than this estimate is based on limited data. Data on biological parameters of roundnose grenadier are given in section 3.1.

In former reports, biological parameters were given for the species in several areas in the same table. Estimates from the Skaggerak are lightly different from those from this northwest

Atlantic management area (Bergstad, 1990). Due to the difference in environment (depth, temperature, primary production …) between the Atlantic and the Skaggerak difference are expected.

7.5.3.6 Catch, effort and research vessel survey

Research Survey

Only one cruise relevant to roundnose grenadier is currently carried out on a yearly basis by FRS (Scotland) see section 3.1.

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. Data analysis was restricted to hauls between 55.5 and 58.5° N, coverage was relatively consistent over the time series at certains depths (Table 7.5.3 & 7.5.4, Figure 7.5.13).

Effort and LPUE data

Effort data was available from France and LPUE were presented in a working document. Details of the calculation are provided in WD11.

7.5.4 Data Analyses

7.5.4.1 Abundance indices

Landings Per Unit Effort (LPUEs) of the French fleet from 1989 to 2005 were presented in a WD (Biseau, WD, 2006). The global LPUE for the whole French trawling fleet showed a globally stable or increasing trend over time. The same trend was observed when selecting different fishing sequences (Figure 7.5.8). A fishing sequence, is a line of a log-book, i.e the catch and effort from one or several fishing operations (trawl hauls) carried out during one day in one rectangle.

Further investigation was carried out selecting some set of statistical rectangles in order to remove the geographical effect. Six zone were selected (Table 7.5.3, Figure 7.5.9). Reference zone "Continental slope in sub-area VI" is the part of the more or less linear slope to the east of the Rockall trough were fishing occurred since the start of the French deepwater fishery. The zone "Others in sub-area VI" is a zone fished from the start of the fishery but with more varied topography (eg bathymetric features such as Hebridean Terrace). Two zones were defined for new grounds in sub-areas V and VI, for rectangle that were not fished before the year 2000. Lastly, one single reference zone was delineated in sub-area VII.

The interpretation of theseLPUEs proved problematic and the working group did not retained then fro roundnose grenadier (see section 3.1).

Some of the factors in LPUE can be addressed from data of the observer program. The LPUE of roundnose grenadier per depth zone in observed hauls shows that the highest catch rate were obtained between 1400 and 1500 m in both 2004 and 2005 (Figure 7.5.11), this is confirmed by the FRS surveys. This depth effect was previously seen in the TECTAC project for year 2001-03 (TECTAC, 2006).

From the SFR survey, the highest abundance of *Coryphaenoides rupestris*, on the west of Scotland slope is found at 1500m with a secondary peak at 1000m (Tables 7.5.3, 7.5.4 Figure 7.5.13).

As formerly known (Gordon, 1979) the data from this survey shows complex changes of the length distribution of roundnose grenadier according to depth (Figure 7.5.14). At relatively shallow depth small and large individuals are observed while intermediate size are more abundant deeper.

Data from surveys before the start of the exploitation indicate that the peak abundance was much shallower. Based on data from commercial trawl type, Ehrich (1983) gives a peak of abundance at 800 m. Interpretation of LPUE from catch statistics become more complicated when considering the apparent change in the depth distribution of the effort from year to year (Figure 7.5.11). Based on this data, the most fished depth were 1100 to 1300 m in both years 2004-05, part of the effort may be targeting other species. This mismatch may make LPUE inappropriate as abundance indices.

The working group was provided with other LPUE series but due to time constraint could not analyse them.

7.5.4.2 Separable VPA

Separable VPA were run on these two method 1 and 2. Other parameters were kept the same and runs were done for F=0.05, F=0.1 and F=0.15. For each of these F values three selectivity factors were tried (S=0.6, S=0.8, S=1). The reference age was set at 25 in the method 1 catch at age and 28 for the method 2 catch at age (10 years older than the younger age in each data set). The weights at age were also different in the two cases but all other input data (landings, natural mortality) were the same.

The pattern of residuals were different for the two catch at age, the residuals for the method 2 being smaller (Table 7.5.8 and 7.5.9 and Fig 7.5.14)

For method 1, the fishing mortality at age showed a quite similar pattern as two years ago (WGDEEP 2004) although a strong peak in fishing mortality appeared for fish of about 30 to 35 years old (Fig 7.5.15). Biomass trends were also consistent with WDGEEP 2004 results.

Method 2 provided a completely different distribution of fishing mortality at age, with high fishing mortalities at age at about 35 years old decreasing down to 0 for younger age in the data (Figure 7.5.17). The trends in biomass appear also decreasing but to a lower extend than for method 1.

Although it may appear natural to use the result based method 1, the group considered there was some inconsistencies in the catch at age over years. Method 2 which produce a more consistent catch at age leads to unrealistic results.

Overall the output derived from the 2 methods are inconsistent. As the working group could not carry out further investigations, it decided to keep both runs equal weighting as a sensitivity analysis. As a result, the working group could not agree on a analytical assessment for this species.

7.5.5 Comments on assessment

Age reading scheme need to be checked for this species and an otolith exchange is on-going between Ifremer, IEO and FRS. The way to the apply Age Length Keys to the catch numbers in length should be reviewed.

For the future it is probably necessary to prepare tuning data taking into account depth and seasonal factors when developing time series of abundance indices.

The way to include discard data in the assessment might also be investigated.

Overall the stock status is uncertain but there are some evidences that the shallow component of the stock has been depleted.

7.5.6 Management considerations.

Given the uncertainty and the fact that there is evidence of depletion, the advice should be precautionary until more evidence is available.

Due to technical interactions the group considered that the advice for this species might be consistent with that given for black scabbardfish. For subareas VI, VII and divisions Vb and XIIb a reduction in exploitation of 50% from the 2000-2002 level is required.

Table 7.5.0a. Roundnose grenadier Vb. WG estimates of landings.

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	989			6		76	**1579**
2005*	440	858			1		17	**1316**

* Preliminary data

Table 7.5.0b. Roundnose grenadier VI. WG estimates of landings.

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	4585		8	961		13	72	252		72	6001
2005*		24	2874		17	939	1		71	467		29	4422

* Preliminary data

Table 7.5.0c. Roundnose grenadier VII. WG estimates of landings.

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		253	320			**573**
2005*		141	55			**196**

* Preliminary data

Table 7.5.0d. Roundnose grenadier. WG estimates of unallocated landings in Vb, VI and VII

Year	Unallocated	TOTAL
1988		**0**
1989		**0**
1990		**0**
1991		**0**
1992		**0**
1993		**0**
1994		**0**
1995		**0**
1996		**0**
1997		**0**
1998		**0**
1999		**0**
2000		**0**
2001	208	**208**
2002	504	**504**
2003	952	**952**
2004		**0**
2005*		

* Preliminary data

Table 7.5.0e. Roundnose grenadier XII. WG estimates of landings.

Year	Estonia	Faroes	France	Germany	Iceland	Ireland	Latvia	Lithuania	Russia/ USSR	Poland	Spain	UK (E+W)	UK (Scotl.)	Norway	**Total**
1988									10606						**10606**
1989			0						9495						**9495**
1990			0						2838						**2838**
1991			14				4296		3214						**7524**
1992			13				1684		295						**1992**
1993		263	26	39			2176		473						**2977**
1994		457	20	9			675								**1161**
1995		359	285												**644**
1996		136	179		77				208		1136				**1736**
1997		138	111						705	5867	1800				**8621**
1998		19	116						812	6769	4262				**11978**
1999		29	287				1		576	546	8251				**9690**
2000		6	391	9					2325		5791		6		**8528**
2001		2	156			3			1714	121	5922		7	1	**7926**
2002			14					18	737	1	10696	1	1		**11468**
2003			543			1		31	510	32	9684		3		**10804**
2004	28	8	1707					120	436	21	8423		4		**10747**
2005*		4	509					31	600		4199				**5343**

* Preliminary data

** Spanish landings include VI

***Origin of Estonian catch in 2004 is uncertain

Table 7.5.0f. Roundnose grenadier Vb, VI, VII, XII. WG estimates of landings.

Year	Vb	VI	VII	XII	Unallocated	**Total**
1988	1	32	0	10606	0	**10 639**
1989	258	2218	222	9495	0	**12 193**
1990	1549	5515	215	2838	0	**10 117**
1991	2311	7304	489	7524	0	**17 628**
1992	3817	6782	1556	1992	0	**14 147**
1993	1681	8205	1916	2977	0	**14 779**
1994	668	5938	1922	1161	0	**9 689**
1995	1223	6472	1295	644	0	**9 634**
1996	1078	6044	1051	1736	0	**9 909**
1997	1112	6032	1038	8621	0	**16 803**
1998	1667	5207	1157	11978	0	**20 009**
1999	1996	5642	896	9690	0	**18 224**
2000	1791	8956	889	8528	0	**20 164**
2001	2016	14773	1363	7926	208	**26 286**
2002	1025	11538	1060	11468	504	**25 595**
2003	1532	6598	588	10804	952	**20 474**
2004	1579	6001	573	10747	0	**18 900**
2005*	1316	4422	196	5343	0	**11 277**

* Preliminary data

** Spanish landings in VI included in XII

Table 7.5.1. Catch of roundnose grenadier in Vb, VI, VII and XIIb.

ROUNDNOSE GRENADIER, CATCH IN ASSESSMENT ZONE (VB, VI, VII, XIIB)					
Year					
	Vb	VI	VII	XIIb	**Total**
1988	1	32	0	0	**33**
1989	258	2 218	222	0	**2 698**
1990	1 549	5 515	215	0	**7 279**
1991	2 311	7 304	489	14	**10 118**
1992	3 817	6 782	1 556	13	**12 168**
1993	1 681	8 205	1 916	26	**11 828**
1994	668	5 938	1 922	20	**8 548**
1995	1 223	6 472	1 295	285	**9 275**
1996	1 078	6 044	1 051	1 315	**9 488**
1997	1 112	6 032	1 038	1 911	**10 093**
1998	1 667	5 207	1 157	4 378	**12 409**
1999	1 996	5 642	896	8 538	**17 072**
2000	1 791	8 956	889	6 188	**17 824**
2001	2 016	14 773	1 363	6 089	**24 241**
2002	1 025	11 538	1 060	10 712	**24 335**
2003	1 532	6 598	588	10 231	**18 949**
2004	1 579	6 001	573	10 134	**18 287**
2005*	1 316	4 422	196	4 708	**10 642**
	(*) preliminary				

Table 7.5.2. Reference areas for French CPUE time series

ZONE DEFINITION	STATISTICAL RECTANGLES
Edge in sub-area VI	38D9 39D9 39E0 40E0 41E0 42E0 43E0 44E0 45E0 45E1 46E1 46E2 47E3 48E3
Others in sub-area VI	46E0 47D9 47E0 47E1 47E2 48E1 48E2
Reference sub-area V	49E0 49E1 49E2 49E3
New grounds in sub-area V	49D7 49D8 49D9 50D8 51D8 51D9 51E0 52D8
New grounds in sub-area VI	46D4 46D5 47D4 47D5 48D5 48D6 48D7 48D8 48D9
Reference in sub-area VII	29D8 30D5 30D6 30D8 31D4 31D5 31D6 31D8 32D4 32D5 32D7 33D4 33D5 35D6 36D5 36D6 36D7 37D6 37D7 37D8 37D9

Table 7.5.3. FRS survey to the west of Scotland, CPUE (No. h^{-1}) for *C. rupestris* at different depths between 55.5 and 58.5° N.

YEAR	1998	2000	2002	2004	2005
Depth (m)					
<500	0	0	0	0	
500-599	4.7	3.8	0.5	0.0	0.3
600-699	90.4	1.3	3.5	19.0	5.3
700-799	110.6	39.3	64.0	17.5	
800-899	222.0	337.0	3.3	171.5	150.8
900-999	708.0	277.2		402.3	
1000-1099		404.6	259.4	152.7	563.0
1100-1299	29.7	543.5	154.0		
1300-1399			433.0		
1400-1599		728.7	1032.8	890.0	826.9
1800			249.5	271.0	167.5
1900			0		

Table 7.5.4. FRS survey to the west of Scotland, CPUE (Kg h^{-1}) for *C. rupestris* at different depths between 55.5 and 58.5° N.

Year	1998	2000	2002	2004	2005
Depth (m)					
<500m	0	0	0	0	
500-599	12.13	2.38	0.05	0.00	0.01
600-699	29.04	2.05	3.30	16.65	5.23
700-799	31.10	3.90	46.90	4.05	
800-899	89.85	126.25	4.00	27.83	80.26
900-999	70.35	66.30		116.06	
1000-1099		130.75	87.44	57.86	131.73
1100-1299	14.73	214.85	45.05		
1300-1399			111.80		
1400-1599		314.32	455.31	419.38	351.72
1800			116.35	158.28	71.53
1900			0.00		

Table 7.5.5. Length distribution of discards from the French fleet from Scottish observer program 1997-01.

Year	1997		1998			1999			2000				2001	
Quarter	3	4	1	2	3	1	2	3	1	2	3	4	1	2
Weight discarded	4391	3050	203	1705	10728	1642	1882	10953	7138	1204	8946	1205	4741	6122
Weight landed	16926	7301	1086	19550	17150	4514	6268	20643	5212	3462	23049	7210	17305	10927
	20.59858329	29.46575	15.74864	8.021642	38.48196	26.67316	23.09202	34.66578	57.79757	25.80369	27.96062	14.31967	21.50503	35.90826
Discard length frequency														
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0	0	0	0			
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	0	0	0	0	0.09	0.25	0	0	0	0	0			
5	0	0	0	1.19	0	0.64	0	0.06	0	0	0	0	0	0
5.5	0.76	0	4.8	0.93	0	0.25	0	0.08	0	0	0			
6	4.54	0.24	0	1.43	0.09	0	0.14	0.34	0	0	0	0	0	0
6.5	5.18	0	0	1.07	0.27	0.61	0.55	0.26	0	0	0			
7	3.56	0.16	5.43	1.7	0.5	3.6	0.69	0.32	0	0.99	0	0	0	0.07
7.5	4.01	0	2.66	1.47	0.15	3.43	1.52	0.81	0	0.68	0			
8	4.09	0.24	0.55	1.31	0.22	4.68	2.19	1.62	0	1.33	0	0	0.19	1.69
8.5	3.25	0.04	0.99	1.29	0.76	5.16	1.87	2.8	0.06	2.82	0			
9	2.97	1.1	4.94	0.21	0.65	2.6	2.1	4.18	0.72	7.53	0.12	0	0.72	14.9
9.5	5.04	1.16	10.79	2.45	0.92	2.19	3.33	5.65	2.51	11.74	0.77			
10	3.43	2.11	5.78	2.05	1.71	3.75	4.6	5.09	5.15	3.49	0.61	4.14	8.05	33.74
10.5	5.21	1.84	17.75	2.97	1.9	5.92	3.27	6.2	3.4	9.67	1.24			
11	1.81	3.29	14.18	7.17	3.96	3.74	2.7	6.79	3.72	6.64	2.34	5.63	20.44	27.32
11.5	2.89	5.36	12.06	6.32	5.2	8.53	5.49	10.23	10.37	14.73	4.64			
12	6.81	7.17	3.76	10.51	5.99	8.15	9.33	11.77	19.27	9.99	7.07	22.95	38.23	16.81
12.5	7.74	12.13	2.64	9.8	8.58	8.85	7.13	11.24	15.09	9.75	7.69			
13	7.92	15.34	2.82	11.34	11.87	11.45	10.47	9.18	10.44	4.89	12.89	33.15	25	4.16
13.5	8.7	17.67	1.75	14.23	13.54	8.81	11.84	9.02	9.31	7.17	16.64			
14	9.79	13.41	8.05	9.2	12.46	10.89	11.95	6.06	9.97	2.29	19.27	27.1	6.16	1.19
14.5	5.36	9.48	0	7.28	10.03	3.42	8.14	4.25	4.88	4.28	10.51			
15	4.36	5.34	1.06	3.3	9.29	2.44	6.3	2.35	2.78	1.49	8.52	6.14	0.88	0.12
15.5	0.82	2.53	0	1.42	7.35	0.29	3.9	0.57	2.21	0.5	3.93			
16	1.78	0.62	0	1.35	3.6	0.35	1.09	0.93	0.11	0	2.57	0	0.11	0
16.5	0	0.06	0	0	0.64	0	0.3	0	0.01	0	1.04			
17	0	0.34	0	0	0.24	0	0	0	0	0	0.17	0.58	0	0
17.5	0	0.12	0	0	0	0	0	0	0	0	0			
18	0	0.06	0	0	0	0	0	0.21	0	0	0	0.31	0.22	0
18.5	0	0.22	0	0	0	0	0.55	0	0	0	0			
19	0	0	0	0	0	0	0.55	0	0	0	0	0	0	0
19.5	0	0	0	0	0	0	0	0	0	0	0			
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 7.5.6. Catches number age (landings not including discards) based on method 1 (WGDEEP 2004 approach, age readings from 1996, 1999 and 2002-2005)/

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
15	67	97	117	62	100	337	0	0	0	
16	72	110	142	249	406	1079	0	0	0	
17	205	269	311	426	690	1705	0	46	0	
18	382	488	564	667	1078	1986	136	426	55	1
19	483	588	669	726	1183	2151	408	256	255	32
20	539	611	662	873	1395	2376	422	438	430	81
21	755	856	921	765	1282	2153	968	442	586	145
22	636	730	769	1255	1928	3052	634	505	582	326
23	728	784	788	930	1246	1845	1497	676	617	548
24	775	813	816	878	1286	1833	1094	1126	1191	863
25	557	578	570	1253	1415	1829	1334	1380	927	922
26	569	581	580	1111	886	1279	1419	1291	1069	885
27	462	477	439	777	814	1095	1274	1099	905	888
28	618	618	603	614	698	1002	1028	1069	704	784
29	345	331	333	514	397	597	1039	604	946	668
30	335	304	290	341	278	355	1006	823	567	489
31	342	318	304	273	339	495	994	717	674	359
32	271	274	266	146	201	249	565	858	633	246
33	201	185	160	347	143	195	562	527	396	193
34	213	194	182	50	80	111	500	402	275	130
35	144	125	113	195	93	114	246	425	101	46
36	68	68	60	32	38	68	369	210	121	26
37	81	61	55	100	64	72	172	192	109	10
38	20	18	15	156	101	78	203	106	105	4
39	216	185	167	220	116	176	1142	950	645	0

Table 7.5.7. Catches number age (landings not including discards) derived from method 2 (one single ALK from otoliths weights 2001-2004, applied to length at age from 1996 to 2005)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
18	0	0	0	0	6	38	17	2	0	1
19	21	22	13	26	131	454	168	85	44	34
20	51	68	38	98	318	840	335	185	136	85
21	99	129	83	200	522	1246	515	318	250	152
22	253	321	226	479	1061	2229	1020	631	564	342
23	499	582	475	872	1525	2673	1427	916	936	575
24	830	921	823	1398	2119	3375	2039	1301	1448	904
25	1005	1051	985	1523	2188	3375	2175	1386	1493	966
26	1111	1098	1097	1447	1830	2719	2028	1262	1337	928
27	1216	1155	1216	1456	1662	2319	1999	1233	1279	930
28	1234	1169	1243	1219	1355	1838	1772	1120	1060	821
29	1116	1029	1091	1010	1100	1504	1532	938	871	700
30	942	848	923	692	731	1019	1184	738	594	513
31	722	671	710	468	566	774	849	574	438	376
32	502	518	517	329	362	474	584	385	279	258
33	448	479	452	210	289	355	447	322	212	202
34	391	356	328	116	176	192	282	229	120	137
35	122	139	125	40	71	78	101	88	48	48
36	75	106	90	19	43	45	66	59	21	27
37	27	23	24	7	13	16	22	15	10	10
38	7	6	6	7	5	7	9	4	4	4
39	29	35	29	3	16	13	13	24	10	9

Table 7.5.8. Residuals from the separable VPA based on methods 1 cathc at age with F=0.1 and S=1 at age 25.

					YEARS				
Age	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
15/16	-1.621	-1.558	-1.661	-2.932	-3.177	6.939	-1.032	-1.186	-1.537
16/17	-1.655	-1.427	-1.215	-1.279	-1.438	8.906	-6.359	-0.377	-0.728
17/18	1.045	1.121	1.361	1.049	1.159	4.367	-6.377	1.651	-0.805
18/19	-0.621	-0.557	-0.23	-0.706	-0.588	1.288	-0.786	0.198	-0.11
19/20	-0.468	-0.404	-0.286	-0.827	-0.632	1.299	-0.258	-0.867	0.461
20/21	-0.648	-0.648	-0.117	-0.509	-0.317	0.623	-0.178	-0.582	0.457
21/22	-0.179	-0.158	-0.308	-1.074	-0.774	0.926	0.499	-0.585	-0.064
22/23	-0.273	-0.192	-0.039	0.008	0.288	0.568	-0.063	-0.356	-0.436
23/24	0.04	0.059	0.255	-0.112	0.066	0.586	0.491	-0.518	-0.624
24/25	0.323	0.333	-0.188	-0.39	-0.028	0.249	-0.16	0.107	-0.167
25/26	-0.108	-0.121	-0.522	0.337	0.327	0.084	0.004	0.065	-0.479
26/27	0.135	0.187	-0.123	0.325	0.035	-0.145	0.246	0.183	-0.32
27/28	-0.333	-0.329	-0.168	0.118	0.035	-0.092	0.159	0.266	-0.368
29/30	0.545	0.486	0.29	0.408	0.359	-0.233	0.474	-0.1	-0.501
30/31	0.109	0.063	0.167	0.647	0.373	-0.662	0.23	-0.105	0.163
31/32	0.294	0.189	0.505	0.288	-0.079	-0.936	0.562	0.255	0.195
32/33	0.076	-0.021	0.789	0.194	0.408	-0.45	-0.042	-0.241	0.324
33/34	0.282	0.385	-0.165	-0.047	0.173	-1.089	-0.078	0.448	0.547
34/35	-0.09	-0.163	1.238	1.371	0.366	-1.25	0.153	0.29	0.438
35/36	0.247	0.2	-0.153	-0.874	-0.395	-1.258	-0.171	0.869	0.955
36/37	0.5	0.43	1.216	1.423	0.318	-1.585	-0.12	0.803	0.58
37/38	-0.225	-0.175	-0.637	-0.983	-0.704	-1.404	0.313	0.144	1.652
38/39	0.954	0.8	-1.381	-0.506	-0.457	-1.7	-0.037	-0.084	2.279

Table 7.5.9. Residuals from the separable VPA based on methods 2 catch at age with F=0.1 and S=1 at age 25.

					YEARS				
	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Age									
18/19	-2.011	-1.512	-2.264	-3.548	-0.616	1.825	1.355	0.089	-2.722
19/20	-0.501	0.1	-1.433	-1.585	-0.862	0.898	0.153	-0.002	-0.262
20/21	-0.558	0.143	-1.378	-1.059	-0.679	0.771	-0.008	-0.14	-0.02
21/22	-0.577	0.011	-1.241	-0.83	-0.548	0.697	-0.043	-0.188	0.005
22/23	-0.531	-0.12	-1.137	-0.622	-0.333	0.622	-0.047	-0.316	-0.003
23/24	-0.28	-0.044	-0.837	-0.328	-0.194	0.449	-0.05	-0.359	0.077
24/25	-0.181	-0.044	-0.653	-0.171	-0.161	0.31	-0.06	-0.329	0.162
25/26	-0.167	-0.155	-0.558	-0.043	-0.056	0.229	-0.05	-0.296	0.094
26/27	-0.023	-0.12	-0.362	0.092	0.007	0.107	-0.011	-0.256	0.075
27/28	-0.015	-0.163	-0.153	0.228	0.057	-0.026	-0.018	-0.171	0.079
29/30	0.134	-0.015	0.062	0.259	0.043	-0.13	0.028	-0.074	0.053
30/31	0.11	-0.094	0.191	0.36	0.096	-0.211	-0.014	0.005	0.044
31/32	0.225	0.025	0.465	0.283	-0.001	-0.234	0.02	0.115	0.02
32/33	0.093	-0.018	0.428	0.213	0.103	-0.275	-0.053	0.183	-0.037
33/34	0.003	0.052	0.755	0.272	0.116	-0.327	-0.065	0.246	-0.05
34/35	-0.016	0.091	1.009	0.112	0.283	-0.399	-0.231	0.416	-0.149
35/36	0.735	0.704	1.698	0.372	0.631	-0.049	0.202	0.934	0.274
36/37	-0.159	0.092	1.478	-0.192	0.273	-0.525	-0.425	0.804	-0.067
37/38	0.484	0.746	1.751	-0.12	0.456	-0.326	0.142	0.762	-0.296
38/39	0.687	0.492	0.318	-0.259	0.038	-0.473	0.335	0.235	-0.216

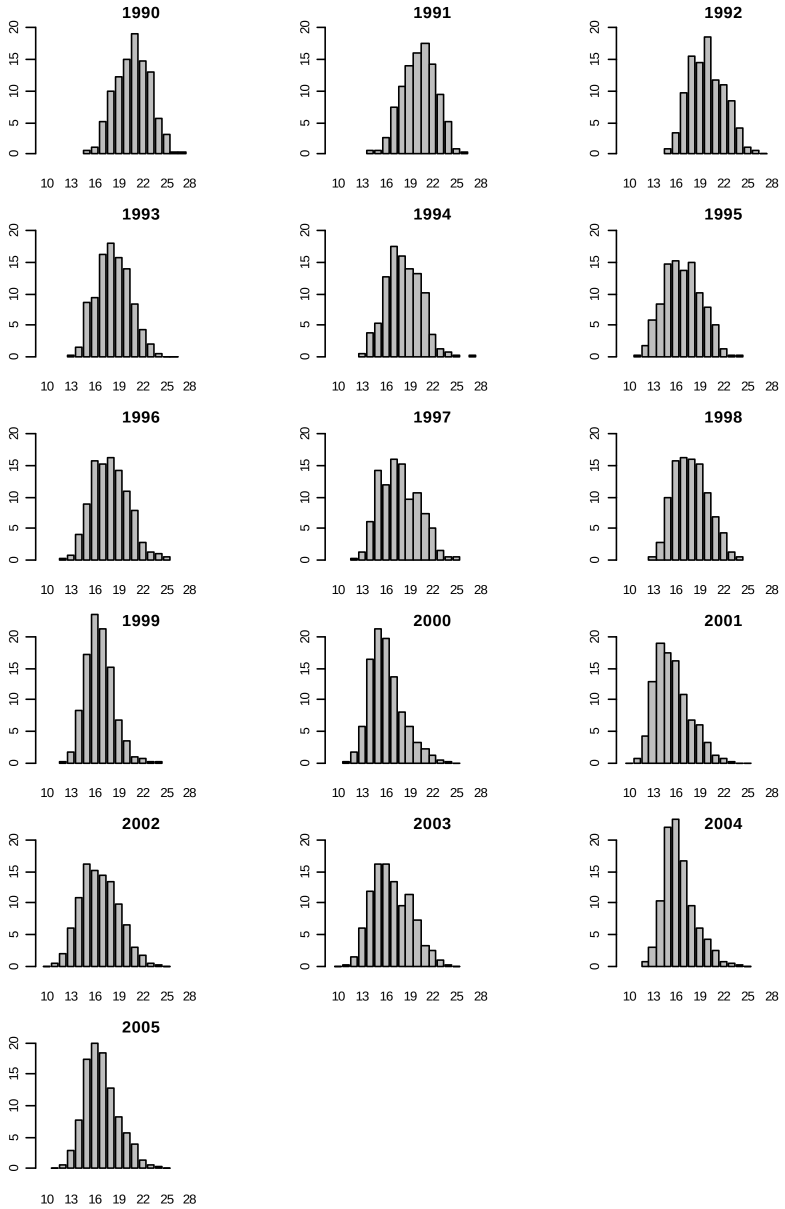


Figure 7.5.1. Length distribution of the French landings, 1990-2005.

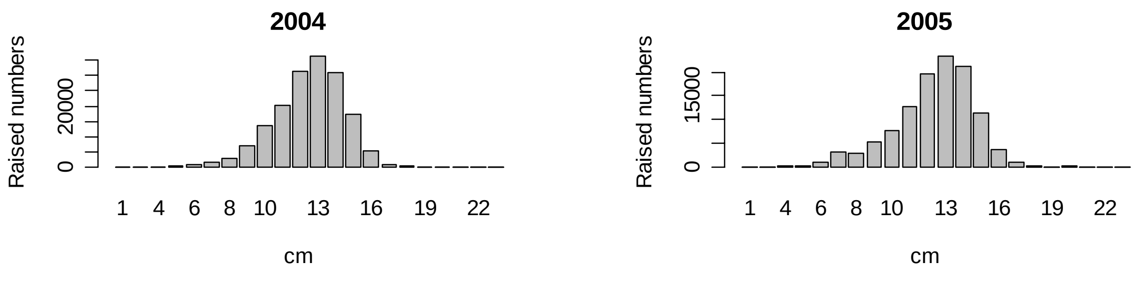


Figure 7.5.2. Length distribution of the discards of roundnose grenadier in 2004 and 2005, from observer program, numbers are raised to the total number of discarded roundnose grenadier in the program (see section 3.1).

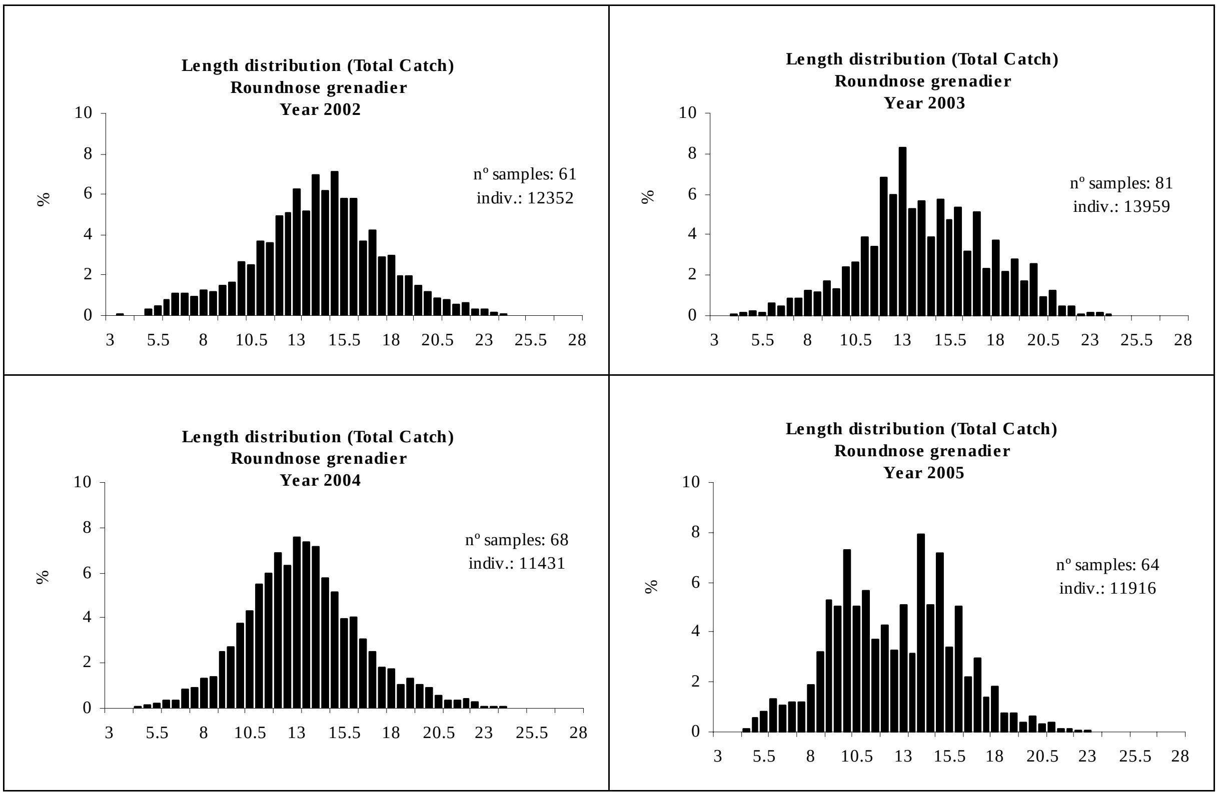


Figure 7.5.3. Length distribution (Pre-anal fin length) for the total catch of roundnose grenadier from the Spanish bottom trawlers fishing on the Hatton bank (2002-05), on-board sampling from IEO.

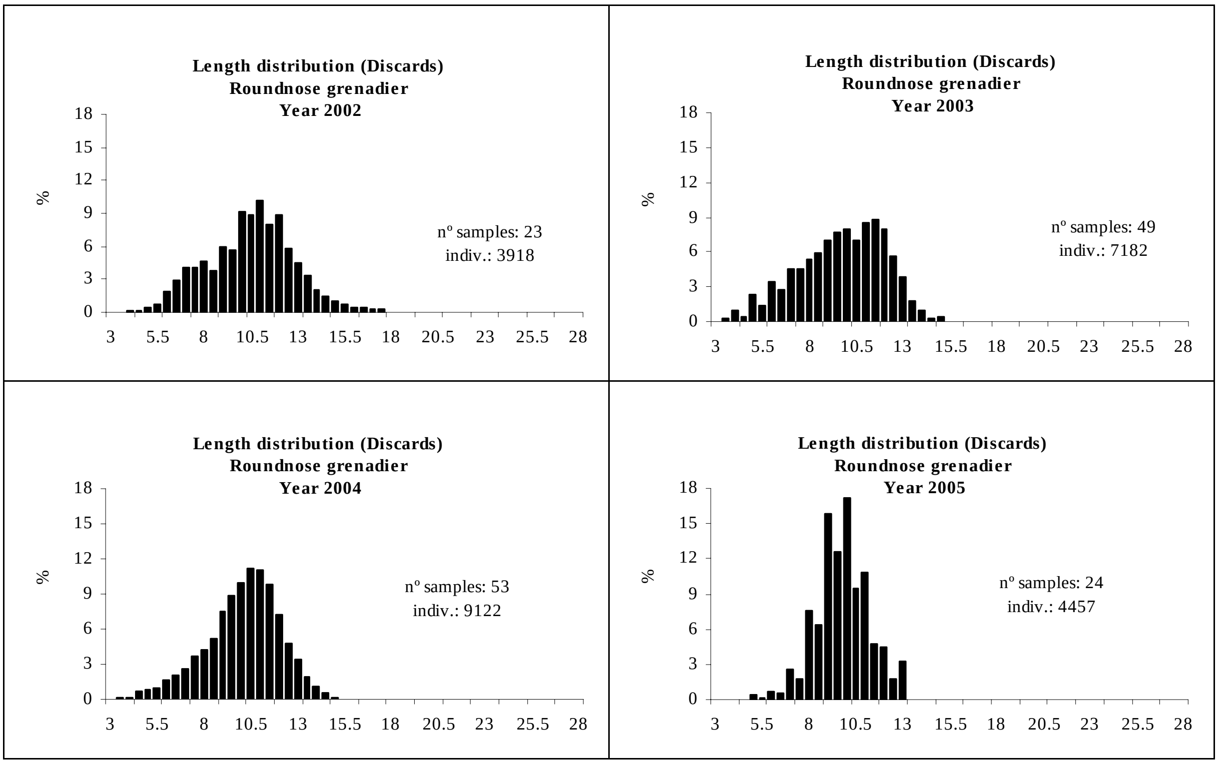


Figure 7.5.4. Length distribution (pre-anal fin length) for the discards of roundnose grenadier from the Spanish bottom trawlers fishing on the Hatton bank (2002-05), on-board sampling from IEO.

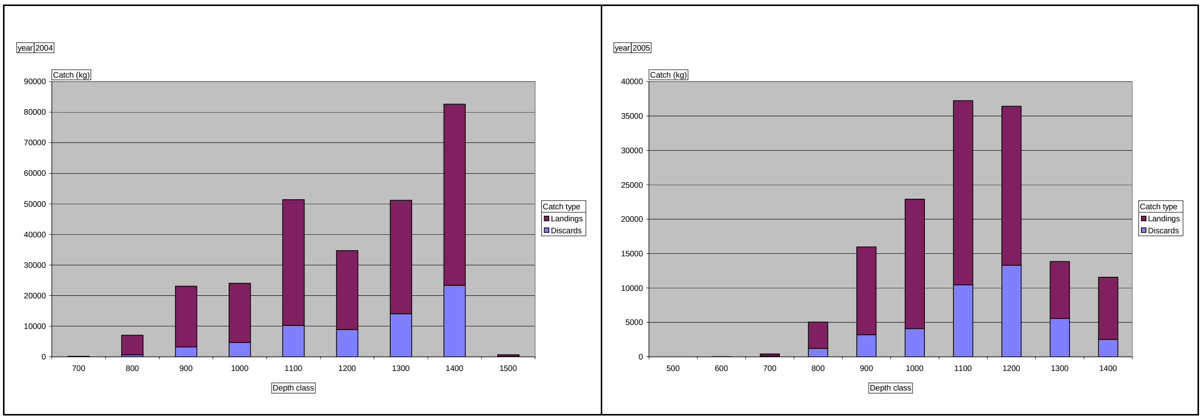


Figure 7.5.5. Landings and discards of roundnose grenadier per year and depth in the French observer program

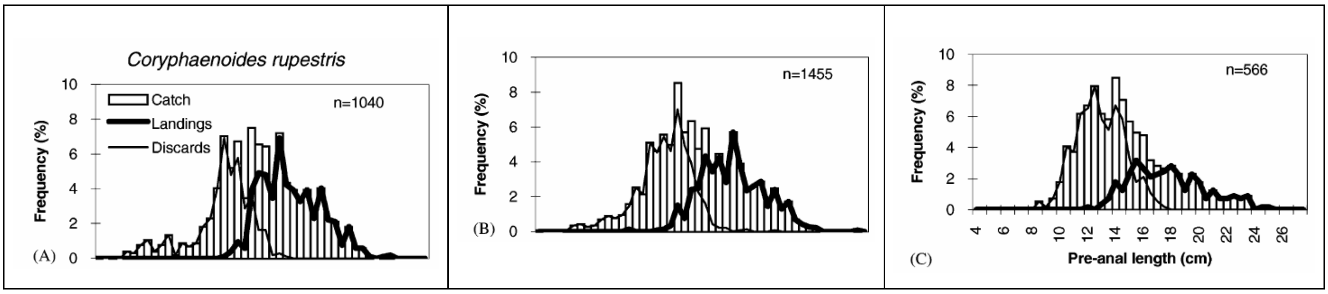


Figure 7.5.6. Length distribution of the discards and landings of roundnose grenadier in 1996-97 by depth (A) 800-1000m, (B) 100-1200m, (C) 1200-1400 m, sampled on-board French vessels, (redrawn from Allain, 2003).

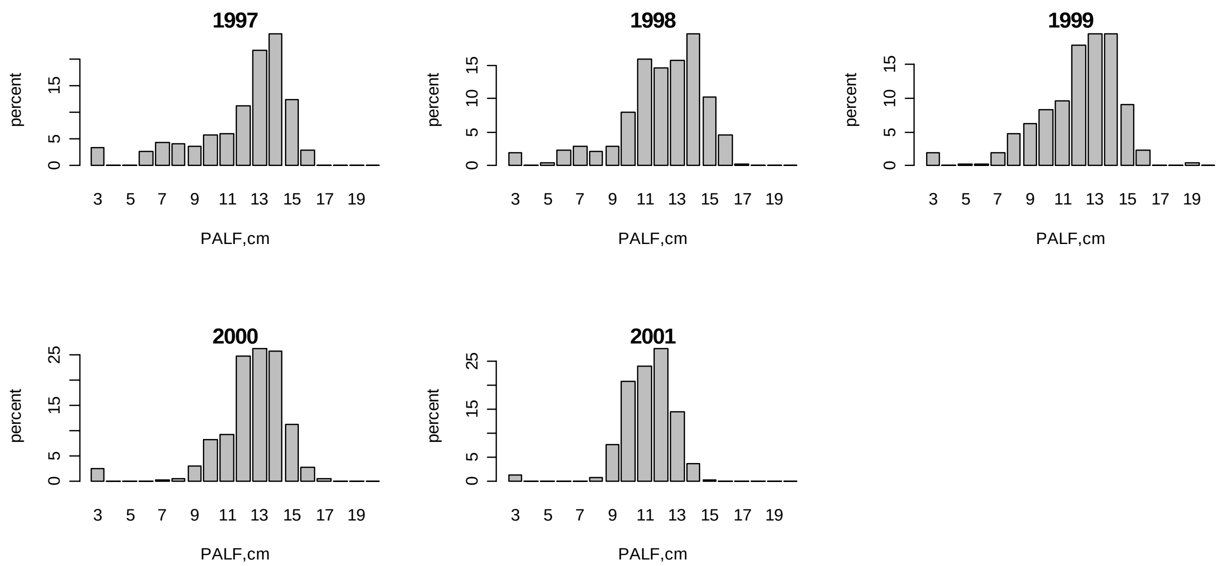


Figure 7.5.7. Size distribution of the discards of the French fleet, sampled on-board French vessels by Scottish observers, 1997-2001

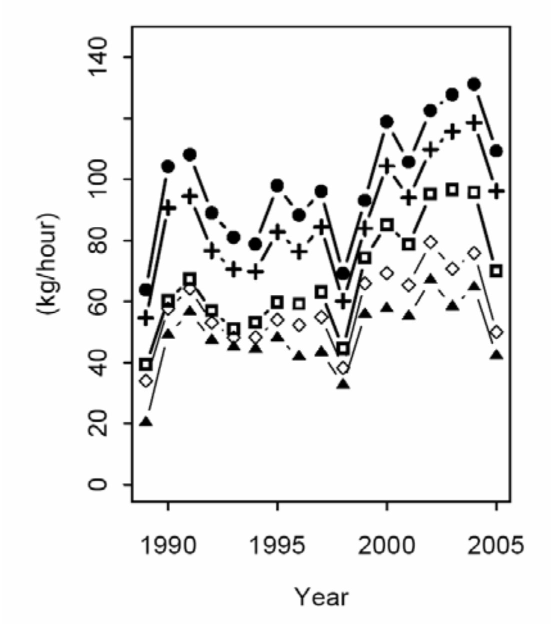


Figure 7.5.8. LPUE of the French trawlers, for different selection of fishing sequences: black circle =sequences with more than 10% roundnose grenadier; cross=sequences with more than 5% roundnose grenadier ; white square sequence with roundnose grenadier present; white diamond=sequences with the three species roundnose grenadier, blackscabbardfish and deepsea sharks present; black triangle all deep water fishing sequences (WD1).

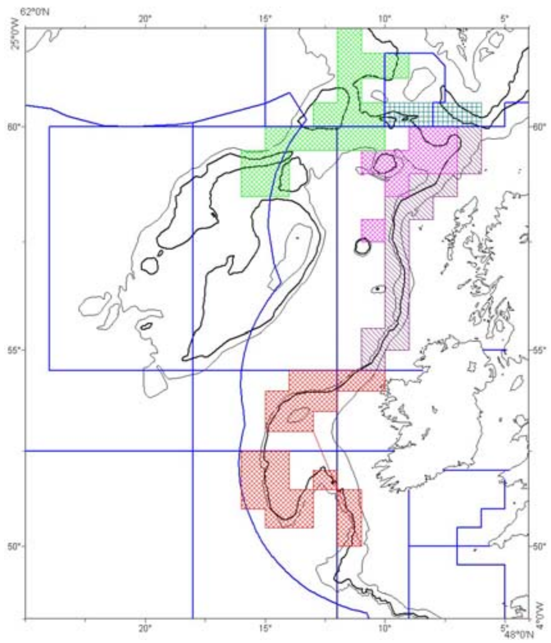


Figure 7.5.9. Reference areas (set of statistical rectangles) used to calculate French CPUEs (green: New grounds in V and VI; dark green: reference area in V; pink: others in VI; purple: continental slope in VI; red reference in VII.

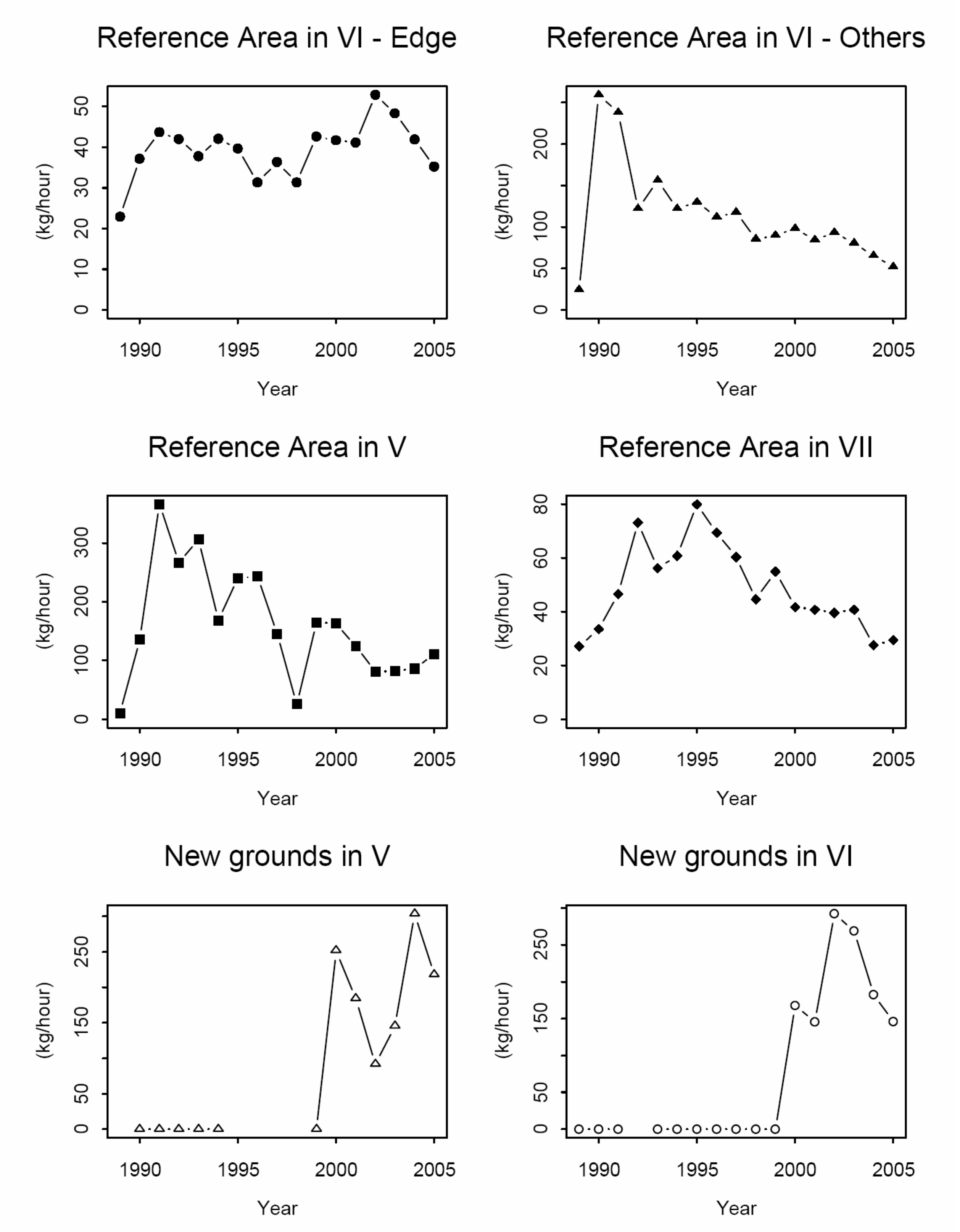


Figure 7.5.10. Trends in CPUE for the different reference zone.

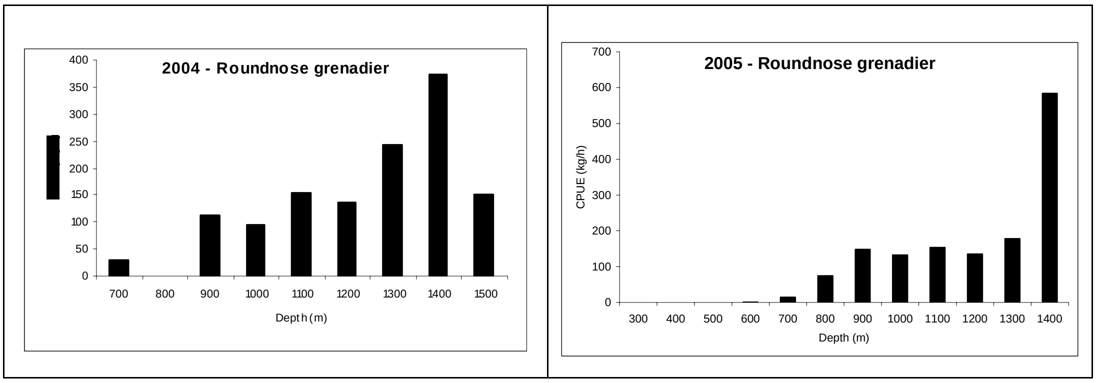


Figure 7.5.11. Roundnose grenadier CPUE of the French fleet based on observers program.

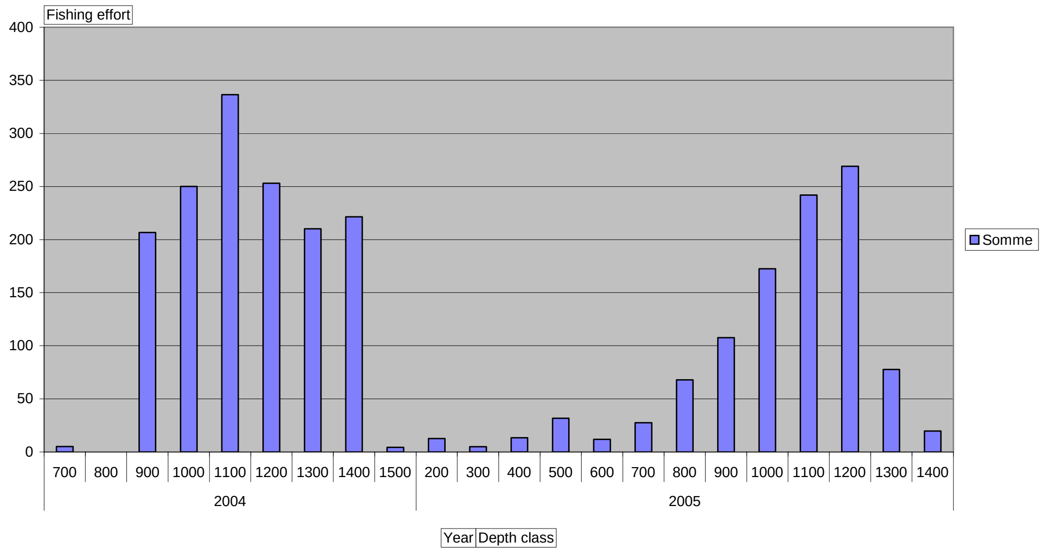


Figure 7.5.12. Depth distribution of the French fishing effort according to observer program in 2004 and 2005.

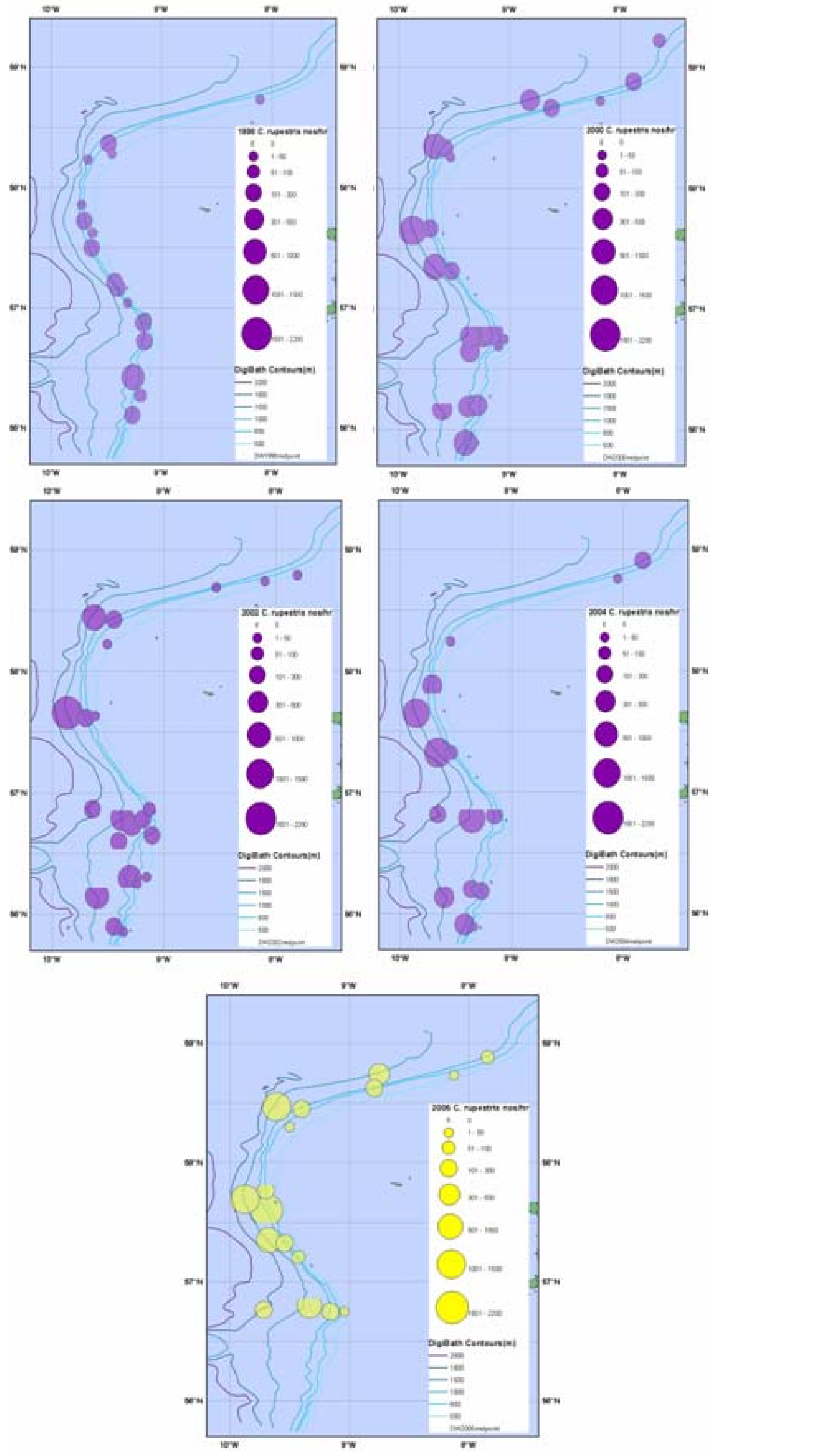


Figure 7.5.13. Distribution and abundance (No per hour) of Scottish survey trawl catches for *C. rupestris* from 1998-2005. (Max abundance category = 1500-2200 no per hour).

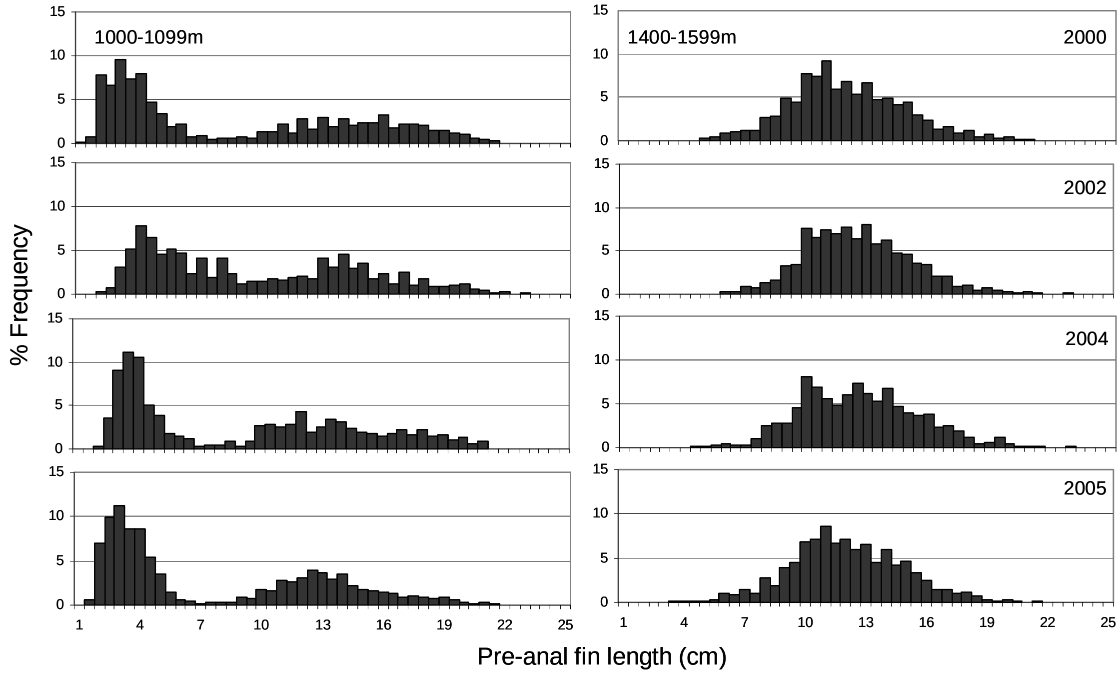
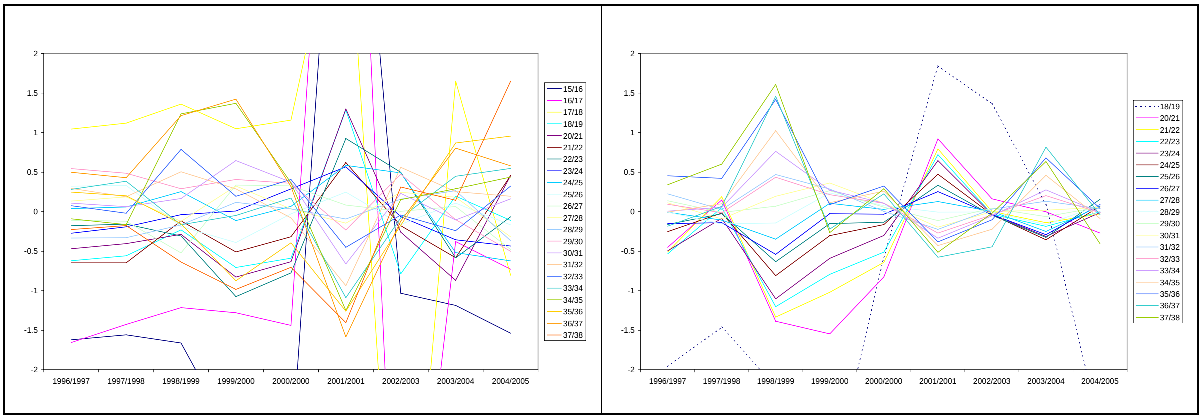


Figure 7.5.14. FRS survey, length Frequency distribution for *C. rupestris* caught at 1000-1099m and 1400 – 1599m between 55.5 and 58.5° N .



Method 1, landings at age	Method 2, landings at age

Figure 7.5.15. Roundnose grenadier residuals from the separable VPA based on methods 1 and 2 catch at age. Method 1 = WGDEEP 2004 approach ; Method 2 based on ALK from otoliths weights.

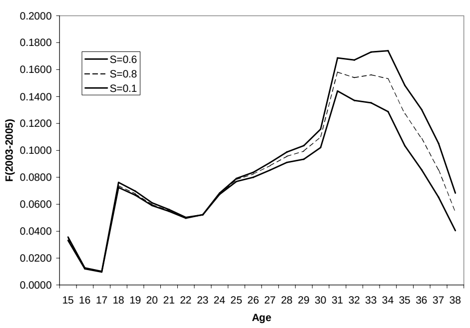
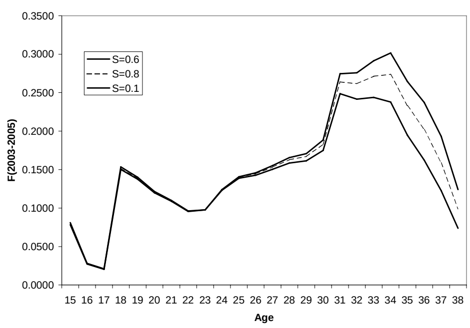
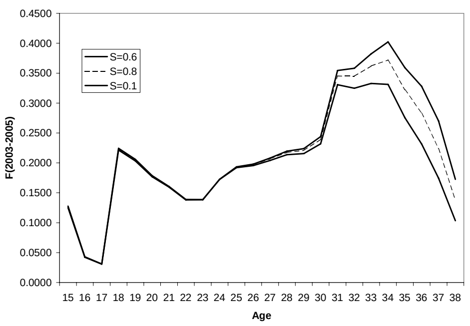
	
F=0.05	F=0.1
	
F=0.15	

Figure 7.5.16. Roundnose grenadier in V, VI and VII. Mean exploitation pattern derived from the separable VPA based on the method 1 catch at age, from different values of terminal F and S.

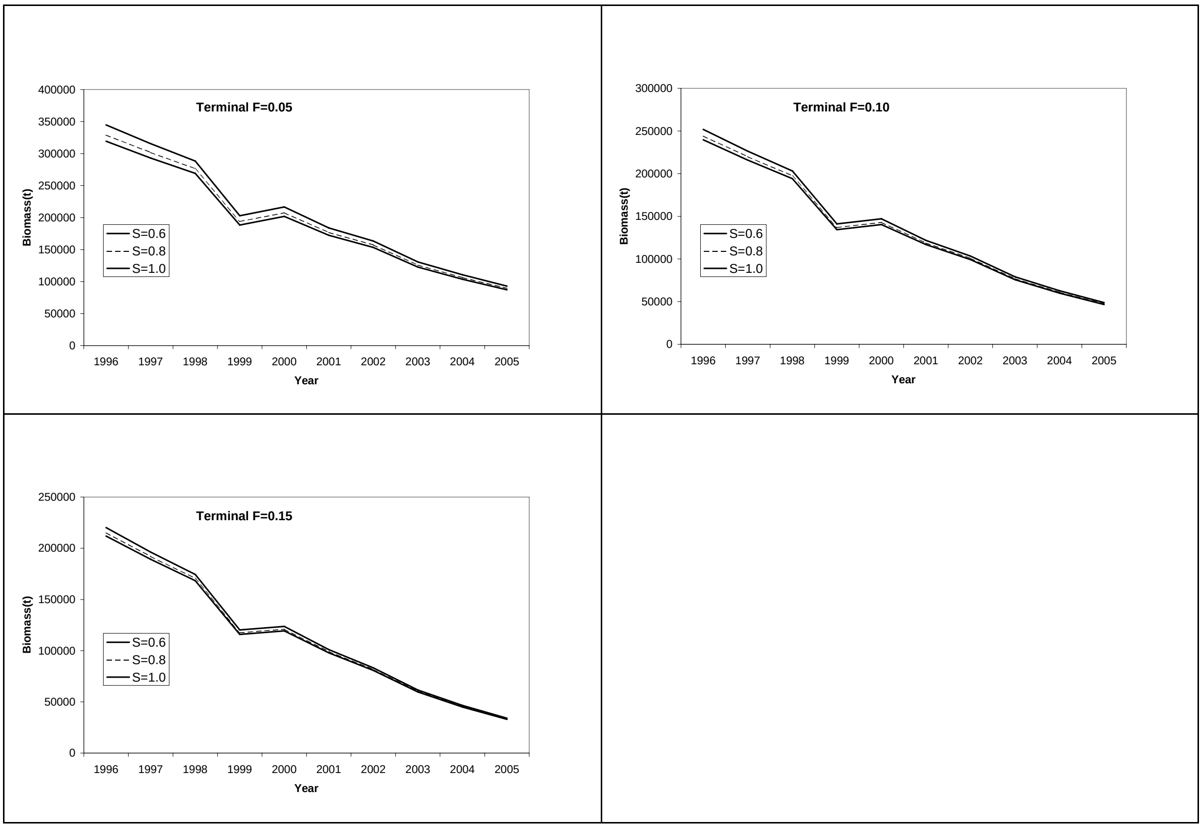


Figure 7.5.17. Estimates of stock biomass (age 15 and over, i.e. SSB) from the separable VPA on method 1 landings at ages, from different values of terminal F and S.

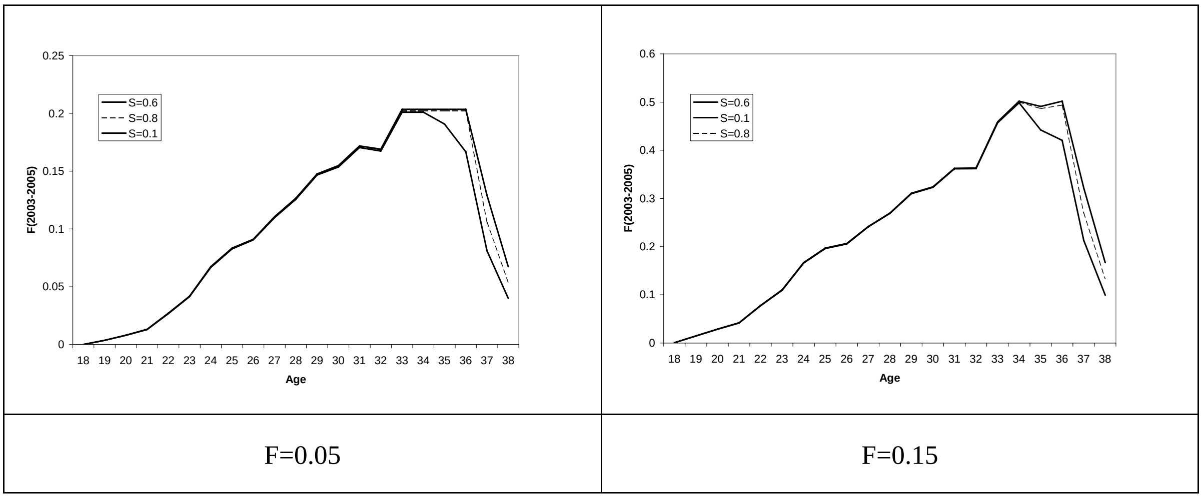


Figure 7.5.18. Roundnose grenadier in V, VI and VII. Mean exploitation pattern derived from the separable VPA based on the method 2 catch at age (one ALK applied to years 1996-2005), from different values of terminal F and S.

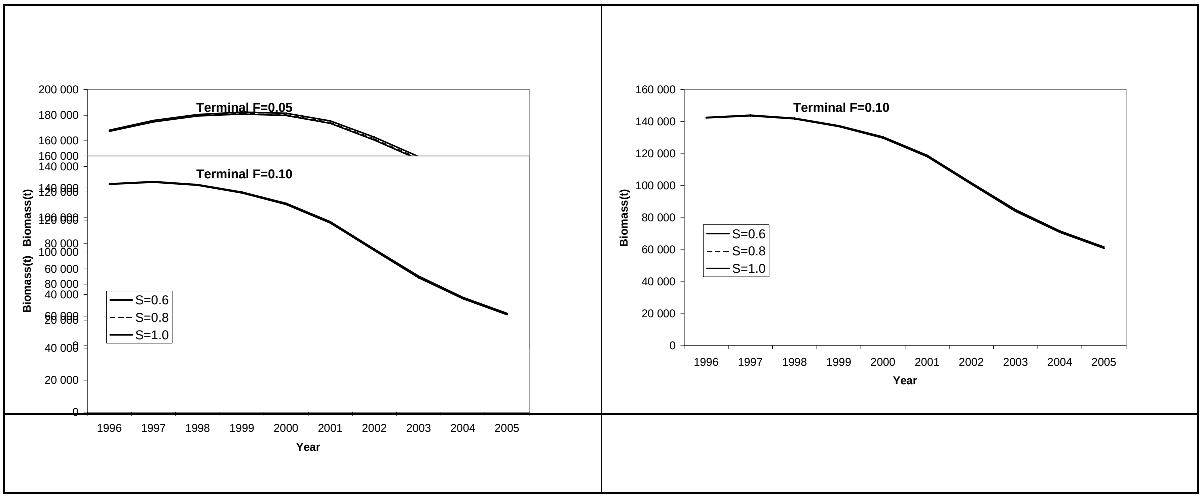


Figure 7.5.19. Roundnose grenadier in V, VI and VII. Biomass trends from the separable VPA (age 18 and over i.e. SSB), based on the method 2 catch at age (one ALK applied to years 1996-2005), from different values of terminal F and S.

7.6 Black Scabbardfish (*Aphanopus Carbo*) in Division Vb, Sub-Areas VI, VII & XII

7.6.1 The fishery

Faroese fisheries take mostly place inside the Faroese zone (Division Vb). In the late 1970s the Faroese trawl fishery extended into deeper waters targeting redfish (*Sebastes* spp.) and blue ling and to a lesser degree black scabbardfish and roundnose grenadier. The main deepwater fleet consist of 13 otter trawlers with engines larger than 2000 Hp (ICES, 2005). In the early 1990s one trawler fished continuously on Hatton Bank for 5-6 years. During the first quarter of the year the vessel was targeting blue ling, while in the second quarter black scabbardfish became the most important species and later in the year roundnose grenadier had increasing importance. The trawler has later changed to fishing on the shelf (ICES, 2002). England and Wales UK(E+W) fisheries did not greatly differ from the descriprion made in 1998 (ICES, 1998). The same happens with Scottish deep-water fishery (ICES, 2002). The majority of the demersal vessels involved in Scottish fisheries continue to exploit a variety of fishing opportunities including the traditional shelf fisheries in the North Sea and west of Scotland, on the Rockall Bank and along the shelf edge fishery for monkfish and megrim as well as in deep water fisheries in the Rockall Trough and the Faroe-Shetland Channel (ICES, 2002). The Irish deepwater fishery commenced in 2000 with 10 boats fishing on the west and north of the Porcupine Bank. In 2005 the number of boats exploiting deepwater species has been reduced (Egan et al., 2006). The largest fishery is the directed orange roughy trawl fishery, mainly based on the continental slopes of the Porcupine Bank in Divisions VIIc and VIIk, the “Peak” fishery. Because of the decline in orange roughy landings, black scabbardfish is becoming the main target species of the Irish deepwater fleet on the so-called “Flats” fishery (ICES, 2005). In 2003, Irish fisheries were subject to restrictive quotas under the terms of the new EU management regime for deepwater species and due to that, Irish vessels might have fished in international waters and Hatton Bank (ICES, 2004). French deep-water fisheries involve only bottom trawlers: Landings occur in three landing ports. In Boulogne-sur-Mer, the 14 high seas bottom trawlers involved in the fishery are large trawlers (50 to 55 meters long). In Lorient and Concarneau, the main part of the fleet is composed of medium high seas trawlers (30 vessels from 32 to 40 m long). The other part is composed with largest high seas trawlers, composed by 8 vessels (ICES, 2002). The commercial fishery is carried out by Spanish stern bottom freezer trawlers in international waters of the Hatton Bank area (ICES XII & VIb). The presence of the majority of the vessels in this fishing ground is discontinuous. Vessels conducted fishing trips of variable duration (1 week to 3 month aprox.). Fishing operations are conducted at depths mainly from 800 to 1600m. Roundnose grenadier and Bairdii smothhead are the most important species in the catches and black scabbardfish a very small by-catch species (Muñoz et al., 2005).

7.6.1.1 Landings trends

Landings from the subareas Vb, VI+VII and XII showed a markedly increasing trend from 1999 to 2002 followed by a decrease (Figure 7.6.1). In recent years, landings in those subareas are at levels similar to those registered from 1992 to 1996. In Subareas VI+VII, French landings represent more than 90% of the total landings. In the last four years Faroese landings in subarea Vb represent 80% of the total landings in this subaraea.

7.6.1.2 ICES advice

The advice statement be set in 2004 was: Given the perceived decrease in stock abundance in the northern areas, effort should be reduced significantly. 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.

7.6.1.3 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 adopted for 2005 and 2006 as well as the total landings in Subareas V, VI,VII and XII are next presented

	V, VI, VII & XII
Uptake in 2004	4 562
Uptake in 2005	3 599
TAC (2005 & 2006)	3 042

7.6.2 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. Information on the size composition in the NE Atlantic was presented by SGDEEP 2000 for the various fisheries exploiting this species, (ICES, 2000). Differences in length structure and optimal depth range of black scabbardfish landings between the northern and southern areas were evident (ICES, 2005). Those differences could be partially explained by the different size selectivity patterns of the fishing gears used; trawl and longline.

In northern areas bottom longline is more efficient in catching black scabbardfish than longlines. In 2005 Spain carried out several investigations at the Hatton Bank and adjacent waters several fishing gears in which both longline (Norwegian Automatic and manual) and bottom trawl were used black scabbardfish catches using bottom longline were insignificant while black scabbardfish catches attained 16 kg/h (Durán Muñoz 2006). The same was observed during previous Irish survey experiments in which the two fishing gears were used (Kelly et al., 1998).

In northern areas length frequency distributions of bottom trawl landings are similar ranging from 80-110 cm being in addition dominated by juveniles (ICES, 2005). Length information from Spanish and Scottish trawl is in agreement with this situation (Table 7.6.1 and Figure 7.6.2 and Figure 7.6.3).

In southern area longliners mainly operate at depths ranging from 800 to 1200 m. In this area the length structure of the exploited population have been stable.

Previous information on length frequency distributions by quarter of specimens caught by bottom trawl in the Rockall Trough and by longline off mainland Portugal and at Madeira (ICES, 2001) suggested the entrance of smaller specimens in Rockall Trough during the last quarter of the year (Figure 7.6.4).

It is thus 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.

A genetic study has been initiated by Azores new results on stock differentiation are expected in the near future.

7.6.3 Data available

Landings were available for all relevant fleets. New revised French CPUE data are available. Length information from Spanish and Scotish trawler and from French landings. Length information from Scottish trawl surveys held in 1998, 2002, 2004 and 2005 at depths ranging from 500 to 1500 m in Subarea VI. Irish discarding data are available.

7.6.3.1 Landings and discards

In 2004 two trips on the Irish deepwater fleet were undertaken and covered both the “peak” fishery targeting orange roughy and the “flats” fishery targeting black scabbardfish. Both trips were in ICES areas VIIk and VIIc. Results from the first trip carried out in June 2004 show that the species with the highest discard rate is roundnose greandier followed by bairds smoothead. There were little or no discards of the main target species orange roughy and black scabbard (Egan et al., 2006 WD).

7.6.3.2 Length compositions

Length frequency distributions by depth strata of black scabbardfish caught by French commercial bottom trawlers in 2004 and 2005 is presented in Figure 7.6.5.

Length frequency distributions of black scabbardfish caught by Spanish commercial bottom trawlers at Hatton Bank (ICES Subareas VIa and XII) in 2000, 2003, 2004 and 2005 are shown in Figure 24.12. Length frequency distribution of black scabbardfish extrapolated to international landings from ICES Subareas VI and VII, based on data from Irish observer scheme in 2003 is presented in Figure 7.6.6 (ICES, 2004).

During 2005 Russian exploratory research and fishing surveys several specimens of black scabbardfish were caught (Vinnichenko and Bokhanov, 2006.). In September, on the Bill Baileys Bank (Faeroes Fishing Zone Division Vb) at the depths of 780-1120 m, the length of specimens caught by bottom trawl varied between 79 and 113 cm (mean length 95.6 cm). Males prevailed in number. One specimen with 39 cm in length was caught in March at a depth about 500 m by pelagic trawl at the Rockall Bank (Subarea VIb). Postspawning specimens with lengths ranging from 86 to 115 cm were caught at depths between 1010 and 1280 m in the southern part of Hatton Bank (Division XIIb). In April, 2 individuals of 39 and 41 cm in length were taken by pelagic trawl at a depth about 500 m in West Scotland (Division VIa).

7.6.3.3 Age compositions

There is still some controversy on ageing black scabbardfish and due to that there are no reliable age determinations.

7.6.3.4 Weight at age

No reliable age determinations are available yet.

7.6.3.5 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. Earlier Russian data from the Hatton Bank reported spawning fish from November to April (Zilanov and Shepel, 1975). At the Rockall Trough there is a weak indication that juveniles enter this region during the last quarter of the year (ICES, 2001).

7.6.3.6 Catch, effort and research vessel data

Information on the French CPUE series (Figure 7.6.7) was available from log-books database from 1989 to 2005, all fishing sequences (i.e. a row in a log-book) with one of the ‘deep water species ' as listed in the EC regulation 2347/2002 (with the exception of Phycis) are considered as deep water fishing activity (Biseau, 2006 WD11).

Faroes data, stored in a database on the Faroese Fisheries Laboratory, was derived from all available logbooks from 8 otterboard trawlers (HP>2000), 8 pair trawlers (HP>1000) and 5 long liners (GRT>100) are. The effort is estimated as number of fishing (trawling) hours from the trawlers, 1000 hooks from the long liners and the catch as kg reported to the Fisheries authorities. The CPUE series for black scabbardfish from the otterboard trawlers (Figure 7.6.8) are selected where the trawling depth > 350 m and the area are west of the Faroe Islands (Ofstad, 2006 WD2).

7.6.4 Data analyses

Most of the French landings were derived from ICES Subarea VIa (above 80 % of the total French landings in subareas Vb, VI+VII and XII). In Subarea VIa landings flutuated along years; maxima occurred in the middle 90´s and in 2002. From 2002 ownwards there was a slight decrease on landings (Figure 7.6.9). In subarea VII landings follow the same pattern of subarea VI but the decrease in the last years is more evident (Figure 7.6.9).

Length frequency distributions by depth strata of black scabbardfish caught by French commercial bottom trawlers in 2004 and 2005 suggest the existence of differences with depth (Figure 7.6.5) larger specimens tend to occur at deeper grounds. Additionally in each depth stratum length frequency distributions do not differ between quarters neither between the two years (Figure 7.6.5).

Fishery independent information from Scottish trawl surveys held in 1998, 2002, 2004 and 2005 at depths ranging from 500 to 1500 m in Subarea VI showed that black scabbardfish was more frequent at depths ranging from 700 to 1000 m (Table 7.6.1), with a slight increase on mean length with depth. Length information available indicates that there are no differences on the length frequency distributions between years in the same depth stratum (Figure 7.6.3). The length structure in this Subarea VI did not change from early to more recent years.

Length frequency distributions of black scabbardfish caught by Spanish commercial bottom trawlers at Hatton Bank (ICES Subareas VIa and XII) in 2000, 2003, 2004 and 2005 (Figure 7.6.2) as well as those from ICES Subareas VI and VII available from Irish observer scheme in 2003 (Figure 7.6.6), both indicate that the major fraction of the individuals lie in a length range between 70 and 100 cm.

The two sources of information on abundance trends were avialble for Faroes and France. The upward trend in Faroese series (Figure 7.6.8) probably reflects the fact that the fishery is taking place at deeper fishing grounds (ICES, 2005).

General considerations about the French CPUE series on deep-sea fishes are presented in section 3.1. However some specificy considerations are made here for black scabbardfish. It is important to stress the seasonal pattern of CPUE along months of the year. The highest values of CPUE were consistently registered at the end of the fourth quarter and at the beginning of the first, possibly reflecting changes on target species by the French fishing fleets along the year or on the availability of the species (Figure 7.6.10). The landings trends observed old exploited areas of Subareas VI and VII may reflect both aspects. In these areas black scabbardfish landings have increased substancially in the last years (Figure 7.6.11).

7.6.5 Comments on the assessment

Trends on French CPUE were difficult to interpret and understand. Due to mixed character of the fisheries taking black scabbardfish improvements on CPUE estimate are strongly recommended disaggregated, as much as possible, both spatially and temporally.

The relative stability on length frequency distribution both in the commercial and survey surveys may indicate the length range in subareas Vb, VI and VII is composed by immature specimens that lie within a small length range. Fisheries operating in this subarea have been continuously acting over the part of the population composed by young specimens that have never mature. Collection of length information should be carried in a routine basis.

7.6.6 Management considerations

The TAC adopted for 2005 and 2006 in Subareas V, VI, VII and XII might have been an incentive for misreporting of landings. The state of stock remains uncertain. However in order to account to the mixed nature of the fisheries any measure taken to manage this species should take into account the advice given for other species, e.g. roundnose grenadier, caught by the same fishery. Therefore for Subareas Vi, VI, VII and XII a reduction in exploitation of 50% of 2000-2002 level is required.

Table 7.6.0. Black scabbardfish in Vb, VI, VII & XII. WG estimates of landings.

Black scabbardfish in Division Vb

Year	Faroes	France	Germany	Scotland	E&W&NI	**Total**
1988	-		-	-	-	
1989	-	170	-	-	-	**170**
1990	12	415	-	-	-	**427**
1991	1	134	-	-	-	**135**
1992	4	101	-	-	-	**105**
1993	202	75	9	-	-	**286**
1994	114	44,926	1	-	-	**160**
1995	249	175,282	-	-	-	**424**
1996	57	128,785	-	-	-	**186**
1997	18	50,406	-	-	-	**68**
1998	36	144	-	-	-	**180**
1999	31	134,8706	-	6	-	**172**
2000	116	186,2114	0	9	-	**311**
2001	404	446,6778	0	20	0	**871**
2002	1360	311,4679		80		**1751**
2003	1451	171,4904		11		**1633**
2004	699	93		70		**862**
2005	393	98		11		**502**

Preliminary.

Black scabbardfish in Sub-area VIa

Year	France VIa	France VIb	Lituania	**Total**
1988				
1989	138	0		**138**
1990	971	53		**1023**
1991	2244	62		**2307**
1992	2998	113		**3110**
1993	2857	87		**2944**
1994	2331	55		**2386**
1995	2598	15		**2613**
1996	2980	1		**2981**
1997	2278	16		**2295**
1998	1094	3		**1098**
1999	1610	8		**1618**
2000	2695	25		**2720**
2001	3269	28		**3298**
2002	3473	131		**3604**
2003	2830	60		**2890**
2004	2595	98		**2694**
2005	2441	57	12	**2510**

Black scabbardfish in Subaraea VII

Year	France VIIA	VIIB	VIIC	VIIE	VIIF	VIIG	VIIH	VIIJ	VIIK	**Total**
1988										
1989	0	0	0	0	0	0	0	0	0	**0**
1990	0	2	8	0	0	0	0	0	0	**10**
1991	0	14	17	1	0	4	2	7	49	**94**
1992	0	9	69	0	0	3	8	49	183	**322**
1993	0	24	149	1	0	4	10	170	109	**468**
1994	0	32	165	0	0	4	4	120	336	**662**
1995	0	52	121	0	0	3	5	74	385	**641**
1996	0	104	130	0	1	0	2	60	360	**658**
1997	0	24	200	0	0	0	1	33	202	**461**
1998	0	15	60	0	1	0	5	45	79	**205**
1999	0	7	97	0	0	0	2	70	177	**354**
2000	0	25	169	0	0	0	3	88	238	**524**
2001	0	39	227	0	0	0	5	161	249	**682**
2002	0	29	102	0	0	1	4	115	51	**303**
2003	0	15	28	1	0	0	3	157	36	**240**
2004	0	31	28	8	0	0	8	124	63	**262**
2005	3	6	11	1	0	0	16	99	21	**157**

Table 7.6.0 (continued).

Black scabbardfish in Sub-areas VI and VII

Year	Faroes	Germany	Ireland	Spain	Scotland	E&W&NI	**Total**
1988							
1989	46						**46**
1990							**0**
1991							**0**
1992	3						**3**
1993	62	48	8				**118**
1994		46	3		2		**51**
1995		3			18		**21**
1996		2			36	1	**39**
1997	3		0	1	235	2	**241**
1998			0	3	148	1	**152**
1999			1	0	191	1	**193**
2000		0	59	1	377	40	**477**
2001	3	0	68	150	673	37	**931**
2002	2		1050	0	1320	43	**2415**
2003	45		159	0	119	5	**328**
2004	59		293	17	123	2	**494**
2005	36		79	0	80	0	**195**

* Preliminary.

Black scabbardfish in Sub-area XII

Year	Faroes	France	Germany	Spain	Scotland	Ireland	E&W&NI	Lituania	**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	-				**447**
1997	102	1	-	98	-				**201**
1998	20	0	-	134	-				**154**
1999	-	3	-	109	0				**112**
2000	1	6	0	237	-				**244**
2001		3	0	115	-				**118**
2002		0	0	1059	1		0		**1060**
2003		7		403		1			**412**
2004	95	10		165	1				**271**
2005*	127	14		0	0	0		1	**142**

* Preliminary [(1)] Includes VIb.

* Preliminary.

Black Scabbardfish (*Aphanopus carbo*) All ICES areas

	Vb	VI+VII	XII	**Total**
1988	0	0	0	**0**
1989	170	184	0	**354**
1990	427	1034	0	**1460**
1991	135	2401	2	**2537**
1992	105	3436	7	**3548**
1993	286	3530	1168	**4984**
1994	160	3099	833	**4092**
1995	424	3275	309	**4008**
1996	186	3678	447	**4310**
1997	68	2996	201	**3265**
1998	180	1455	154	**1789**
1999	172	2166	112	**2449**
2000	311	3721	244	**4276**
2001	871	4910	118	**5899**
2002	1751	6322	1060	**9134**
2003	1633	3458	412	**5504**
2004	862	3450	271	**4582**
2005*	502	2862	142	**3506**

Table 7.6.1 – Scottish surveys length range, numbers of black scabbardfish by depth stratum and year.

ICES_REC	Year	Depth range	n	Length range
39D9	2002	600 - 700 m	385	81 - 109
39D9	2000	900 - 1000 m	134	71 - 112
39D9	2002	1000 - 1100 m	184	72 -118
39D9	2000	1300 - 1400 m	24	78 - 113
39D9	2002	1500 - 1600 m	35	81 - 107
40E0	2000	700-800 m	36	67 - 104
40E0	2002	700-800 m	17	79 - 102
40E0	2000	900 - 1000 m	78	70 - 103
40E0	2002	1000- 1100 m	138	67 - 105
41E0	1998	700 -800 m	7	75 - 86
41E0	2000	800 - 900 m	24	62 - 111
41E0	1998	900- 1000 m	73	64 - 100
41E0	2002	1000 - 1100 m	154	70 - 104
41E0	2000	1000 - 1100 m	52	74 -111
41E0	2000	1400 - 1500 m	9	89 - 112
41E0	2002	1500 - 1600 m	3	105
42E0	2000	500 - 600 m	15	72 - 92
42E0	1998	600 - 700 m	112	66 - 111
42E0	1998	700 - 800 m	1190	75 - 115
42E0	2000	700 - 800 m	348	73 - 107
42E0	2002	700 - 800 m	266	67 - 106
42E0	1998	800 - 900 m	187	71 - 117
42E0	2004	1000 - 1100 m	176	67 - 106
42E0	2000	1000 - 1100 m	355	71 - 111
42E0	2002	1000 - 1100 m	87	74 - 113
42E0	2000	1200 - 1300 m	55	76 - 115
42E0	2002	1200 - 1300 m	43	84 - 114
42E0	2002	1500 - 1600 m	2	99 - 101
43E0	1998	600 - 700 m	164	78 - 106
43E0	1998	700 - 800 m	3	78 - 100
43E0	1998	800 - 900 m	176	72 - 111
43E0	2000	900 - 1000 m	350	71 - 105
43E0	2004	1000 - 1100 m	84	65 - 101
43E0	2000	1500 - 1600 m	3	83 - 99
43E0	2004	1500 - 1600 m	1	98
44E0	1998	600 - 700 m	1	76
44E0	1998	800 - 900 m	27	69 - 114
44E0	2004	900 - 1000 m	67	55 - 111
44E0	2000	900 - 1000 m	150	71 - 102
44E0	2002	1000-1100m	388	71 - 102
44E0	2002	1500 - 1600m	1	100
44E0	2004	1500 - 1600m	2	89 - 90
45E0	2002	1000 -1100 m	103	70 - 103
45E0	2000	1000 -1100 m	95	66 - 100
45E0	1998	1100 - 1200 m	9	84 - 112
45E0	2000	1500 - 1600 m	4	84 - 90
46E1	2002	1000 -1100 m	112	70 - 107
46E1	2000	1000 -1100 m	122	70 - 112
46E2	2002	500 - 600 m	8	79 - 98
46E2	2000	1000 -1100 m	145	68 - 112
47E2	2000	1000 - 1100	75	72 -109

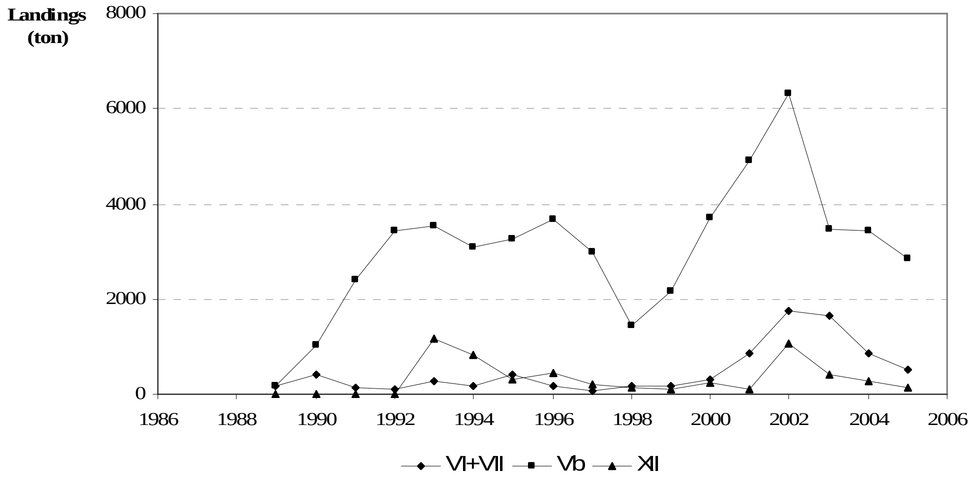


Figure 7.6.1 – Annual total landings (tons) in subareas Vb, VI+VII and XII from 1988 to 2005

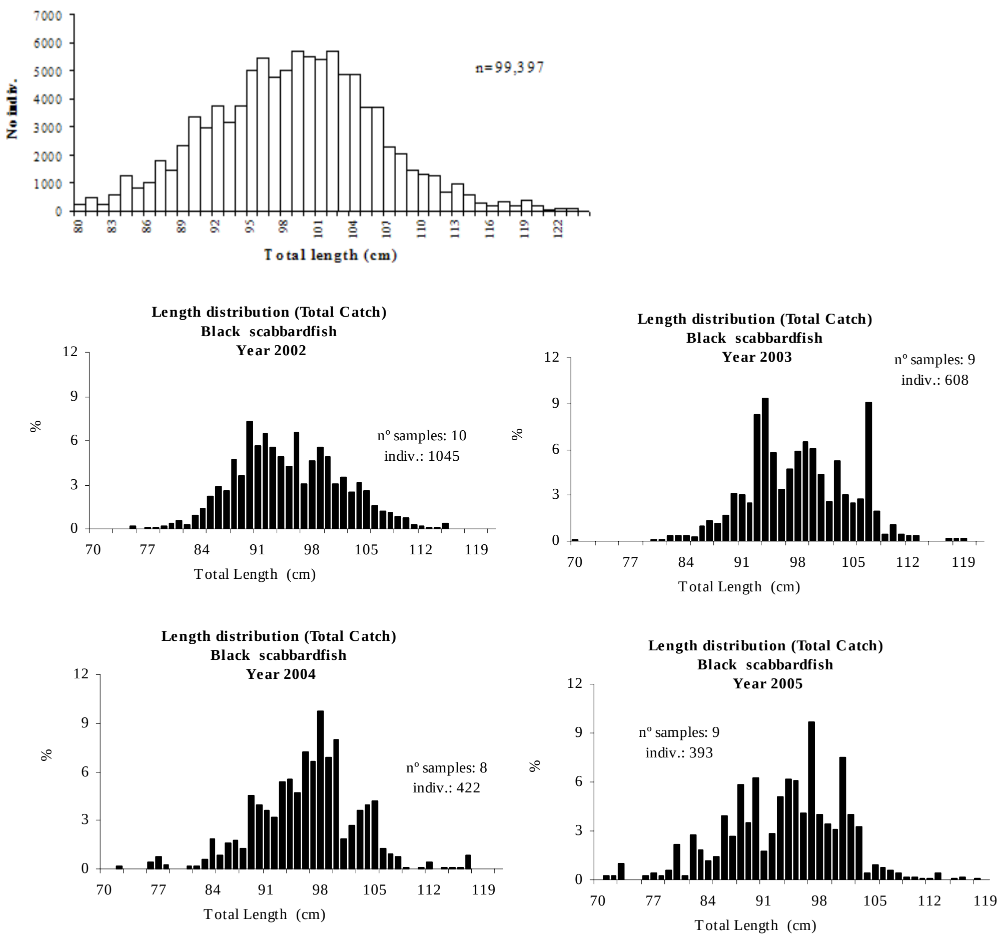


Figure 7.6.2 – Length frequency distribution based on samples taken from Spanish commercial bottom trawlers at Hatton Bank (ICES Subareas VIa and XII) in 2000 (SGDEEP, 2000), 2002, 2003, 2004 and 2005.

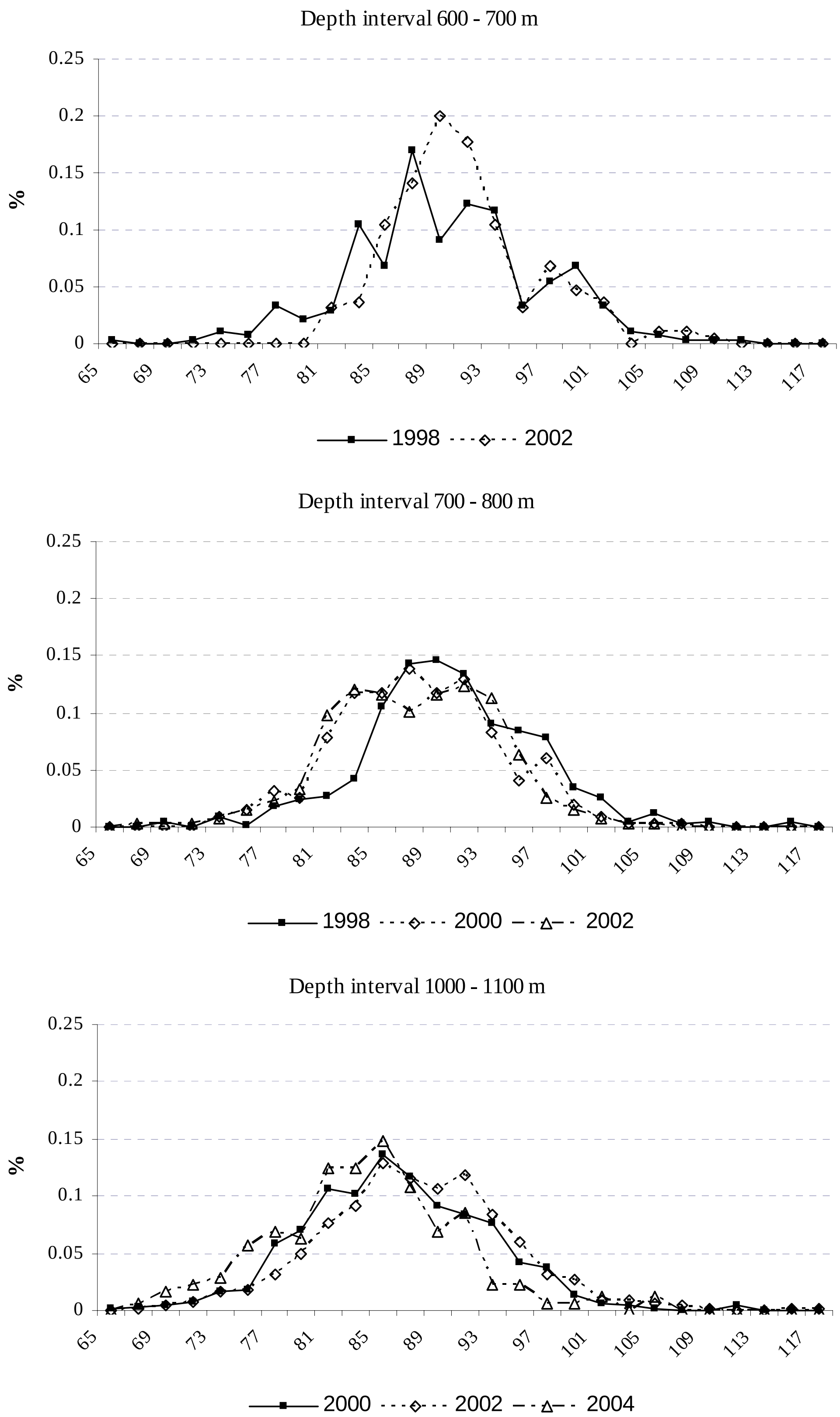


Figure 7.6.3 – Length frequency distribution of black scabbardfish from Scottish survey in different years by 100 m depth stratum.

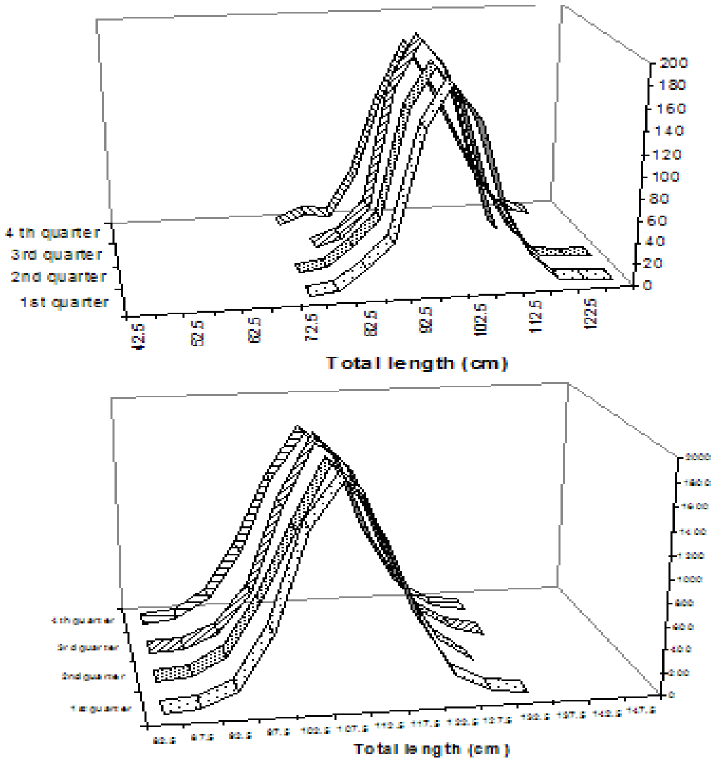


Figure 7.6.4 - Quarterly length frequency distributions of specimens caught by bottom trawl in the Rockall Trough (upper) and by longliners at Portugal mainland (lower).

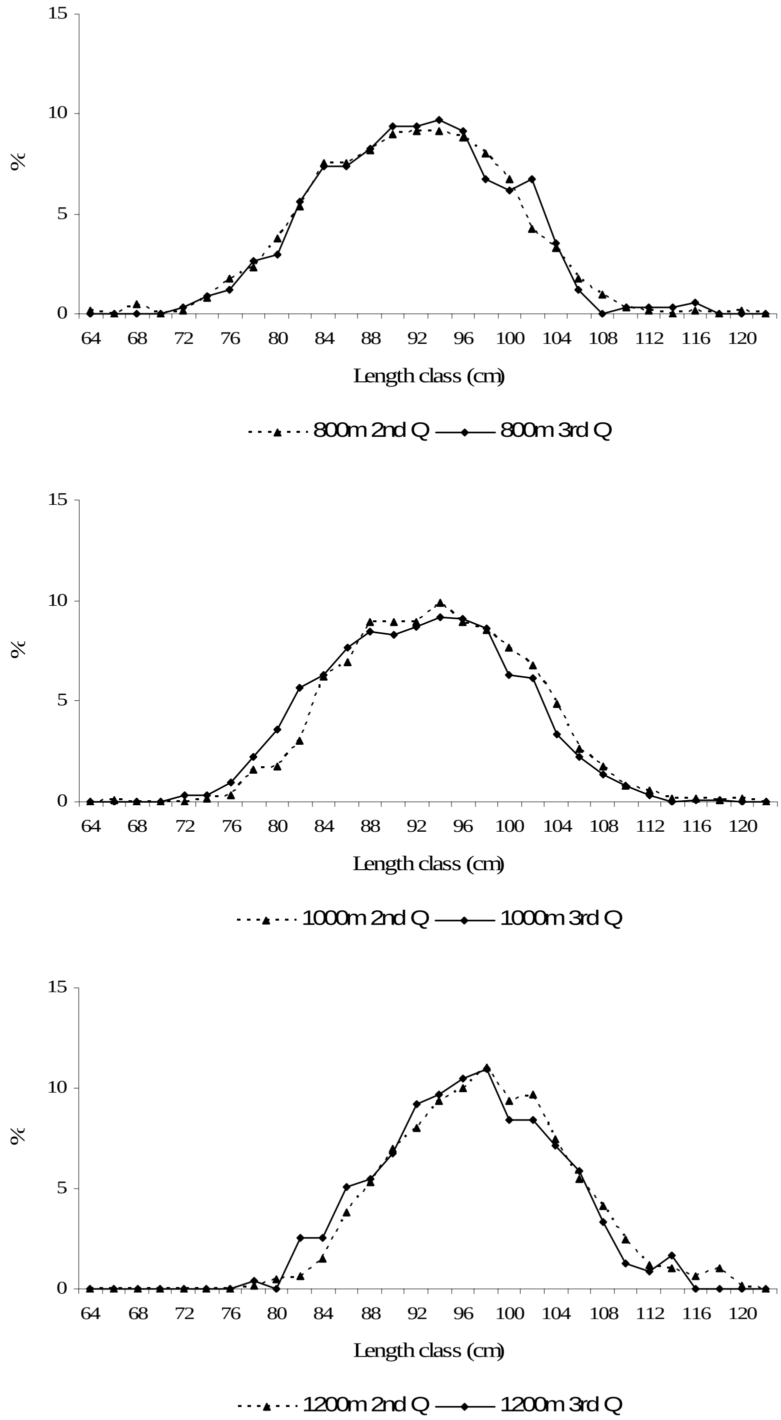


Figure 7.6.5 – Length frequency distributions black scabbardfish by depth strata and quarter of the year based on samples taken from French trawlers (2004 and 2005)

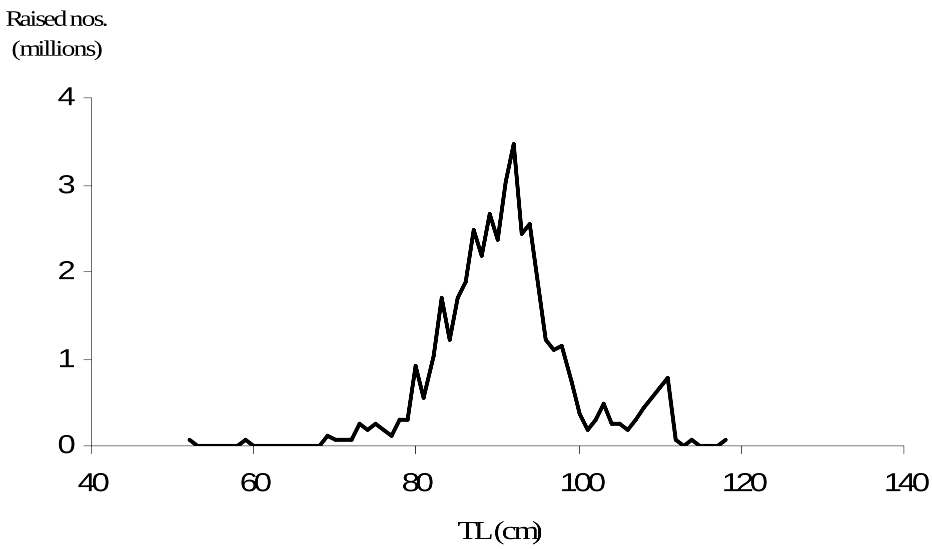


Figure 7.6.6 – Length frequency distribution of internacional landings in V, VI, VII and XII data from Irish observer scheme 2003

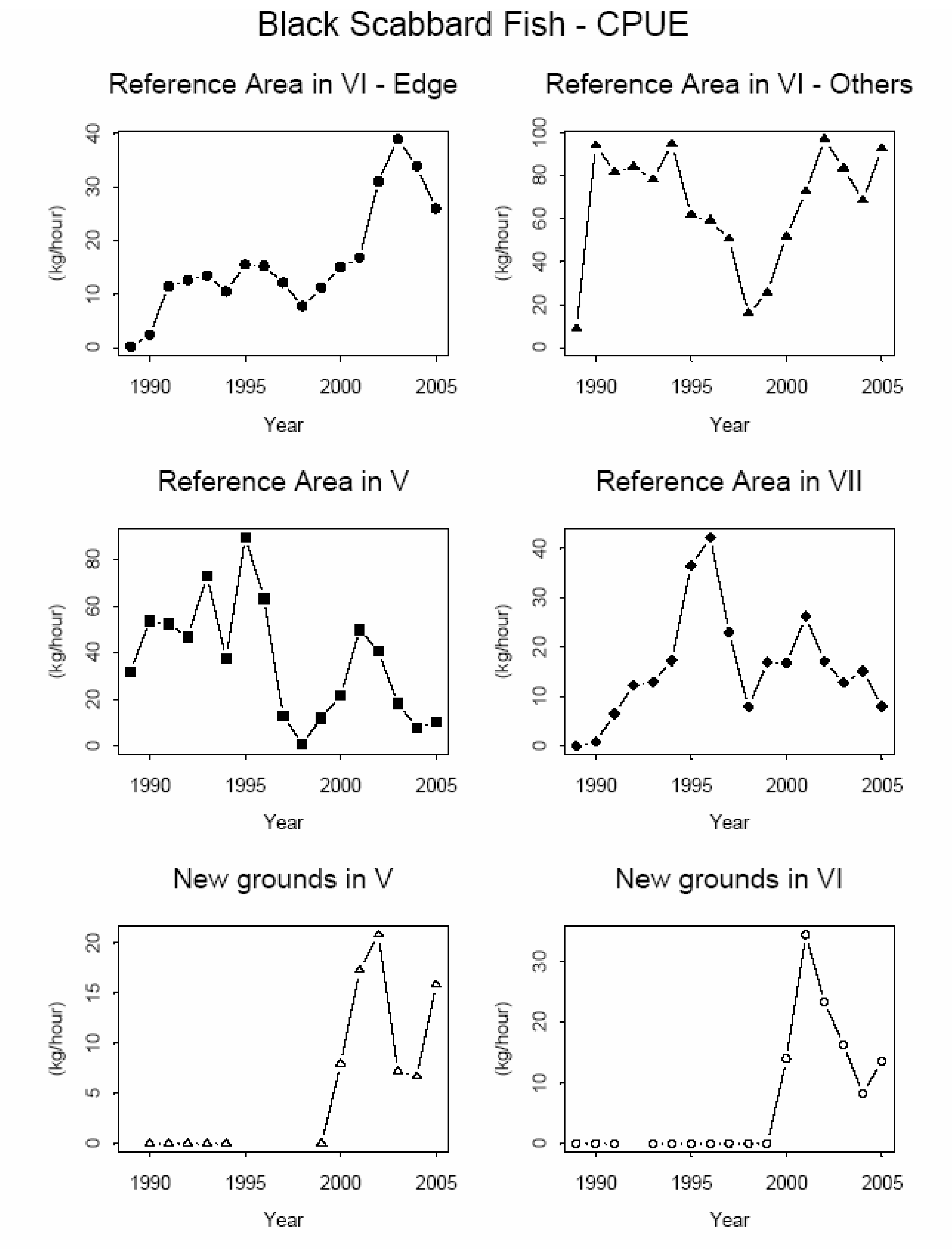


Figure 7.6.7 – Black scabbardfish CPUE estimates from French Trawlers (Biseau, WD11) .

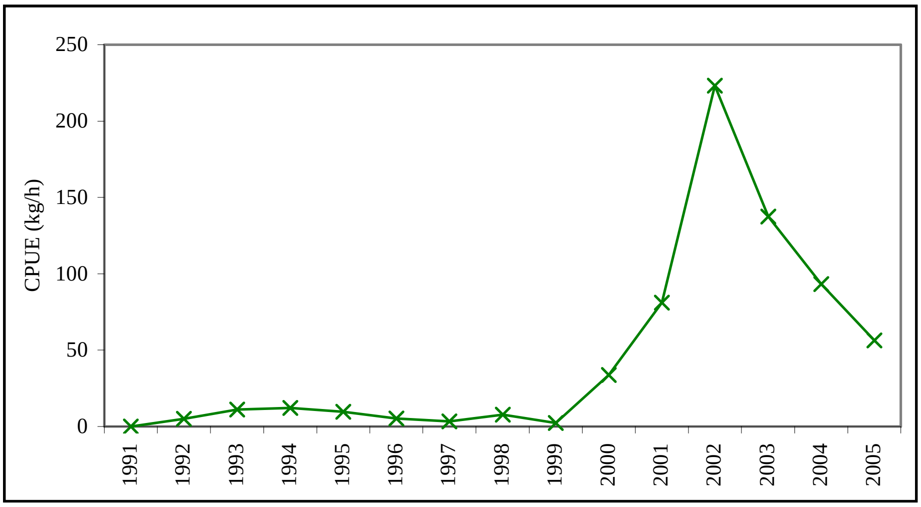


Figure 7.6.8 – Black scabbardfish CPUE in Vb from Faroese commercial otter trawlers >1000 HP.

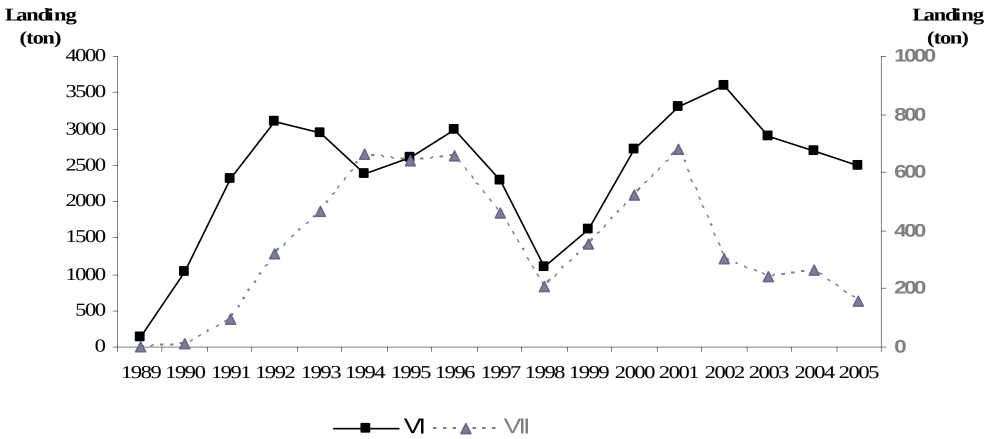


Figure 7.6.9 –French annual landings in ICES subareas VI and VII from 1988 to 2005

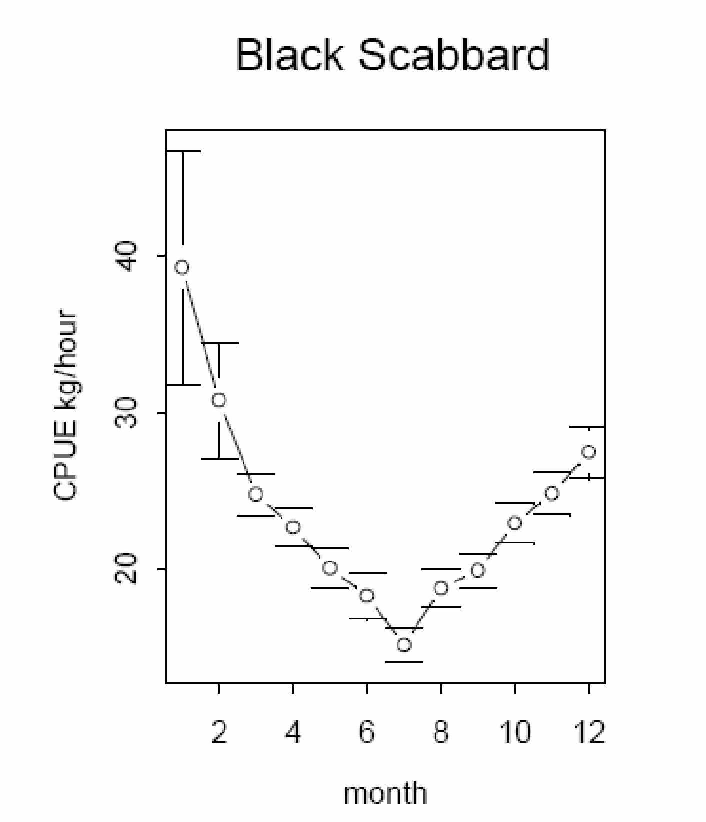
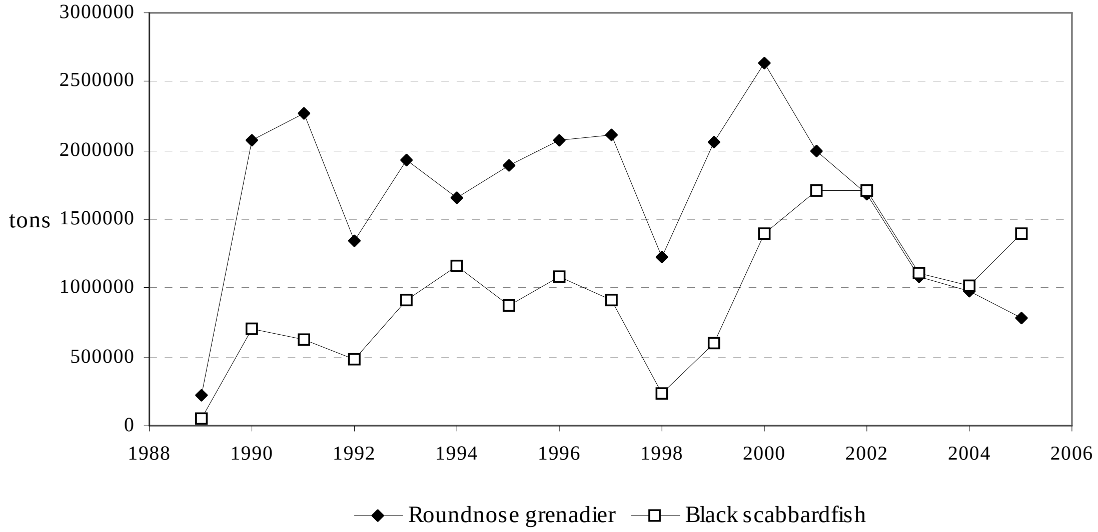


Figure 7.6.10 – Mean CPUE by month for the French deep water trawlers (Biseau, 2006 WD2)



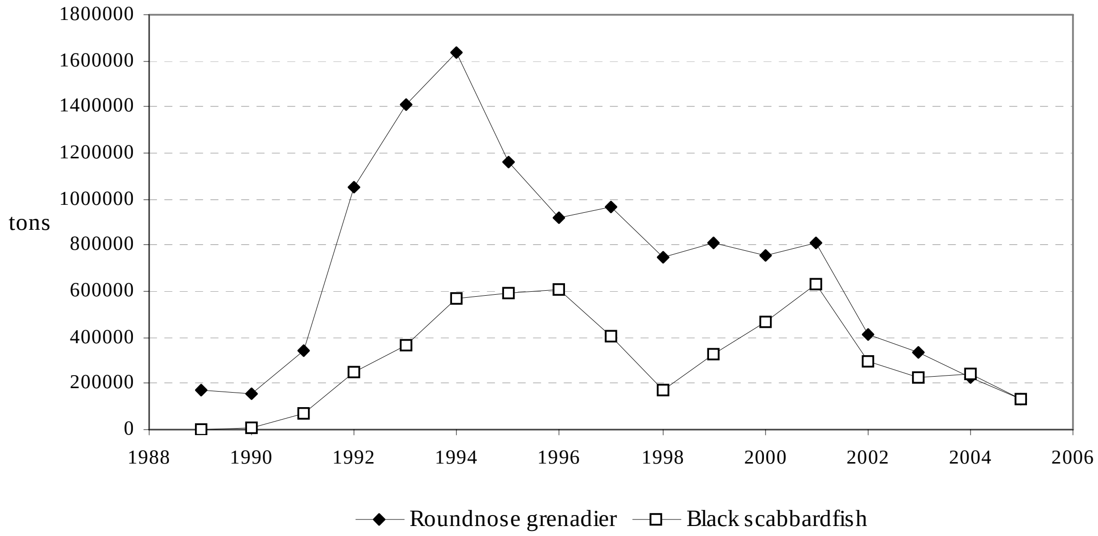


Figure 7.6.11 – Annual French landings of black scabbardfish and roundnose grenadier grenadier in the old exploited areas of Subareas VI (upper) and VII (lower).

8 Stocks and fisheries of the North Sea

8.1 Fisheries overview

8.1.1 Trends in fisheries

A landings overview is shown in Figure 8.1.1. At present, the main fisheries currently targeting deep sea species in the IIIa and IV are the following:

- There is a small U.K trawl fishery for Greenland Halibut in the northern part of the IV west of Shetland Isl. 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 Deepin 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 (2006)
- A Danish directed trawl fishery for roundnose grenadier in the deeper parts of Skagerrak carried out by very few vessels.

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 begun 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 2005 the economic value of the landings was slightly above 1 million €.

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. In the recent 3 years a total of 3 vessels have participated significantly in the fishery, see Sect. 8.2.

8.1.2 Technical interactions

Table 8.1.1 gives an overview of the landings by gear for this area.

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.

8.1.3 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*.

8.1.4 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. 8.2.

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.

Table 8.1.1. Technical interactions in Division IIIa and Sub-Area IV.

year	2005

Sum of Kg		species											
main gear	ICES area	ALF	ARG	ARU	BLI	BSF	FOR	LIN	ORY	RNG	SBR	USK	ZZZ
bottom trav	IIIa		454200	65	50419			54742		12959243		3985	445454
	IVa			2661	21840	12	346	2186236		1634		263274	188
	IVb				123			254394				2020	40
	IVc						13	38475			8		
comb_all	IVa							19					
	IVb							92					
	IVc							590					
gill nets	IIIa				171							6205	
	IVa	812			56848		9798	259764		156		83530	567
	IVb							56731				231	
	IVc							2315			5		
lines	IIIa				274			11850				20016	
	IVa				10106		82019	3291535		106		1438308	49589
	IVb							8685				3879	
pel trawls	IVa							130568				9220	88
	IVb							80723				11965	750
	IVc							16			30		
seines	IVa							23919				696	
	IVb							112					

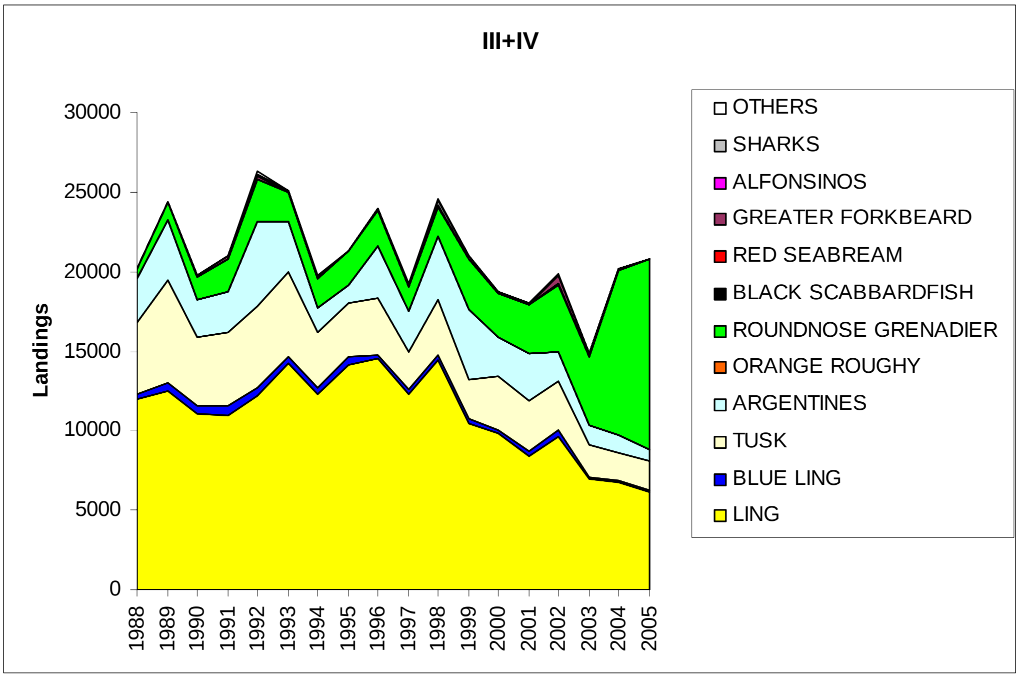


Figure 8.1.1. Overview of deep-sea species landings over 1988-2005 (tonnes).

8.2 Roundnose Grenadier (*Coryphaenoides Rupestris*) in Division IIIa

8.2.1 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, see Sect. 4.3.1. Up to 2003 landings fluctuated between 1000 and 3000 t. The recent geographical distribution of the fishery is shown in Fig. 8.2.1 and Tables 8.2.2 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

8.2.1.1 Landings trends

WG figures for total landings, 1988-2005, by all countries are shown in Table 8.2.0 It is seen that only Denmark has contributed significantly to this fishery. Table 8.2.1 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 – 2005 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 8.2.1 and Fig. 8.2.2). 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 10000 t in 2005. In the recent 3 years a total of 3 vessels have participated significantly in the fishery.

8.2.1.2 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 sub-areas 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, presumably 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.

8.2.1.3 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 and 2005, 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.

8.2.2 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.

8.2.3 Data available.

8.2.3.1 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 and 2005. These samples have been obtained in two ways:

- Samples from landed catch of round nose 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 and 2005 is shown in the text table below.

SAMPLING TYPE	YEAR		GRAND TOTAL
	2004	2005	
Sampling in harbour	46	29	94
Sampling at sea	1	2	3
Total	47	31	97

Figs. 8.2.3 A-C show the size distribution of roundnose grenadier in 1987, 2004 and 2005. 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 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 and 2005.

8.2.3.2 Effort and CPUE.

Tables 8.2.2 A-C and Fig. 8.2.2 show the overall trends in logbook recorded catch, effort and CPUE for the directed fishery on this stock. The catch figures shown here differ slightly from the final (adjusted) landings figures (Table 8.2.1) due to the species allocation procedures in the recording the industrial landings.

8.2.4 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. However, in the period 2003, 2004 and 2005 a drastic increase is observed for all compared to the previous level. 2005 saw a decline in recorded effort, while CPUE increased further. The overall (average) CPUE figures could, however, 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. However, the logbook recorded catch and CPUE further partitioned into single ICES rectangles give the same overall picture for the recent years (Tables 8.2.2 A-C): It seems that the CPUEs from all rectangles increase from 2004 to 2005. As said in Sect. 8.2.1.1 the number of vessels participating in this fishery increased from 1 to 3 in 2003-2005, but examining the CPUE for single vessels gives the same picture: Increasing CPUE by vessel by square in 2003 – 2005.

- 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.

CPUE figures are also available for 2006 (January-March). The 2006 january CPUEs are lower than the corresponding ones for 2005. However, this might be due also to monthly variations in other factors, for instance weather conditions, other opportunities a.o. 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 and 2005, 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 the difference of the 2004 and 2005 size distribution suggests that recruitment to the fishery was larger in 2004 than in 2005.
- The trends in the Danish CPUEs based on logbook records (Table 8.2.2 C) does not indicate any signs of decline in stock abundance. However, since 2 new vessels entered the fishery in 2004 and 2005.

Thus, even if more biological and fisheries data for this stock were available to WGDEEP in 2006 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 continuing 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.

8.2.5 Management considerations

Until further information to clarify the status of this stock is available, a precautionary management strategy is required, and ICES has previously recommended (for the stocks of roundnose grenadier in IIIa, Vb, VI & VII) a 50% reduction of effort compared with the 2000-2002 level. However, contrary to this ACFM recommendation the effort in IIIa seems to have increased drastically in the last 2 years.

Management consultations in 2005 between the EC and Norway have called for restrictions of fisheries that would facilitate reduction in fishing opportunities to a sustainable level. The Group was unable to quantify what would be a sustainable catch level. However, the historical records from 1987 to 2002 did not suggest any negative development of abundance under the exploitation level at that time, and a level of total international catch as in that period may thus be regarded as sustainable.

Table 8.2.0. 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**

* Preliminary data

Table 8.2.1. Danish landings, 1996-2005 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**

Table 8.2.2 A-C. The Danish fishery for roundnose grenadier in IIIa. Trends in catch, effort and CPUE by major ICES rectangle, see text.

	Total catch (t) by ICES rectangle					
year	44F8	44F9	45F8	45F9	46F9	Total
1996	80	0	25	691	98	894
1997	28	0	115	1093	163	1398
1998	238	235	180	1483	1117	3253
1999	0	25	64	714	1340	2143
2000	0	0	40	843	854	1737
2001	105	8	65	862	955	1995
2002	165	79	0	928	1531	2702
2003	0	120	545	1223	1769	3657
2004	1104	5847	215	1704	1721	10591
2005	518	4073	682	4754	2808	12834

	Total reported effort (days) by ICES rectangle					
year	44F8	44F9	45F8	45F9	46F9	Total
1996	12		3	96	14	125
1997	7		12	135	9	163
1998	13	16	13	110	63	215
1999		4	15	94	143	256
2000			10	94	85	189
2001	8	4	4	88	114	218
2002	23	15		78	135	251
2003		17	45	145	198	405
2004	142	550	24	150	147	1013
2005	67	243	20	206	140	676

	Total reported CPUE (tons/day) by ICES rectangle					
year	44F8	44F9	45F8	45F9	46F9	Average
1996	6.7		8.3	7.2	7.0	7.1
1997	3.9		9.6	8.1	18.1	8.6
1998	18.3	14.7	13.8	13.5	17.7	15.1
1999		6.3	4.2	7.6	9.4	8.4
2000			4.0	9.0	10.0	9.2
2001	13.1	1.9	16.3	9.8	8.4	9.1
2002	7.2	5.3		11.9	11.3	10.8
2003		7.1	12.1	8.4	8.9	9.0
2004	7.8	10.6	9.0	11.4	11.7	10.5
2005	7.7	16.8	34.1	23.1	20.1	19.0

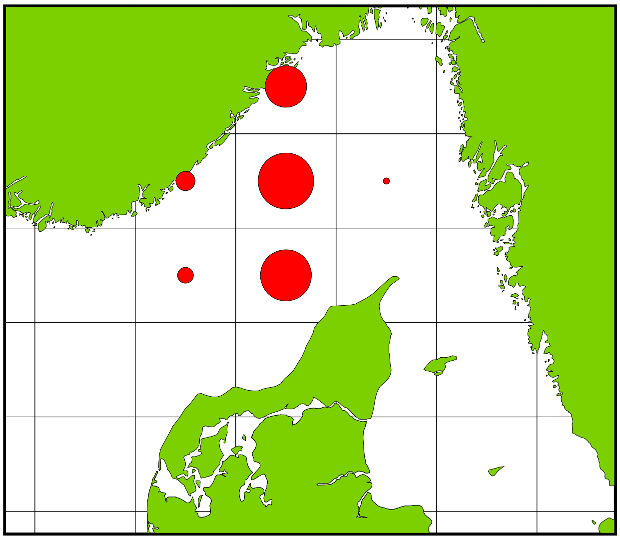


Figure 8.2.1 Geographical distribution of the fishery for roundnose grenadier in IIIa

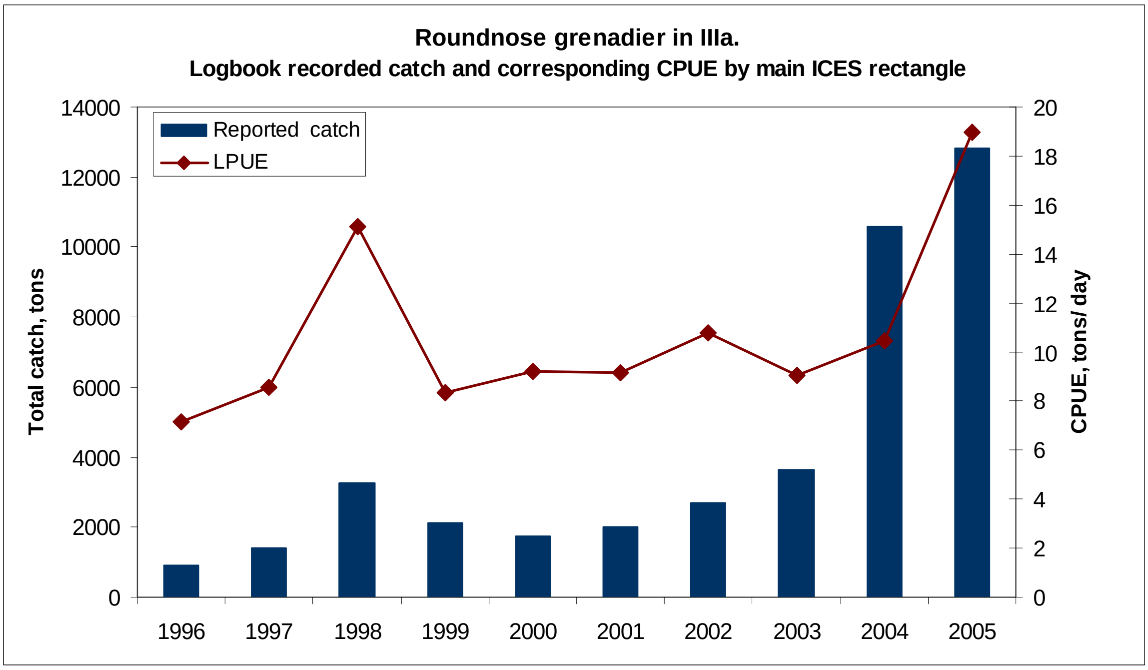


Figure 8.2.2. Danish catches and CPUE by main ICES rectangle. Based on logbook records.

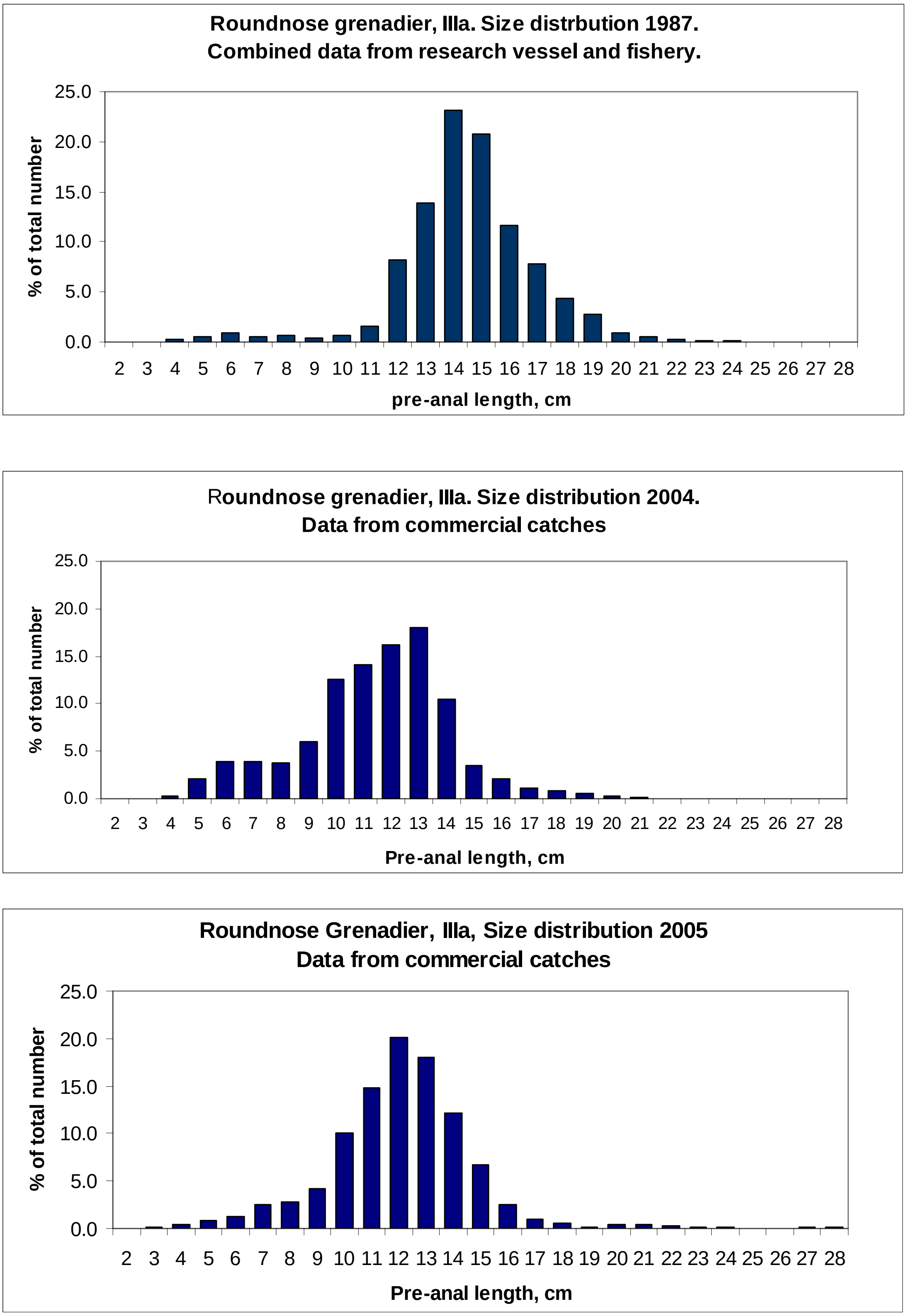


Figure 8.2.3 A-C. Length distribution Danish catches of roundnose grenadier.

9 Stocks and fisheries of the South European Atlantic Shelf

9.1 Fisheries overview

In ICES Subarea VIII there are two main fishing fleets defining the fisheries: trawler fleet and longliner. 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*.

The longline fishery that mainly targets deepwater species on conger, greater forkbeard and ling.

In ICES Subarea IX on the contrary there is a main directed longline fishery for black scabbard fish (*Aphanopus carbo*) with a bycatch of the deepwater sharks and also a longline (Voracera) fishery for *Pagellus bogaraveo*.

Also there are some deepwater species are a bycatch of the trawl fisheries for crustaceans. Typical species 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*).

9.1.1 Trends in fisheries

Although since 1988 from six to seventeen deep species are usually landed (excluded deep water sharks), historically the catches of *Aphanopus carbo* (45,9%) *Lepidopus caudatus* (19,8%) *Pagellus bogaraveo* (11,2%), *Molva molva* (10,8%), *Phycis blennoides* (5,2%), *Polyprion americanus* (3,7%) and *Beryx spp*.(1,7%) represent on average more than 98,2% of total Subarea VIII and IX landings.

Since 1988 on average 7277 ton of these species are landed from these subareas, but in last 6 years this amount has been never reached (Table 9.1.1). 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 incomparable amounts to *Aphanopus carbo* landings in Subarea IX.

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

They 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. The landings of Black scabbarfish never has been lower than 2500 t/year and in 1993 reached its higher value (4524 t). Since this year the trend indicates a decrease until 2002, and after this year the landings remained around 2500 t.

The Silver sacabbarfish series of landings are more variable. The landings have been often lower than 2500 t, except in 1995 in which 5672 t were reached. In 2000 only 16 t are recorded and in 2005 the landings of this species were around 500 tonnes. (Figure 9.1.1).

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

In the historical series the main landings of Red seabream come from Subarea IX (82% on average). From 1988 to 1998 the landings rank between 800 and 1000 t, but since 1998 the landings have been decreased and in the period from 2003 to 2005 less than 600 t have been recorded yearly.

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 t) is raised. Since 1999 the landings have been stabilised around 500 tonnes per annum (Figure 9.1.1)..

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 t/year. The wreckfish landings don't show a clear trend, and during the historical series landings from 123 t to 410 tonnes per annum can be observed. However a series of low landings seem to be recorded since 1999.

The first important alfonsinos landings in Subareas VIII and IX was recorded in 1995. Although a noticeable decline in catches is recorded in 2003, since 1995 a clear increase of landing trends is observed until 2005 (Figure 9.1.1)..

9.1.2 Technical interactions

The situation in these Subareas is that except for black scabbardfish, silver scarbbardfish and Red sea bream in subarea IX in which the artisanal longline fisheries are directed to these species, in Subareas VIII the landings of deep-sea species are exploited as by-catch in target fisheries for other species such as e.g. cod, hake, monkfish, and redfish by trawler and longliners. Ling (*Molva molva*) and Greater forkbeard *Phycis blennoides* are examples of a species almost solely exploited as by-catch and are not landed in important amounts in subarea VIII. A summary of gear interaction by species is shown in table Table 9.1.2.

With the aim of estimate CPUE by individual vessels and fishing grounds and to investigate possible trends in the exploitation pattern of the fleet, a preliminary analysis of VMS data from the Portuguese deep-water longline fleet targeting black scabbardfish (Aphanopus carbo) in the Portuguese continental slope was conducted (Machado et al., 2006 WD16b).

The fishery targeting rose shrimp (*Parapenaeus longirostris*) and the Norway lobster is mainly carried out off the south and southwest coasts of mainland Portugal at depths between 200 and 700 m. The deepest grounds (400 to 700 m) are only fished when Norway lobster is the target species. Landings of additional bycatch species can be important for profitability, especially when the catches of the target species are lower. Bycatch of deepwater fish species from the deeper fishing grounds include, conger eel, bluemouth, greater fork-beard and blackmouth catshark (*Galeus melastomus*). However, because of the over exploitation of Nephrops and the better yields of the shallower living rose shrimp, deep-water trawling does not occupy a major part of the effort of the fleet.

The fishery for deep-water sharks in northern Portugal include the gulper shark (*Centrophorus granulosus*) as target specie, but other deep-water species landed are the leafscale gulper shark (*Centrophorus squamosus*), Portuguese dogfish, blackspot seabream, greater fork-beard and conger eel. Since 1992, the catch rates have steadily decreased and the fishery is now almost finished. An investigation carried out under the auspices of the EC Deep-fisheries Project found that in most landings the deep-water bluemouth were a bycatch of a longline fishery for conger eel.

The hake is fished by trawl, gill net, trammel net and longline. More than 60% of the landings are by the artisanal fleet using static gear. A semi-pelagic ("pedra-bola") longline fishery takes place on the continental slope of the southern coast of Portugal at depths between 200 and 700 m and. Hake accounted for 41% of the catch and most of the remaining diverse catch of 27 species of fish and invertebrates was discarded. Deep-water bycatch species landed include the larger blackmouth catsharks, Ray's bream (*Brama brama*), conger eel, bluemouth and red (blackspot) seabream.

In Divisions VIIIa,b,d Basque "Baka" bottom trawlers targeting a great variety of species (mixed fisheries: pout, cephalopods, anglerfish, horse mackerel…) and hake can be considered almost as a "by-catch". In this fishery landings of deep sea fish are practically negligible. The pair bottom trawlers with very high vertical opening nets (VHVO fleet) has hake as target (close to 80% or more of the landings) in Div. VIIIa,b,d and only insignificant catches of deeps sea fish are obtained (WGDeep 2004).

A small bottom longline fishery targeting deepwater shark was developed in the continental slope of Bay of Biscay (VIII a and b) since middle nineties. Only a single vessel usually is focused in this fishery during all the year, but in last four year occasionally another bottom longliner spends two or three months per year fishing on these species. These vessels catches 15 different deepwater sharks but only portuguese dogfish (*Centroscymnus coelolepis*), gulper sharks (*Centrophorus granulosus and C. squamosus*), *Deania calceus* and *D. histricosa* are landed. As the target deepwater sharks species are the most valuables on sales, landings of teleost deepwater species have been observed only occasionally. No information of discard on these species is available.

9.1.3 Ecosystem considerations

The Subarea VIII and IX extends from west of Brittany (48°N) to the Gibraltar Straight (36°N). To the North, the Bay of Biscay is limited by the Brittany coast. A large shelf extends west of France. The southern part of the Bay of Biscay, along the Northern Spanish coast is known as the Cantabrian Sea and is characterised by a narrow shelf. Further south a narrow shelf continues west off Portugal (Figure 2.8.1). Lastly, to the south, the Gulf of Cadiz has a wider shelf strongly influenced by the Mediterranean Sea. Within these zones the topographic diversity and the wide range of substrates result in many different types of coastal habitat (OSPAR, 2000).

Deep water canyons are important deep-water topographic features of the Portuguese continental coast. For example, the Nazaré Canyon is one of Europe's most dramatic

underwater landscape features. It stretches for more than 150 miles from the shores of Portugal out into the abyssal Atlantic Ocean. It is a particularly difficult area to study because of its mountainous topography, high sediment loads and episodic down-canyon flows (Amaro et al., 2006).

Seamounts are also important topography features. Banco Gorringe (36°30'30N ; 11°20'W). This is a seamount formation, but it has not yet been investigated whether or not it is colonised by corals. However, there is no doubt that this particular seamount in this area is of high importance for the local invertebrate and fish fauna. Morro area includes a seamount formation influenced by the Mediterranean outflow current. There are indications that it is colonised by corals. It is characterised by a high level of species diversity, which is in contrast to that in the adjacent waters.

Several coral locations have been recorded in the Bay of Biscay and seem to be more abundant between depths of 200 to 500 m. The status of these benthic communities is unknown; however the deep water trawling is little developed in the Bay of Biscay as a consequence of the topography of the slope in this area. Moreover, fisheries with static gears are already well developed in the Bay of Biscay. Such gear and in particular gill net may affect both the benthic fauna itself as coral communities are broken when the net is hauled in as a result of the entanglement of the net if the structure. Moreover, some gear may be lost (as seen west of Ireland) and they are very likely to exert ghost fishing.

In relation to hydrographical influence in the distribution of species, temperature increase has been related with changes on the distribution of several species (Quéro *et al.* 1998) that are progressively increasing their northernmost distribution limits.

Some species may be favoured by warming (Blanchard and Vandermeirsch, 2005) and

recently, species from North Africa were reported in the Algarve. Fishing is a major disturbance factor of the continental shelf communities of the region.

the fisheries have a major effect on the structure and dynamics of the ecosystem. Fisheries have a considerable influence at different levels on the distribution of seabirds at sea due to the supply of discards that are used as food for scavenging species (WGRED 2006).

Concerning other anthropogenic impacts on the ecosystem in Subarea VIII it is important to mention the Prestige oil spill off Galicia in November 2002. This event affected most of the northern Spanish coast and especially the northern part of Galicia and Biscay Gulf. A very wide number of multidisciplinary researches have been carrying out in order to assess the spill oil impact in coastal ecosystems and fisheries. Many of these researches are still in course and are included in pollution monitoring projects. Preliminary result of spill effects in Bay of Biscay demersal and pelagic fisheries as result of IMPRES and PRESTEPSE projects have been presented in WGBEC 2005 and 2006 and in specific congresses related with this subject. However first conclusions of these studies are not expected to be ready after 2007.

More extent information about Prestige spill oil projects is available from the webs: http://otvm.uvigo.es/presentacion.html and http://www.ehu.es/ImpactoBiologicoPrestige.

9.1.4 Management measures

Management measures and considerations for deepwater species of Subareas VIII and IX can be applied from the general advices highlighted in the WGDeep 2004 report:

In that report the WG recommended that Measures should also be implemented to reduce exploitation of deep-sea species by fisheries primarily targeting shelf species (hake, anglerfish, and megrim). This paragraph is consistent with the situation of Subarea VIII fisheries in which deepwater species are mainly by-catches of hake, anglerfish, and megrim fishery.

In which concern to Subarea IX fisheries, a management plant for “voracera” fleet in the Strait of Gibraltar for the Red seabream fishery is currently being applied. Local technical management measures such as seasonal closure of the fishery, minimum landing size, gear size regulation, licensing, etc., have been introduced since 1999. Recovery Plan of *P. bogaraveo* related to this Spanish fishery must be continued or even improved.

For the main species under exploitation in these subareas like black scabbarfish, until further information to clarify the status of this stock is available, the WG recommends that the commercial exploitation is maintained at the actual levels.

For ling (*Molva molva*) of Subarea VIII (but also in Subareas IV, VI and VII), the WG concludes that although estimates suggest a decline in number of hooks set per year it is uncertain if the current management has effectively reduced effort by 30% compared with the level in 1998 (ref. ICES advice from 2004). It is furthermore uncertain if the current management of by-catch fisheries by e.g. trawlers is in accordance with ICES advice from 2004. Based on the current perception of status and trends in the stock(s), there is no basis to suggest amendment of the advice statement from 2004.

The trawler fisheries in Subarea IX and Baka trawler in VIII targeting species such as *Nephrops* and hake respectively, also have variable by-catch of deepwater species as we described in the Fisheries description of this section. Since 2005 the southern hake and

Norway lobster stocks in ICES Divisions IXa and VIIIc, have under a special UE regulation with the objectives to reduce in the amount of fishing effort applied to these stocks until they return to safe biological levels. The management measures to reach this objective include the temporal closure of fishing areas in north-west coast of Spain in to the south-west of Portugal.

Table 9.1.1. 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**
ALFONSINOS (Beryx spp.)			1		1		2	82	88	135	269	201	167	229	237	109	280	191
ARGENTINES (Argentina silus)															191	37	23	202
BLUE LING (Molva dypterigia)										14	33	4	4	6	29	22	22	61
BLACK SCABBARDFISH (Aphanopus carbo)	2602	3473	3274	3979	4398	4524	3434	4272	3689	3555	3152	2752	2404	2767	2725	2664	2502	2770
BLUEMOUTH (Helicolenus dactylopterus)		2	5	12	11	8	4			1	3	29	33	34	18	124	135	206
DEEP WATER CARDINAL FISH (Epigonus telescopus)												3	5	4	8	5	10	9
GREATER FORKBEARD (Phycis blennoides)	81	145	234	130	179	395	320	384	456	361	665	377	411	494	489	422	482	337
LING (Molva molva)	1028	1221	1372	1139	802	510	85	845	1041	1034	1799	451	331	577	439	450	527	487
MORIDAE								83	52	88			26	20	8	12	11	15
ORANGE ROUGHY (Hoplostethus atlanticus)	0	0	0	0	83	68	31	7	22	24	15	40	52	20	20	31	43	27
RABBITFISHES (Chimaerids)												2	2	7	6	2	6	5
ROUGHHEAD GRENADIER (Macrourus berglax)																		
ROUNDNOSE GRENADIER (Coryphaenoides rupestris)			5	1	12	18	5		1		20	16	5	7	3	2	2	7
RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)	826	948	906	666	921	1175	1135	939	1001	1036	981	647	691	553	489	560	574	584
SHARKS, VARIOUS	3545	1789	1789	2850	6590	3740	4	43	64	1104	2890	2287	704	549				
SILVER SCABBARDFISH (Lepidopus caudatus)	2666	1385	584	808	1374	2397	1054	5672	1237	1725	966	3069	16	706	1832	1681	854	526
SMOOTHHEADS (Alepocephalidae)										7								
TUSK (Brosme brosme)	1										1							
WRECKFISH (Polyprion americanus)	198	284	163	194	270	350	410	394	294	222	238	144	123	167	156	243	141	196

Table 9.1.2. Quantitative descrition of fishing gears and deepwater species interaction (2005 landing tonnes) in Subareas VIII and IX.

	ICES Subarea	Alfonsino	Argentine	Blue Ling	Black scabbardfish	Phycis	Ling	Orange Roughly	Roundnose Grenadier	Read Seabream	Tusk	Others
artisanal (lines)	IX	0	0	0	0	0	0	0	0	0	0	0
bottom trawls	IX	0	0	8	0	39	0	0	0	2	0	81
	VIII	19	32	14	0	97	27	0	0	25	0	34
gill nets	IX	0	0	0	0	0	0	0	0	0	0	0
	VIII	35	0	7	0	11	29	0	0	14	0	11
lines	IX	0	0	0	2746	0	0	0	0	334	0	456
	VIII	21	0	3	0	119	274	0	0	45	0	15
other gear	IX	6	4	0	0	0	0	0	0	29	0	0
	VIII	62	0	23	0	0	66	0	0	24	0	0
pelagic trawls	VIII	0	0	0	0	0	1	0	0	0	0	0

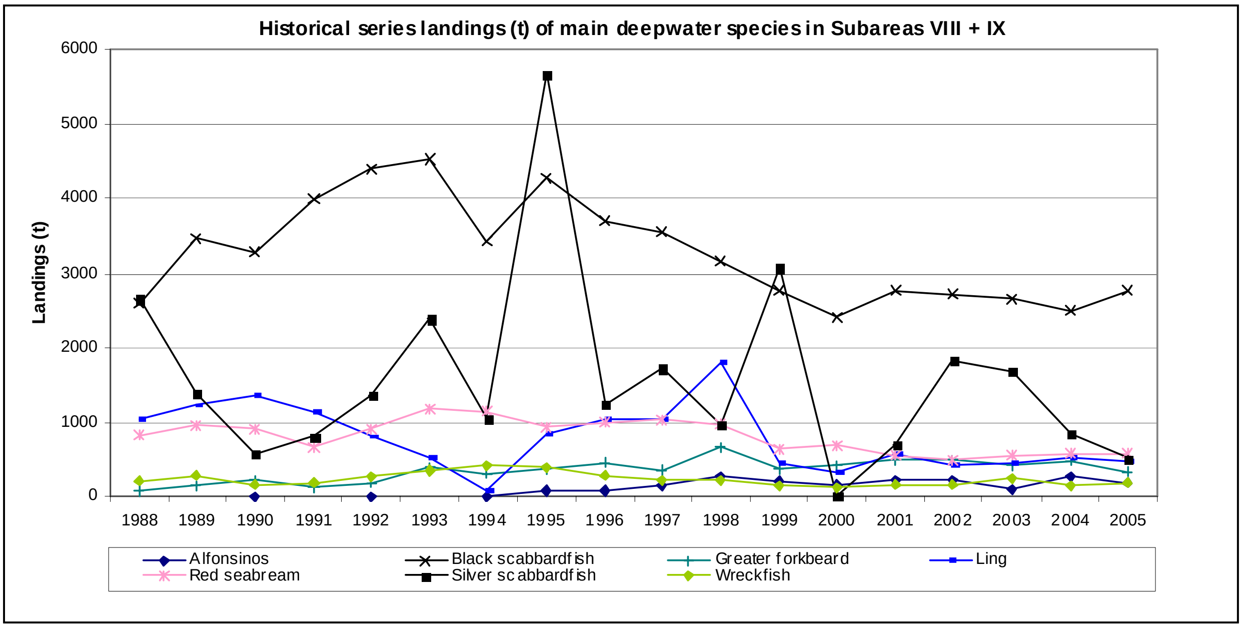


Figure 9.1.1. Historical series of seven main species landed in combined Subareas VIII + IX since 1988.

9.2 BLACK SCABBARDFISH (*APHANOPUS CARBO*) IN SUB-AREAS VIII & IX

9.2.1 The fishery

The 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. The longline gear used is designed to match the vertical distribution of the black scabbardfish and also to prevent gear loss on the hard grounds. This fishery has an artisanal character (ICES, 2004). The French bottom trawlers operating in subareas mainly VI and VII have a small marginal activity in subarea VIII.

9.2.1.1 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). 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 five years landings increased up to 30 tons. In Subarea IX Portuguese landings peaked in middle 90´s; after 2000 landings remained stable around the around 3000 tons (Figure 9.2.1)

9.2.1.2 ICES advice

The advice statement from 2004 was: In Division IXa the adoption of a status quo exploitation level is advised.

9.2.1.3 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 2004	2 577
Uptake in 2005	3 117
TAC (2005 & 2006)	4 000

9.2.2 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. Information on the size composition in the NE Atlantic was presented by SGDEEP 2000 for the various fisheries exploiting this species, (ICES, 2000). Differences in length structure and optimal depth range of black scabbardfish landings between the northern and southern areas were evident (ICES, 2005). Those differences could be partially explained by the different size selectivity patterns of the fishing gears used; trawl and longline.

In northern areas bottom longline is more efficient in catching black scabbardfish than longlines. In 2005 Spanish investigations at the Hatton Bank and adjacent waters several fishing gears in which both longline (Norwegian Automatic and manual) and bottom trawl were used black scabbardfish catches using bottom longline were insignificant while those of black scabbardfish attained 18.2 kg/h (Munõz 2006). The same was observed during previous Irish survey experiments in which the two fishing gears were used (Kelly et al., 1998).

In northern areas length frequency distributions of bottom trawl landings are similar ranging from 80-110 cm being in addition dominated by juveniles (ICES, 2005). Length information from Spanish and Scottish trawl is in agreement with this situation (Table 24.1.1 and Figure 24.1.2 and Figure 24.1.3).

In southern area longliners mainly operate at depths ranging from 800 to 1200 m. In this area the length structure of the exploited population have been stable (Figure 9.2.1).

Previous information on length frequency distributions by quarter of specimens caught by bottom trawl in the Rockall Trough and by longline off mainland Portugal and at Madeira (ICES, 2001) suggested the entrance of smaller specimens in Rockall Trough during the last quarter of the year (Figure 24.1.4).

It is thus 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.

A genetic study has been initiated by Azores new results on stock differentiation are expected in the near future

9.2.3 Data available

Landings were available for all relevant fleets. Portuguese longliner CPUE series and length frequency distribution of the landings were available. Discarding data from the Portuguese longliner fishery was also presented.

9.2.3.1 Landings and discards

The onboard discards sampling for longline Portuguese commercial fleet started in mid 2005 and are part of the Portuguese discard sampling programme, included in the EU DCR/NP. Four trips in two co-operative vessels of about 20 meters long were performed despite problems mostly related to weather conditions and other with difficilties onboard accommodation. Results from this preliminary study showed catches were almost composed by target species (89% in number and 84% in weight of total catch). Discarded species had an insignificant representation in the overall of the catches (6% in number and 2% in weight of total catch). Most discarded species was *Etmopterus pusillus*, followed by *Alepocephalus bairdii* and *Aphanopus carbo*. While the first two species are discarded because they have no commercial interest, the targeted species is discarded mainly because it's damaged due mostly to marine mammal predation. The percentage of damaged target species (discarded) in relation to its total catch averaged 12%, ranging from 6% and 21%. Gear efficiency for total capture averaged 17% and for target species capture averaged 14%. Nearly 90% of the remaning hooks were still baited reflecting a low bait loss rate (Fernandes and Ferreira, 2006 WD 16a).

9.2.3.2 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 2005. A total of 4223 and 222 specimens were sampled under length and biological sampling schemes, respectively. Length frequencies from the period 2000 to 2005 was compiled and extrapolated to the total annual landings of Sesimbra landing port. (Figueiredo and Machado, 2006 WD 16d). Length ranges were similar between different years and varied between 71 and 135 cm with a mean around 106 cm (Figure 9.2.2).

9.2.3.3 Age compositions

There is still some controversy on ageing black scabbardfish and due to that there are no reliable age determinations.

9.2.3.4 Weight at age

Not available.

9.2.3.5 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).

9.2.3.6 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) During 2005 and 2006 data on the nominal annual effort from this fleet has been collected by IPIMAR since 2000. These data was obtained from interviews to the fishermen, logbooks and the fishery databank of the Portuguese General Directorate of Fisheries.

9.2.4 Data analyses

Comparing length frequency distribution information with the mean length ± st. deviation intervals estimated for several years before 2000 (Figure 9.2.3) no great changes on the length structure of the exploited population are evident during the overall period.

Figure 9.2.4 shows the variation of the global CPUE (calculated as: total annual catch / (avg.no.hooks x no.trips)) for a reference group of six vessels operating on the slope near Sesimbra in the period 1990 – 2005 (Figueiredo and Machado, 2006 WD16d). For the years before 2000, CPUE estimates wre considered less reliable. Despite this fact no special trend was observed along the years.

The analysis of data retrieved from Portuguese fishing logbooks that contain information on the catches by species, number of hooks and location of fishing areas indicated that there are statistical differences on LPUE values between vessels. Due to that LPUE for the period 2000-2005 values were standardized following the procedure suggested in Quinn and Deriso (1999) and the 95% confidence intervals of LPUE estimates presented by year for both standardized and unstandardized data: did not show a clear trend (Figueiredo and Machado, 2006 WD16c).

The data used in the assessment comprised total international catch data for Subareas VIII and IX from 1990 to 2005, where the majority of landings are taken in Subarea IX by the Portuguese longliners. Landing data from fleets operating in these ICES Sub areas were fitted using an ASPIC model. The input estimates of CPUE series is derived from Portuguese longliners. The low contrast on the CPUE series leads to highly unrealiable estimates and since no other information was available no further progresses was done.

9.2.5 Comments on the assessment

The stability on CPUE data from the long-liners in Subarea IXa indicates the abundance in this area appears to have remained relatively stable during the past decade. The Portuguese licensing scheme adopted for deep-water species and implemented since 2002 avoid changes on total effort.

Improvements on CPUE estimate are recommended for future through the integration of data on the technological improvements. A more spatially detailed information of effort from Portuguese longliner is also expected as a consequence of the work already initiated, which aimed to estimate CPUE by individual vessel and fishing ground and to investigate possible trends in the exploitation pattern of the fle (Machado, et al. WD 16b).

9.2.6 Management considerations

There is no new relevant information demonstrating changes on the stock. So the 2004 advice “In Division IXa the adoption of a status quo exploitation level is advised “ is maintained.

Table 9.2.0. Black scabbardfish in VIII & IX. WG estimates of landings.

Black scabbardfish in Sub-areas VIII

Year	France VIIIa	France VIIIb	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	17	0	6	1	**24**

* Preliminary.

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**

* Preliminary.

Black Scabbardfish (*Aphanopus carbo*) All ICES areas

	VIII	IX	**Total**
1988	0	2602	**2602**
1989	0	3473	**3473**
1990	0	3274	**3274**
1991	1	3978	**3979**
1992	9	4389	**4398**
1993	11	4513	**4524**
1994	5	3429	**3434**
1995	0	4272	**4272**
1996	3	3686	**3689**
1997	2	3553	**3555**
1998	5	3147	**3152**
1999	11	2741	**2752**
2000	33	2371	**2404**
2001	23	2744	**2767**
2002	33	2692	**2725**
2003	34	2630	**2664**
2004	39	2463	**2502**
2005*	24	2746	**2770**

Figure 9.2.1 - Portuguese annual landings of black scabbardfish from 1988 to 2005.

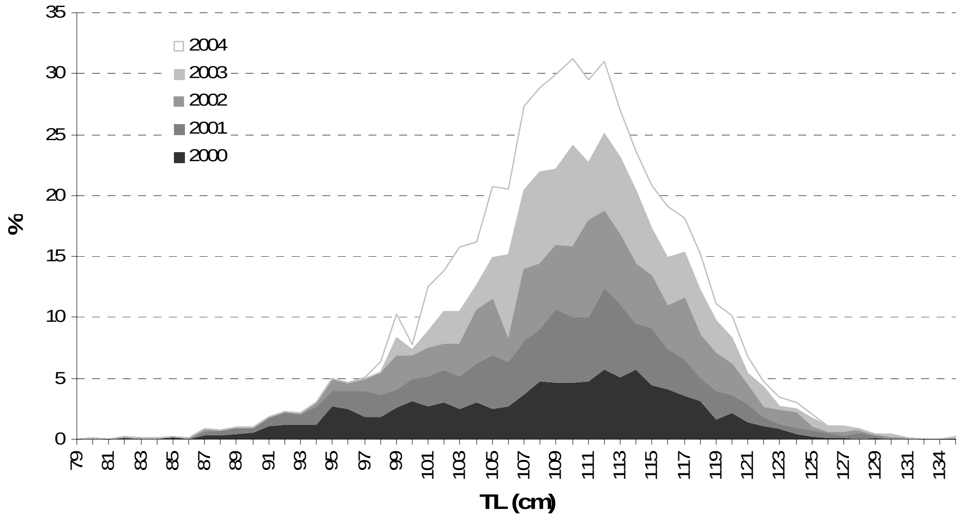


Figure 9.2.2 - Length frequency distributions of black scabbardfish based on specimens sampled at Sesimbra landing port from 2000 to 2005

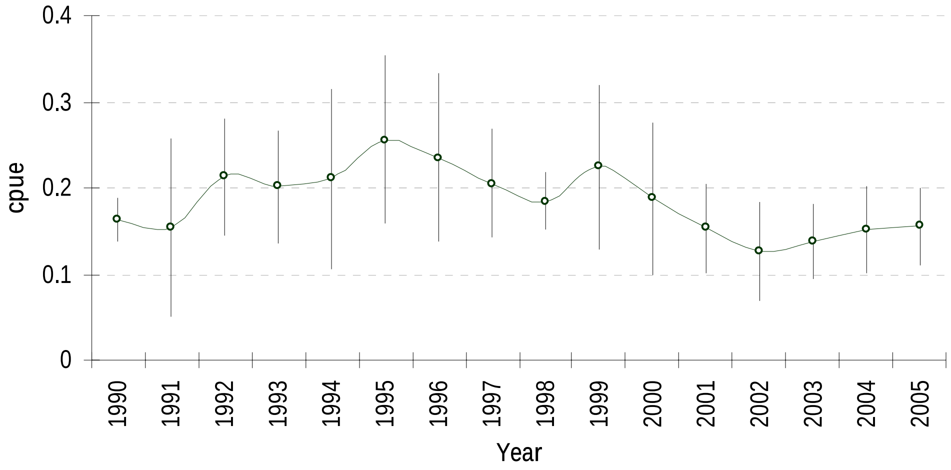


Figure 9.2.3 - Annual CPUE average values of the black scabbardfish fleet for the period between 1990 and 2005. (calculated as: total annual catch / (avg.no.hooks x no.trips)) Black bars indicate mean variation interval: mean ± st. deviation. (only six vessels were used).

9.3 Red Seabream (*Pagellus Bogaraveo*) In Sub-Areas VI, VII & VIII

9.3.1 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. In last 18 years landings from sub-area VIII represents the 62% and VI and VII the 27% 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).

9.3.1.1 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 9.3.1. 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 t in 1989 to 52 t in 1996, then they increased until 2000 (290 t), and since 2001 they have been decreased continuously (100 t in 2005). In the period considered (1988-2003), most of the estimated landings from these areas were taken by UK (41 %), followed by Spain (35 %), France (15 %) and Ireland (8 %).

Portuguese landings data in CECAF area are available at least from 1990 to 1999. In this period they have ranged from 4 to 14 t. From 2000 to 2004 there are no available data but in 2005 the catches reported by Portugal reached 270 t.

In Subarea XII, landings data are available from only one year (1994). They amount to 75 t 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 9.3.1 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.

9.3.1.2 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.

9.3.1.3 Management

In following table a summary of *P. bogaraveo* international TAC, quota and landings by Subareas VI, VII and VIII combined is shown. Noticed that the TAC is by far never reached in last three years.

Pagellus bogaraveo	**2003**		**2004**		**2005**	
SUBAREA	**TAC**	**Landing (t)**	**TAC**	**Landing (t)**	**TAC**	**Landing (t)**
VI, VII, VIII	350	127	350	135	298	100

Pagellus bogaraveo	**2003**		**2004**		**2005**	
COUNTRY	**Quota**	**Landing (t)**	**Quota**	**Landing (t)**	**Quota**	**Landing (t)**
Spain	281	90	281	86	238	94
France	14	17	14	22	12	n.a
UK	35	20	35	26	9	6
Ireland	10	0	10		30	
Others	10	0	10	0	9	0

9.3.2 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)

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. However, 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) (Menezes et al., 2001).

Migration patterns is studied by tagging surveys in the Spanish South Mediterranean region and the Strait of Gibraltar (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 catched with the “voracera” gear. Recaptures from matures tagging do not reflect important movements so far. All the recaptures come from the Strait of Gibraltar and was notified by the “voracera” fleet.

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.

9.3.3 Data available

9.3.3.1 Landings and discards

Historical series of landings data available to the Working Group have been described in text and tables of section 9.3.1.1. No discard data were available to the Working Group.

9.3.3.2 Length compositions

No length data were available to the Working Group.

9.3.3.3 Age compositions

No age data were available to the Working Group.

9.3.3.4 Weight at age

No weight at age data were available to the Working Group.

9.3.3.5 Maturity and natural mortality

No maturity and natural mortality at age data were available to the Working Group.

9.3.3.6 Catch, effort and research vessel data

No catch, effort and research vessel data were available to the Working Group.

9.3.4 Data analyses

No data analysis was carried out by the Working Group.

9.3.5 Management considerations

Even though in recent years a small directed fishery to *P. bogaraveo* has been developed in France most of the catches in Subareas VI, VII and VIII must be considered as very occasional by-catches of the fleets, mainly longliners, targeting other demersal species. The data reported to the group indicate that since the middle of 1980s the landings have been reduced dramatically. In 2004 a regime of TAC (289 t) and Quotas for 2005-2006 was established for the total area (Sub-area VI, VII, VIII, together considered) for the Spanish, French, UK and Irish fleets, and extra quota of 9 t in same sub-areas is available as by-catches for other countries. In relation to that it’s noticeable that the TAC and quotas established have been never reached by far for any country in last three years.

In agreement with the ACFM advice saying that *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*, the WG considers that studies focused to define juvenile aggregation areas must be carry out. The definition of such areas is a previous step necessary to establish in the future red seabream juvenile protection areas in North East Atlantic waters. Management considerations such as the implementation in of a minimum landing size and selectivity measures in order to reduced by-catches and juvenile landings are also recommended by the WG.

Table 9.3.0. 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	n.a		4	6		**10**

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	n.a	90	0	**90**

(1) in 2005 England & Wales

Table 9.3.0 (continued).

RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*) XII

Year	Latvia	**TOTAL**
1988		
1989		
1990		
1991		
1992		
1993		
1994	75	**75**
1995		
1996		
1997		
1998		
1999		
2000		
2001		
2002		
2003		
2004		
2005		

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		

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	10	90			**100**

Table 9.3.1. Working Group estimates of landings of Red (=blackspot) Seabream (*Pagellus bogaraveo*) .

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	10	90			**100**

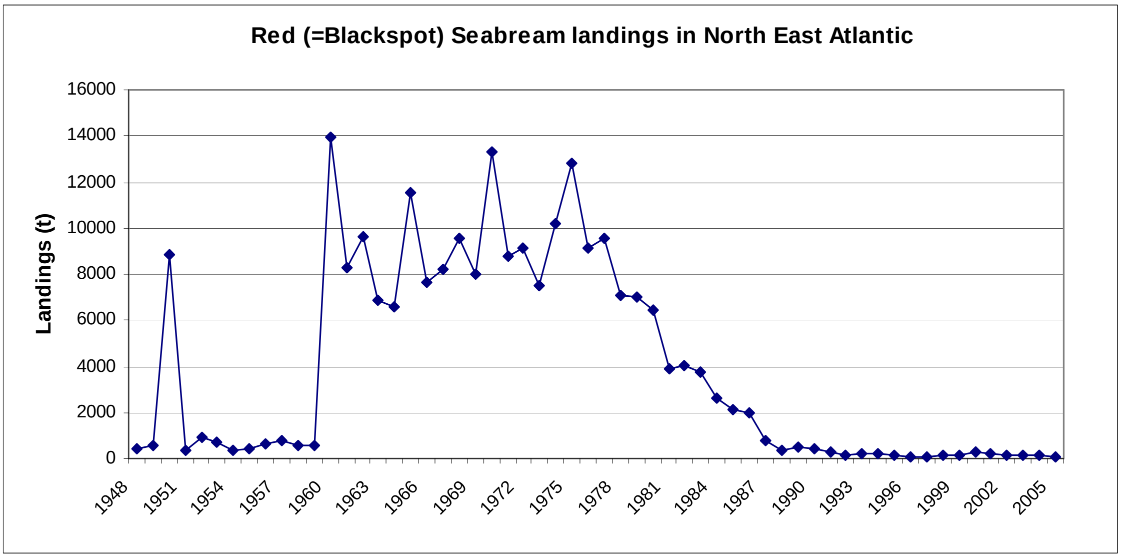


Figure 9.3.1. Historical series of Red Seabream landings since 1948 in North East Atlantic (sub-areas VI +VII + VIII) by the Spanish, French and E & W fleets.

-. 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

-. 1988-2005: 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)

9.4 RED SEABREAM (*PAGELLUS BOGARAVEO*) IN SUB-AREA IX

9.4.1 The fishery

Although *Pagellus bogaraveo* is caught by both Spanish and Portuguese fleets in Sub-area IX, a complete description of only one of the fisheries has been provided to the Working Group, that corresponding to the Spanish fishery in the southern part of Sub-Area IX (close to the Strait of Gibraltar). The majority of landings of deep-water species in mainland Portugal are from the artisanal fleet, comprising mainly longline fisheries. These operate on the Portuguese continental slope from ports such as Peniche and Sagres (Figueiredo & Bordalo Machado, WD 16d 2006).

An updated description of the Spanish fishery in the southern ICES Sub-Area IXa has been presented to the Working Group by Gil *et al.* (WD 20, 2006), completing the information offered in the previous WGs (Gil *et al*., 2000; Gil & Sobrino, 2001, 2002 and 2004; Gil *et al*., 2003 and 2005). This artisanal longline fishery targeting red seabream has developed along the Strait of Gibraltar area and comprises almost 70 % of the landings for this species in the IXa. The fleet use a "*voracera*", a type of mechanised hook and line baited with sardine. There are two base and landing ports; Algeciras and Tarifa (Cádiz, SW Spain). Fishing takes place as the tide turns at depths of 200 to 400 fathoms (~360-700m). Landings are usually in categories due to the wide range of sizes and for market reasons. These categories have varied over time.

In the beginning of the 1980s, there were 25 small boats engaged in this fishery. Since the 1990s the fleet has increased to more than a hundred. The mean technical characteristics of this fleet by port are given 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

In 2002, artisanal boats from another port, Conil, have begun to direct their fishing activity towards *P. bogaraveo* on different grounds to the boats of Tarifa and Algeciras.

9.4.1.1 Landing trends

In Sub-area IX, catches, most taken by longliners, correspond to Spanish (70%) and Portuguese fleets (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 2005 amount to 494 t. Almost all Spanish catches in this area are taken in waters close to the Gibraltar Strait. Until 2002 they were restricted to two ports (Tarifa and Algeciras), but from 2002 significant catches were also obtained by artisanal Spanish boats from a third port (Conil) from different fishing grounds of the same area.

No clear trend is observed in the Portuguese landings. The maximum values took place in 1988 (370 t) and in 1998 (357 t) and the minimum one in 2000 (83 t), and since then they have increased successively in the last years (183 t in 2004).

9.4.1.2 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.

9.4.1.3 Management

In 2003, for the first time, a regime of TAC and Quotas has also been applied to the *P. bogaraveo* fishery in Sub-area IX. The following table shows a summary of *P. bogaraveo* TAC, which has not been reached in last three years.

P. bogaraveo	**2003**		**2004**		**2005**		**2006**
ICES Sub-Area.	TAC	Landings	TAC	Landings	TAC	Landings	**TAC**
IX	**1271**	**471**	**1271**	**480**	**1080**	**494***	**1080**

* Preliminary

In addition, 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* relating 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 of the year (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).

9.4.2 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 and ICES C.M. 2004/Assess:15):

- • *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 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 from 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 (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. Recapture results do not, as yet indicate important movements. All the recaptures have come from the Strait of Gibraltar from the "*voracera*" fleet.

Thus, due to the very different status of the red seabream fishery currently 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.

9.4.3 Data available

9.4.3.1 Landings and discards

Historical series of landings data available to the Working Group have been described in text and tables of section 9.4.1.1. No discard data were available to the Working Group, but for this species this could be considered minor. The landings data used in the assessment attemp of red seabream in IX included Spanish and Portuguese landings from 1990 onwards. The full time-series are presented in Table 9.4.1.

9.4.3.2 Length compositions

Length frequency data are only available for Spanish red seabream catches landed in the Strait of Gibraltar fishery (1990-2005). The raised length composition of total landings of the Sub-Area IX is presented in Figure 9.4.1.

9.4.3.3 Age compositions

An ALK was obtained by 492 three agreed readings from otoliths collected in 2004 and 2005 presented by Gil *et al*. (WD 20, 2006). It covers lengths from 25.5 to 58.5 cm (Figure 9.4.2). ALK comprises ages between 3 and 10. Younger ages are well sampled while the older groups are susceptible to poorer estimates. Results are preliminary and are not validated yet.

Red seabream is considered a slow growing species. From ICES Sub-Areas VI, VII and VIII, Gueguen (1969) reported a maximum age of 20 years. In the Azores, ICES Sub-Area X, a maximum age of 15 years was observed in a 56 cm length fish (Krug, 1994).

Annual age frequencies (catch at age) were derived by the application of the ALK to the landings length distributions. Figure 9.4.3 shows the landings age distribution for the period considered. Age 4 individuals are the most represented in the landings, even in the early years. Since 1995, age class 6 and older are more poorly represented.

9.4.3.4 Weight at age

Weight at age were assumed to be the same in both the catch and the stock. These were estimated according to the ALK and the length-weight relationship presented by *Gil et al*. to this WG. Figure 9.4.4 shows the evolution of the mean weight at age. As a result of the application of an unique ALK to all the series, the weights at age do not present a lot of variation along the years because differences are only related to the landings length distribution variability. For all the assessment exercises, mean weight at age in the stock was considered equal to the mean weight at age in the catch.

9.4.3.5 Maturity and natural mortality

An annual reproductive cycle is defined for the species in this area by Gil and Sobrino in 2001: The spawning season seems to take place during the first quarter of the year. The smallest specimina are mainly males, maturing at a L_{50}=30.1 cm. Around 32-33 cm length an important part of individuals change it sex and became females. Females maturing at L_{50}=35.1 cm. Thus, from age 5 all individuals could be considered mature ones.

The natural mortality of *Pagellus bogaraveo* is uncertain because there is no data available to estimate M directly. A mortality rate of 0.2 year^{-1} has been adopted by several authors in several studies from other areas (Silva, 1987; Silva et al., 1994; Krug, 1994, Pinho et al., 1999, Pinho, 2003).

9.4.3.6 Catch, effort and research vesssel data

Catch and effort data for the Strait of Gibraltar fishery were presented by Gil *et al*. (WD 20, 2006). 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 Sub-Area.

9.4.4 Data analyses

9.4.4.1 Exploratory analysis

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, in 2004, landing mean length decreased in both ports but in 2005 grows again (Figure 9.4.5).

Estimate of Z=0.40 year^{-1} (R^2=0.97) were obtained from catch at age data in the 2000-2005 period from ages 4 to 8 (Figure 9.4.6).

Several exploratory analysis were attemped to select the required parameters for a separable VPA. All of these are done considering age 10 as a plus group (10+), reference age=4 (which is the most represented in the landings) and weighting default values (6 recent years).

Figures 9.4.7 and 9.4.8 show the diferent options considered. Selection pattern from S=0.4 seems to be realiable related to a hook fishery and also sum of squares residuals are the lowest of all the S choices, altough all obtained are very close. Diferents options of F could be considered, although preliminary Z estimate from catch curves is lowest than 0.4.

Other exploratory runs were attemped considering the last age as a real age (10) and also choosing a weighting value of 1.0 to all the series.

9.4.4.2 Conclusions drawn from the exploratory analysis

As it shown in Figure 9.4.9 residuals in all the cases present similar trends and also close values. However, traditional VPAs starting from these separable analysis reflects differences with regard to spawning biomass estimates, mainly in early years (Figure 9.4.10). Main differences are related to the use, or not, of age 10 as a plus group.

9.4.4.3 Final assessment

Reference age=4, S=0.4 and F=0.3 (considering closest values of the sum of squares residuals and the preliminary Z estimate) are the option that seems the most reliable option without keeping in mind the the results sensibility to the plus group use, mainly in the firts years of the series. Anyway, these assessment attemps should be considered exercises and due to its related uncertainty results should be examined only in qualitative terms.

9.4.5 Comments on the assessment

The assessment exercises shown here has been carried out under some uncertainties. ALKs computed from one year must not be applied to samples taken in a different year, because they could give biased results (Westrheim and Ricker, 1978). Nevertheless, it is the first attemp in this WG to assess the species in this Sub-Area.

SSB differences dues to the use, or not, of a plus group do not so important in the recent years. In every case the decreasing trend is clear enough. Current SSB remains in minimus of the whole series. This arise the 38% of the first year SSB (1990) in the most optimistic scenario while only represents the 22% in the pesimistic one.

9.4.6 Management considerations

For 2005 and 2006 a regime of TAC (1080 t) was established for whole Sub-area IX. This is more than the double of the total landings of the Sub-Area and does not seems a relevant constraint.

Only the Strait of Gibraltar fishery is under a local fishing plan. Then, from a precautionary point of view, the local technical measures adopted by the Regional Recovery Plan of *P. bogaraveo* related to this Spanish fishery must be continued or even improved.

ACFM advice says that 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. The WGDEEP Group was of the opinion that the previous ACFM was quite consistent with present advice.

The WG considers that data availability has been improved in recent years. Based on the preliminary assessments, the decrease of the mean length in the landings and the recent increasing trend of landings the fishery may be considered unsustainable.

Table 9.4.0. Red seabream in IX. WG estimates of landings.

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

* Preliminary

Table 9.4.1 Red seabream (*Pagellus bogaraveo*) in Sub-Area IX: Working Group estimates of landings (tonnes)

RED (=BLACKSPOT) SEABREAM (*Pagellus bogaraveo*) IX

Year	TOTAL
1988	689
1989	676
1990	594
1991	532
1992	797
1993	1000
1994	1004
1995	829
1996	978
1997	1011
1998	877
1999	543
2000	421
2001	374
2002	359
2003	471
2004	480
2005*	494

* Preliminary

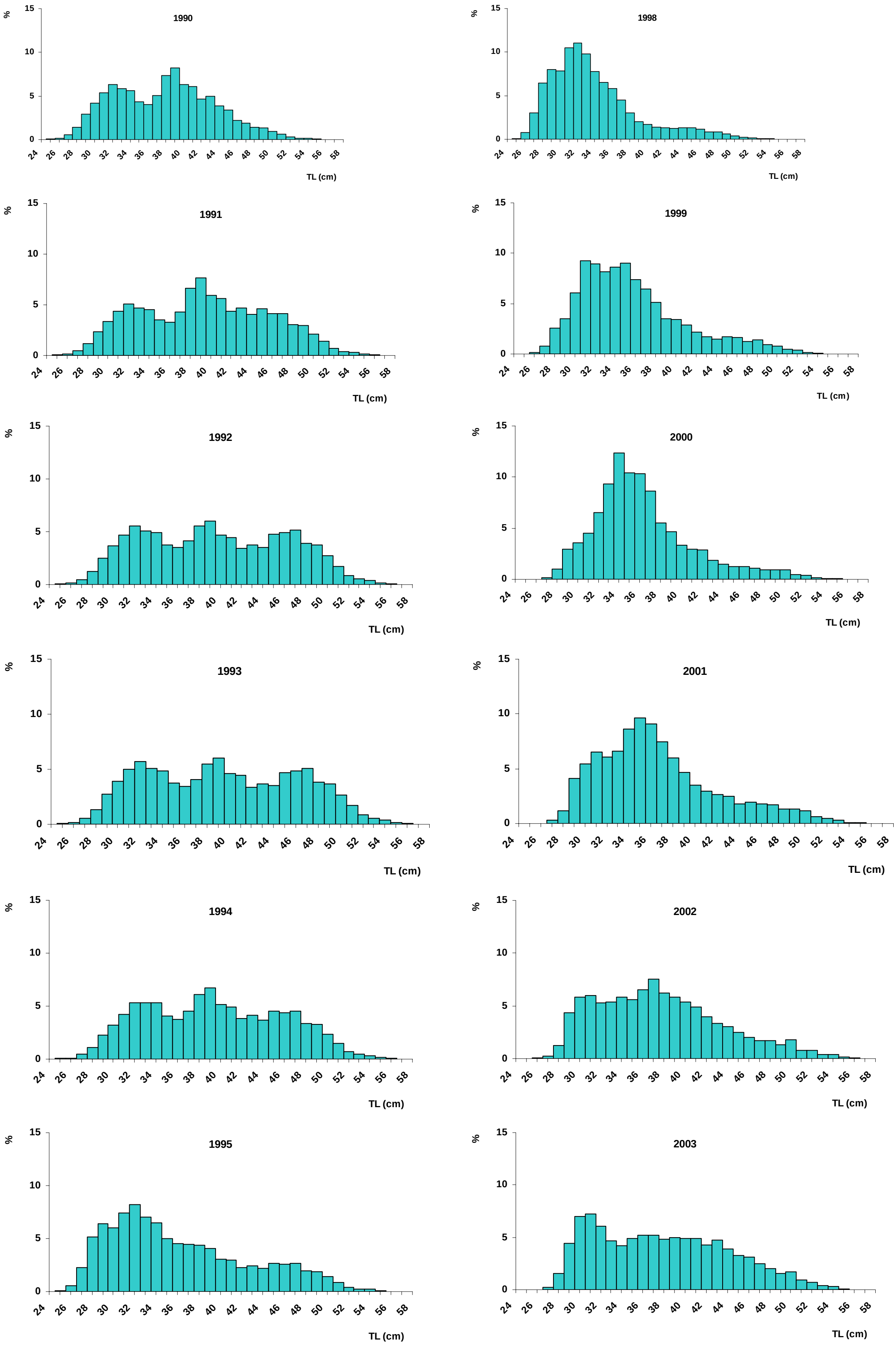


Figure 9.4.1. Red seabream (ICES Sub-Area IX): 1990-2005 landings length distribution (raised from the Strait of Gibraltar fishery).

Length(cm)/Age(y)	3	4	5	6	7	8	9	10	Total
25.5	1								1
26.5	3								3
27.5	3								3
28.5	5	1							6
29.5	9	4							13
30.5	18	16	1						35
31.5	16	31	1						48
32.5	11	41	7						59
33.5	4	48	7						59
34.5	3	33	13						49
35.5		17	21	2					40
36.5		8	21	1					30
37.5		6	8	3					17
38.5			6	7	1				14
39.5			9	7	1				17
40.5		1	3	7	4				15
41.5			1	7	5	1			14
42.5				3	13	1			17
43.5				4	4	2			10
44.5				3	2	1			6
45.5					3	2			5
46.5					1	3			4
47.5						4	1		5
48.5						2			2
49.5					1	1	1		3
50.5						1	1		2
51.5							2	1	3
52.5							1	1	2
53.5							1	1	2
54.5							1	1	2
55.5							1	1	2
56.5							1	1	2
57.5								1	1
58.5								1	1
Total	73	206	98	44	35	18	10	8	**492**

Figure 9.4.2. Red seabream (ICES Sub-Area IX): ALK from three agree readings (WD20, Gil *et al.*, 2006).

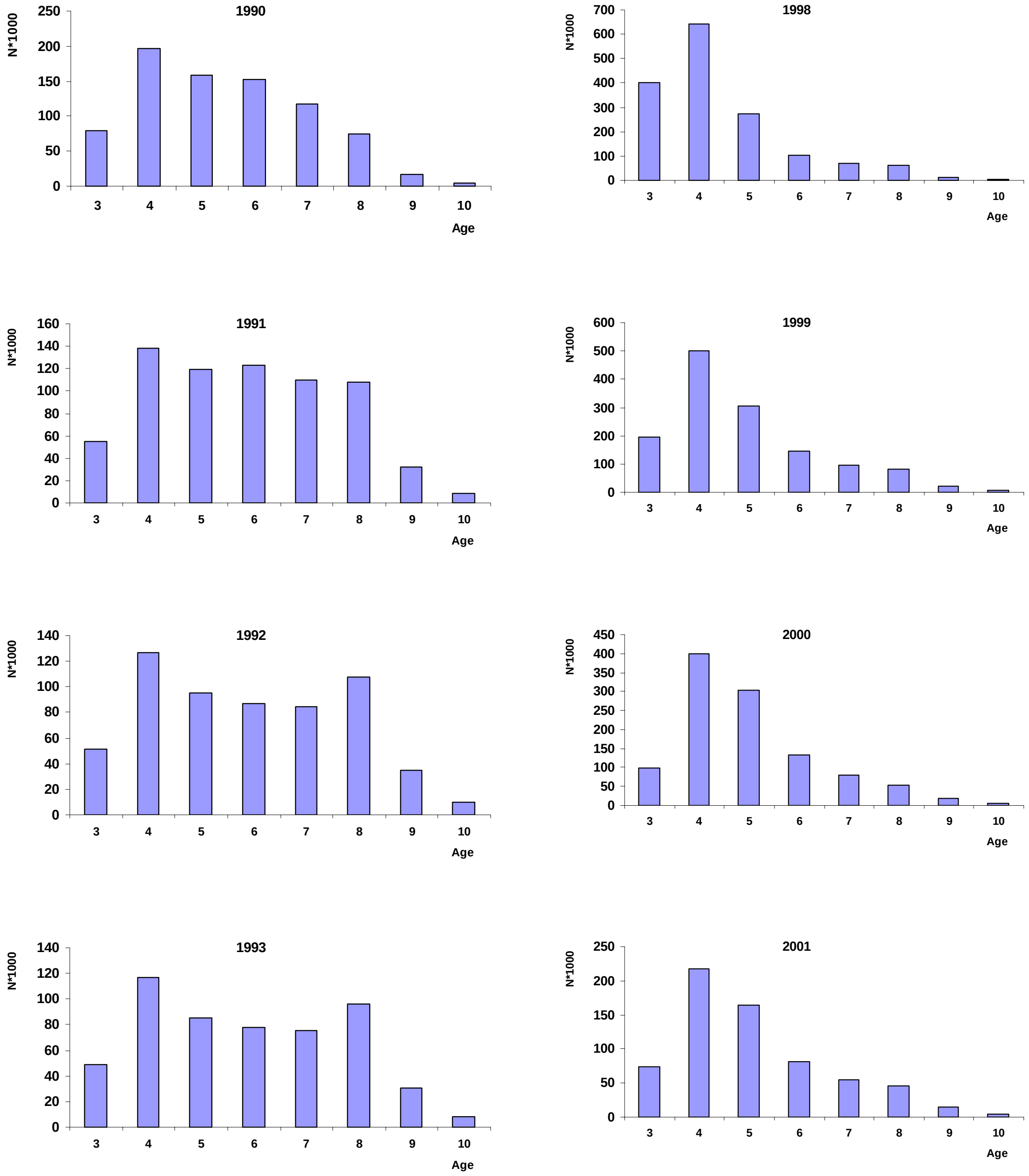


Figure 9.4.3. Red seabream (ICES Sub-Area IX): 1990-2005 landings age distribution (raised from the Strait of Gibraltar fishery).

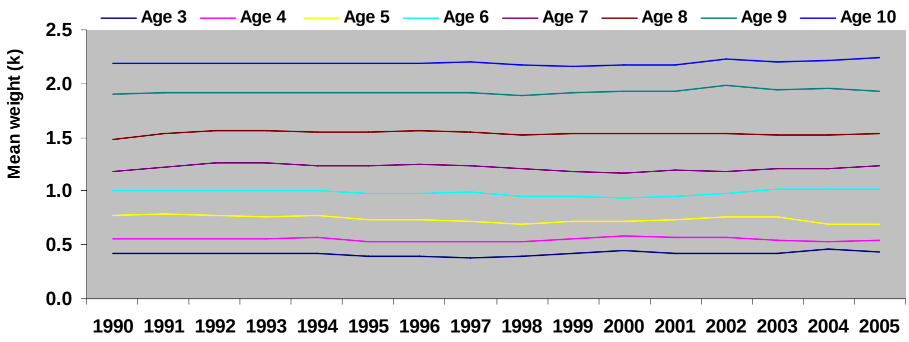


Figure 9.4.4. Red seabream (ICES Sub-Area IX): Mean weight at age

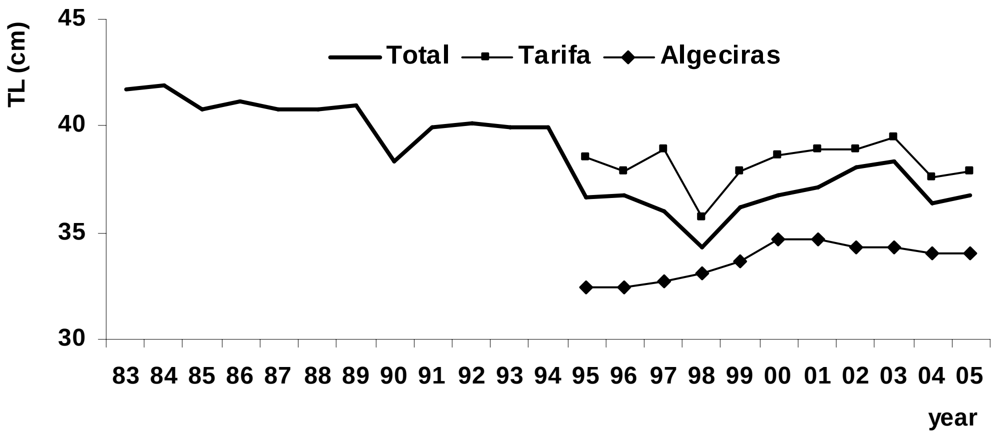


Figure 9.4.5. Red seabream fishery of the Strait of Gibraltar (ICES Sub-Area IX): 1990-2005 landings length distribution.

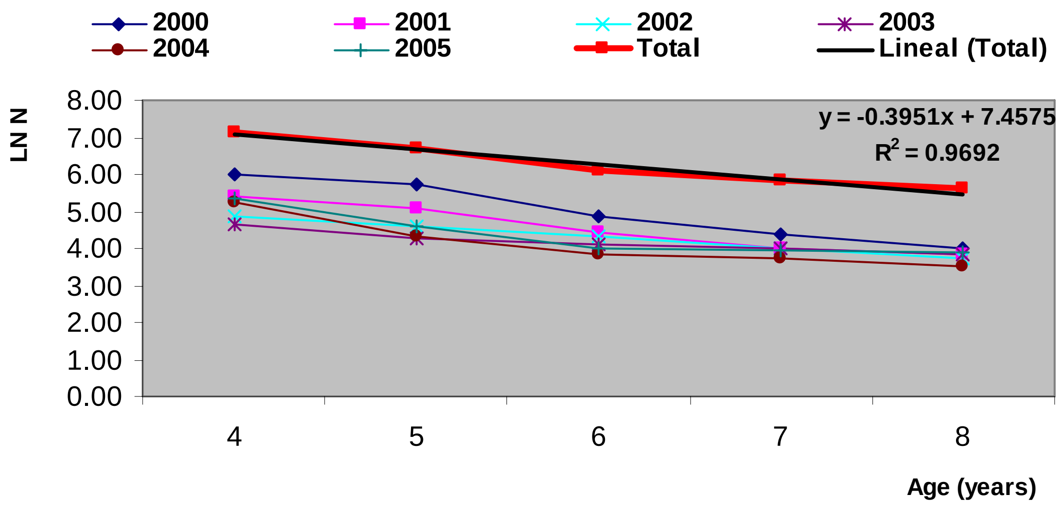


Figure 9.4.6. Red seabream (ICES Sub-Area IX): Catch curves for Z estimate.

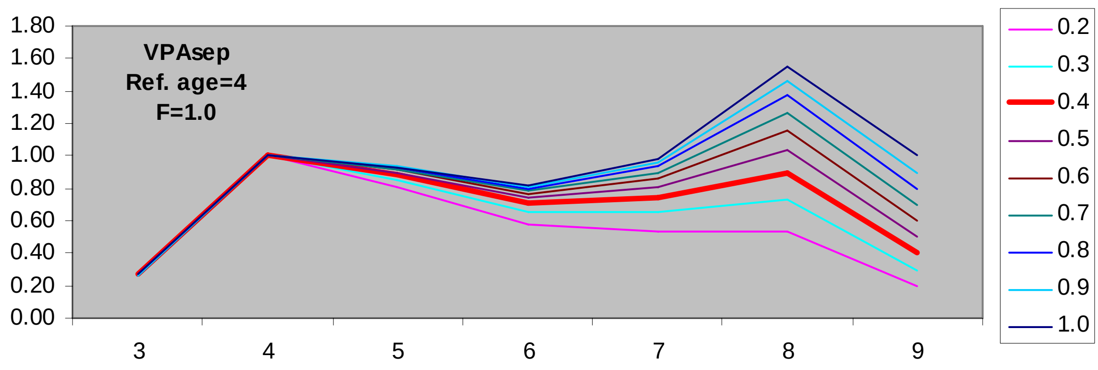


Figure 9.4.7. Red seabream (ICES Sub-Area IX): Several S input values in the separable VPA (Reference age:4 and F:1.0)

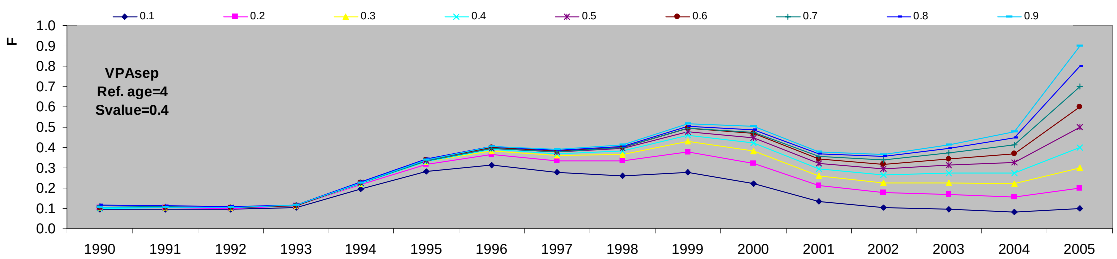


Figure 9.4.8. Red seabream (ICES Sub-Area IX): Several F input values in the separable VPA (Reference age:4 and S:0.4)

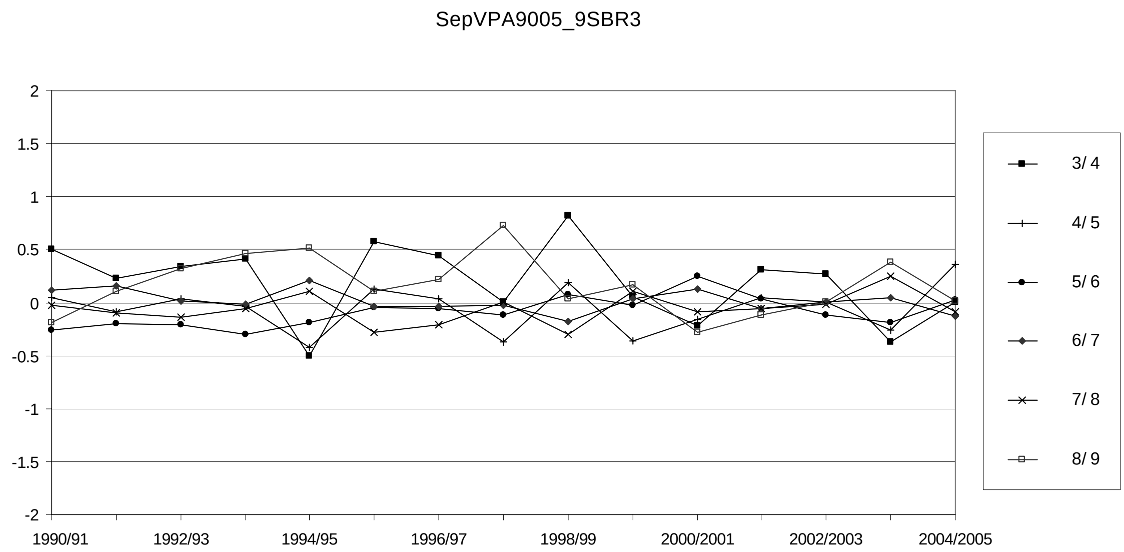


Figure 9.4.9. Red seabream (ICES Sub-Area IX): SepVPA residuals matrix (reference age:4, S:0.4, F:0.3 and weight default values)

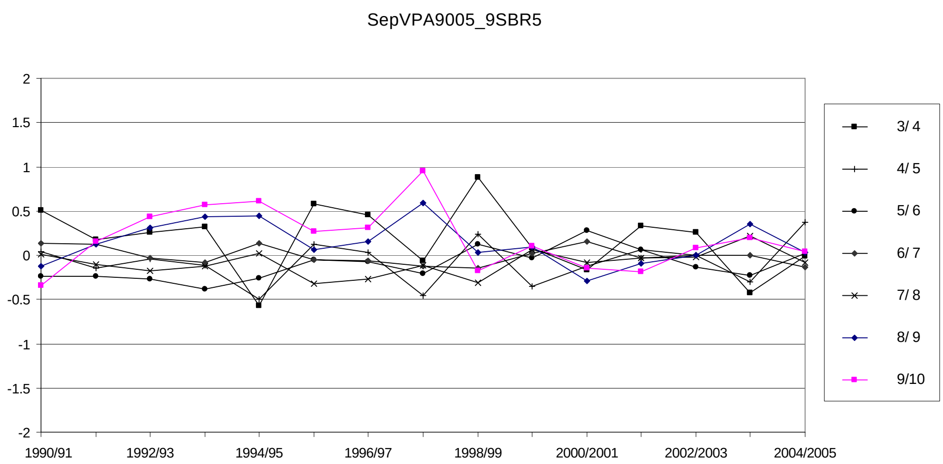


Figure 9.4.9 (cont.). Red seabream (ICES Sub-Area IX): SepVPA residuals matrix (reference age:4, S:0.4, F:0.3 considering age 10 as a real age and weight default values)

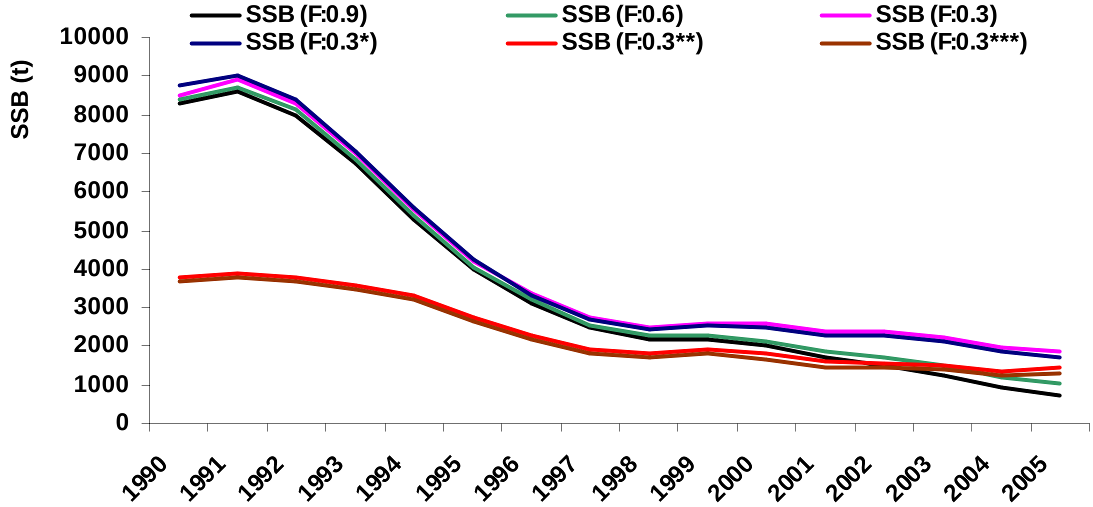


Figure 9.4.10. Red seabream (ICES Sub-Area IX): SSB estimates from traditional VPA (separable analysis with reference age:4, S:0.3 and different weighting and F choices and considering, or not, age 10 as a plus group)

*weight 1.0 for all the series

**age 10 considered as a real age (weighting default values)

***age 10 considered as a real age (weight 1.0 for all the series)

10 Stocks and fisheries of the Oceanic northeast Atlantic

10.1 Fisheries overview

10.1.1 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.

10.1.1.1 Trends in fisheries

Since mid-nineties the global landings of deep water species show a decreasing tendency (figure 10.1.1), 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.

10.1.1.2 Technical interactions

Table 10.1.1 shows landings by gear and by species.

The reported by-catch in this fishery seems rather insignificant, according to a pilot study conducted in 2004. Data on discards in the Azores longline fishery, collected in 2005, it’s currently been analysed and the results were not available during the WGDEEP meeting.

10.1.1.3 Ecosystem considerations

The Azores are considered a “seamount ecosystem area” because of the high density of seamounts. Most of the volcanic islands don’t have a coastal platform and are surrounded by extended areas of great depths, punctuated by seamounts where the fisheries occur. The average depth in the Azores EEZ is of 3000 meters, and only 0.8% (7715 km2) has depths below/above 600 meters while 6.8% are between 600 and 1500 meters. The rocky volcanic nature of these slopes and seamounts provide a high energy environment ideal for sessile suspension-feeding fauna such as cold-water corals, sea fans and sponges. Around 150 different species of coral are known from this region, occurring from 500-1700m depth. This rich assemblage supports a complex and diverse community of deep-sea fauna which is highly fragile and vulnerable to damage by fishing gear. A mark and recapture programme for bluemouth in this region has recaptured many specimens in exactly the same place as originally tagged after more than three years (ICES, WGDEC 2005). This study supports others suggesting that for some deep-sea species hydrographic or topographic barriers may limit dispersal of adults and/or larvae resulting in isolation and genetic distinctions between populations at regional scales.

The Azores EEZ (and that of Madeira and Canaries) is protected by EU regulations and legislation from bottom trawls and deep-water gill nets.

10.1.1.4 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.

10.1.1.5 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 10.1.2). 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 areas XII, X, XIV and V (Figure 10.1.2) by Russian, Iceandic, Faroese, Polish and Latvian vessels.

10.1.1.6 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. During the entire fishing period to 2005, the catch of roundnose grenadier from the northern MAR amounted to more then 230,000 t, most 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 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.

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, mostly on the MAR. Several vessels began a commercial fishery but by the end of 1995 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, which includes both MAR and Hatton Bank) catches increased from 131 t in 1995 to 534 t from January to July 1998. Catches of over 400 t per annum were also made in ICES Sub-area X in the years 1995-1997.

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 or coral banks 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.

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)* (Vinnichenko, 2002a). 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 1,800 t over the next 5 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 fished the area.

10.1.1.7 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 longline fishery of 'giant' redfish and tusk on the Reykjanes Ridge in 1996-1997. 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.

10.1.1.8 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 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 (Moranta et al 2004). 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).

10.1.1.9 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.

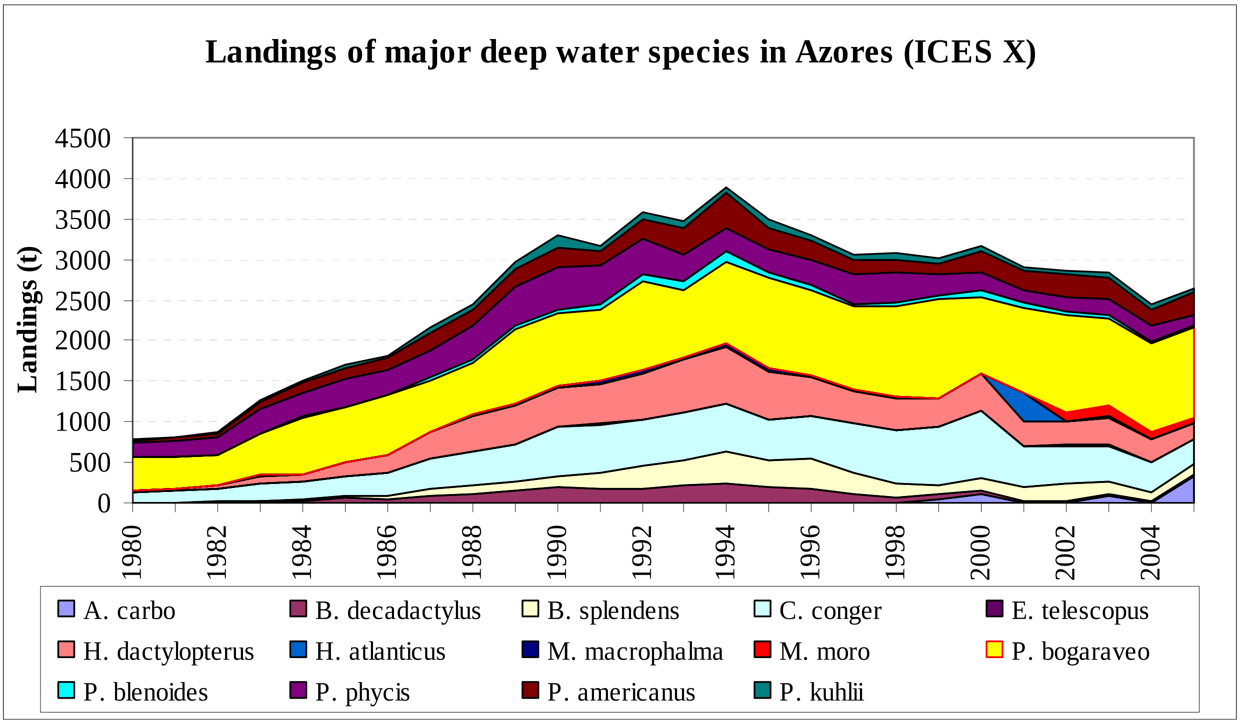


Figure 10.1.1. Annual landings of major deep water species in Azores from hook and line fishery (1980-2005).

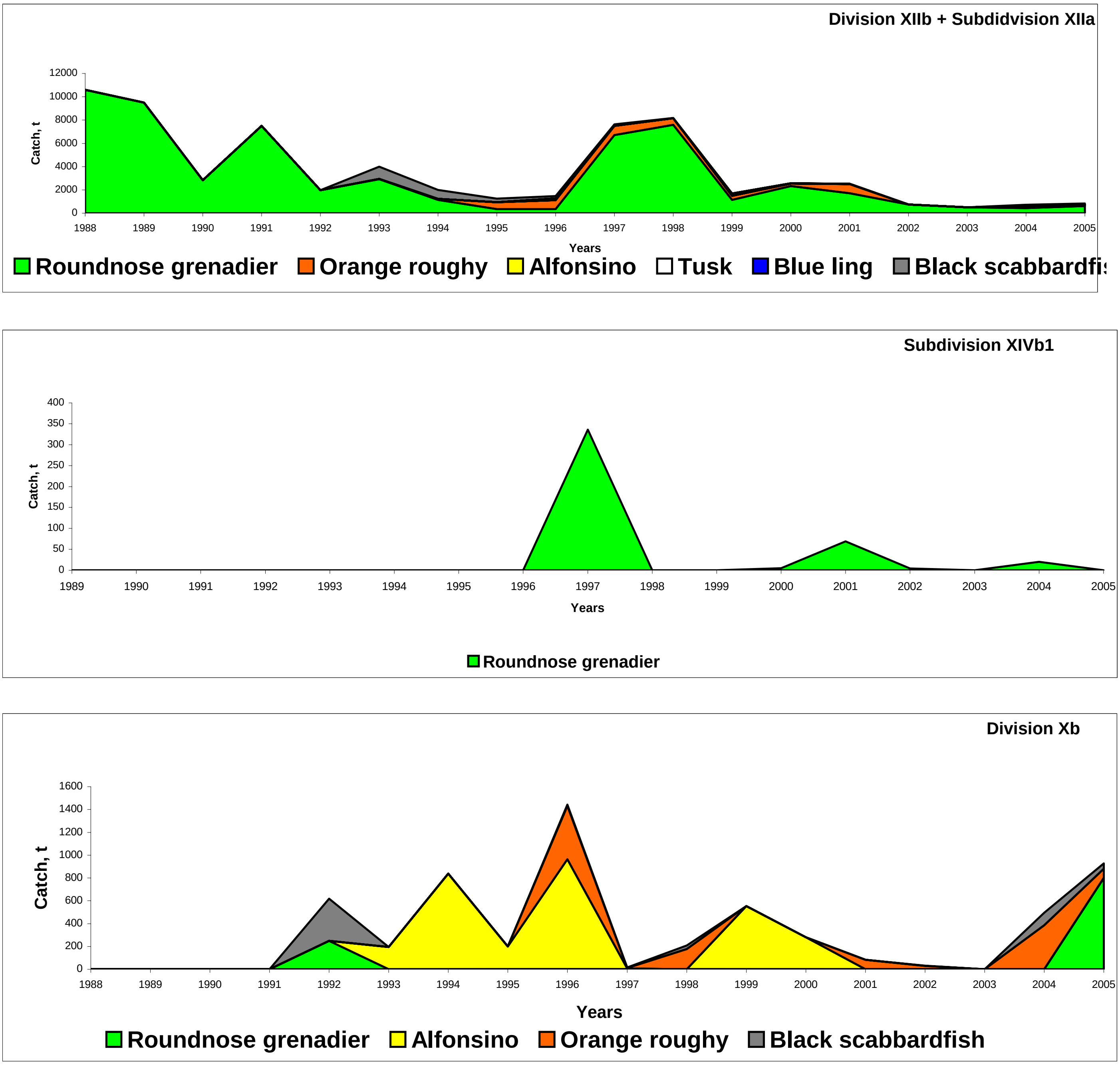


Figure 10.1.2. Annual landings of major deep water species on MAR in 1988-2005.

Table 10.1.1.- Quantitative description of fishing gears and deepwater species interactions in Subarea Xa. Landings (t) by gear and boat category in 2004.

Year	**2004**	**2004**
Boat size	<12	≥12
Gear	Hooks & lines	Hooks & lines
P.phycis	115.5	78.0
P. kuhlii	21.1	46.7
H. dactylopterus	67.4	214.7
E. telescopus	1.5	4.5
P. bogaraveo	515.9	558.9
P. americanus	49.1	139.7
C. conger	166.9	187.0
P. blenoides	13.3	23.8
B. decadactylus	14.7	14.3
B. splendens	13.7	95.9
M. moro	32.8	54.1
M. macrophtalma	6.2	4.6
A.carbo	1.8	0.1

Table 10.1.2. 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	1.2
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

10.2 Roundnose Grenadier (*Coryphaenoides Rupestris*) In Divisions Xb, XIIc And SubAreas Va1, XIIa1, XIVb1

10.2.1 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.

10.2.1.1 Landings trends

The greatest annual catch (almost 30,000 t) in that area was taken by the Soviet Union in 1975 (Table 10.2.1, Fig. 10.2.1) 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.

In April-July 2005, one Russian trawler (length 82 m, power 2400 hp) operated in the ICES Divisions XIIc and Xb. For the first time fishery was conducted to the south of 48°N where some new seamounts with concentrations of roundnose grenadier were registered. By preliminary data, catch was estimated at 1399 t with the daily catch rate 17.7 t (Table 10.2.2). There is little information about other countries fisheries of roundnose grenadier on the MAR in 2005.

10.2.1.2 ICES advice

Due to absent of an assessment ICES could only give a general recommendation for MAR stock in 2005: "… *the current advice is that any further development in these areas (and other areas that are re-visited or explored) should not be permitted unless a proper evaluation of stock status and sustainable exploitation rate is available*".

10.2.1.3 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. 10.2.3). In the international waters there are NEAFC regulation of efforts in the fisheries for deepwater species.

10.2.2 Stock identity

The intraspecific stock status for MAR roundnose grenadier is unclear.

10.2.3 Data available

10.2.3.1 Landings and discards

Data on catches are given in Tables 10.2.1 and 10.2.2. 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.

10.2.3.2 Length compositions

No new data on length compositions were available.

10.2.3.3 Age compositions

No new data on age compositions were presented.

10.2.3.4 Weight at age

No new weight at age data are available.

10.2.3.5 Maturity and natural mortality

New data on maturity and natural mortality are unavailable.

10.2.3.6 Catch, effort and research vessel data

Catch and CPUE data are given in Tables 10.2.1, 10.2.2 and Figure 10.2.1. 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 1995-1996. Effort data separated by Sub-areas are available for Russian fleet in 2003-2005 only (Tables 10.2.1 and 10.2.2). There were no research vessel data presented for 2005.

10.2.4 Data analyses

No analytical assessments were possible due to lack of suitable data.

10.2.4.1 Explor atory analysis

No exploratory analysis was carried out due to the lack of suitable data.

10.2.4.2 Final assessment

No analytical assessment was attempted due to the lack of suitable data.

The only source of information on abundance trends was the CPUE series from the Soviet/Russian official data (Tables 10.2.1, Figure 10.2.1). 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 of CPUE dynamics.

According to Soviet trawl acoustic survey data and analytical assessments in the 1970-1980s a stock size was estimated as 400,000-900,000 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.

10.2.5 Comments on the assessment

No analytical assessments were carried out.

10.2.6 Management consideration

The state of the stock is uncertain. Soviet data suggest a high stock biomass (400,000-700,000 t) in 1970-1980s but a decreasing trend of the CPUE indicate that the abundance of roundnose grenadier was reduced to a low level in recent years. Moreover, Russian trawl acoustic survey in 2003 showed relatively low biomass of the pelagic component of stock, an increasing depth of the aggregations, and a higher number of small immature fish. As the fishery on the MAR has been limited in recent two decades, these changes may have natural causes.

According to the Soviet estimates the annual possible catch of roundnose grenadier on MAR was estimated to 30,000-200,000 t in 1970-1980s. The only more recent estimate was a single trawl acoustic survey in 2003. It is currently impossible to provide an advice for roundnose grenadier fishery on MAR owing to lack of information. Consistent with a precautionary approach the expansion of fisheries should not be allowed until reliable assessments indicate that increased harvests are sustainable.

Table 10.2.1. Roundnose grenadier catches (t) by area, nation and Soviet/Russian efforts and CPUE on the MAR, 1973 to 2005

Year	ICES Sub area and Division	Catch, t USSR/Russia	Poland[2]	Latvia[2]	Faroes[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				4		
2003	XIIa1+XIIc	510				510	51	10.1
2004	XIIa1+XIIc	436			8	444	25	16.1
	XIVb1	20[1]				20[1]		
	Xb				1	1		
2005[3]	XIIa1+XIIc	600				600	42	17.7
	Xb	799				799	37	
Total		208143	13182	8831	1669	231825		

[1] – revised catch data [2] – official ICES data [3] – preliminary data

Table 10.2.2. Russian catches of roundnose grenadier on the MAR in 2005 (preliminary data)

Month	Division	Number of fishing days	Catch, t	
			Total	Per fishing day
May	Xb	9	174.9	18.8
June	Xb	28	624.3	22.3
Sub-total		***37***	***799.2***	***21.6***
April	XIIc	9	94.9	10.2
May	XIIc	17	230.6	13.7
June	XIIc	11	190.3	17.3
July	XIIc	5	84.4	16.9
Sub-total		***42***	***600.2***	***14.5***
Total		***79***	***1399.4***	***17.7***

Table 10.2.3. 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

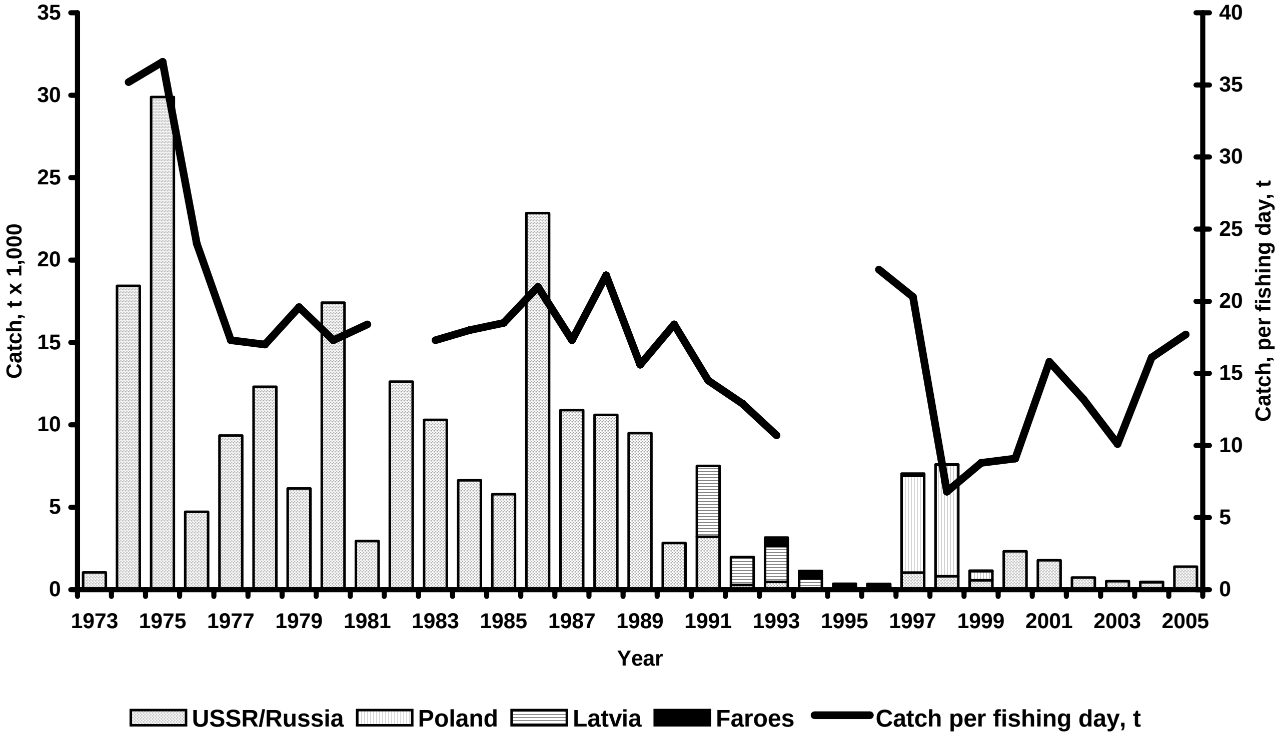


Figure 10.2.1. International catch and Soviet/Russian CPUE of roundnose grenadier on the MAR in 1973-2005

10.3 Red Seabream (*Pagellus Bogaraveo*) In Division Xa

10.3.1 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.

10.3.1.1 Landings trends

Historically three phases can be described in the development of the target fishery (Fig. 10.3.1). The first phase is considered as a predevelopment phase. This phase lasted until the end of the sixties and was characterized by an artisanal fleet that operated near the islands coasts. This fleet used small wooden boats of open decks (<12m in length), the majority of which were without a motor, fishing with hand lines in shallow waters, with annual catches reaching less than 100 tones.

The second, considered as a growth phase, started in the seventies. This phase lasted until the beginning of the nineties and generally introduced the engine boats. The catches increased significantly since the beginning of the eighties (from 415 mt in 1980 to 1090 mt in 1992). This increase in the catches during the eighties was mainly 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. Landings of blackspot seabream from longliners during this phase represented between 50 to 70% of the total landings.

The third phase, considered as a fully exploited phase of the fishery, occurred from 1992 to 2005, with total catches averaging 1000 mt and with a maximum catch of 1200 mt observed in 1999. This phase is characterized by an improved knowledge of the fishermen towards fish behaviour (i.e. distribution by area, depth, and season) and fishing technology and tactics (e.g. gear configuration and depth coverage in time and space) and increasing catch efficiency.

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

Under the European Union Common Fisheries policy an analytical TAC of 1116 mt was introduced in 2003 (EC. Reg. 2340/2002) and maintained in 2005 (EC. Reg. 2270/2004).

2003		2004		2005		2006
TAC	Landings	TAC	Landings	TAC	Landings	TAC
1116	1068	1116	1075	1116	1113	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.

10.3.2 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.

10.3.3 Data available

10.3.3.1 LandingS and discards

Total landings are available since 1980. However, detailed and precise landing data are available for the assessment since 1990 (WD15h Pinho et al, 2006). Landings from area Xa2 are presented in the Table 10.3.1. 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 are landed in the Azores ports. A recent study shows that almost no blackspot seabream is discarded on the target demersal fishery (Catarino, 2006).

10.3.3.2 Length compositions

Annual length composition from ICES area Xa2 is available since 1990 and was presented to group on a (WD15h Pinho et al, 2006) (Fig. 10.3.2). Length composition is stable along time with a mode, in general, on age 4 (28cm). However, for some years (e.g. 1999, 2000 and 2005) high amounts of large individuals were caught.

10.3.3.3 Age compositions

The age composition of commercial catches is usually estimated by applying an age-length key to the length distribution. Age length keys are only available from survey data, from length stratified age samples, for the years 1995-2005. From the fishery no data is available to construct an annual age-length-key unless we combine the data from different years, 1982-1985, 1987-1991 and 2002-2005. However, age-length-keys computed from one year must not be applied to samples taken in a different year, because they will give biased results, particularly when there is high overlap between the length distributions of successive age groups, as is the case of blackspot seabream (Kimura, 1977; Westrheim and Ricker, 1978). Furthermore, annual age data from the survey presents, for some years, low coverage of youngest and older ages.

So, annual survey growth curves were evaluated in order to test if there were significant differences between years (WD15h Pinho et al 2006). Because no biological significant differences were found data was combined for all years and a single growth curve was estimated.

Annual survey and fishery age frequencies (catch at age) were then created by slicing the fishery length frequencies using the von Bertalanffy equation estimated from this procedure.

Annual age composition from ICES area Xa2 is available since 1990 and was presented to group on a (WD15h Pinho et al, 2006).

10.3.3.4 Weight at age

Catch weight at age was considered equal to stock weight at age.

10.3.3.5 Maturity, Sex-ratio and natural mortality

An annual reproductive cycle is defined for the species with spawning occurring between January and April. Mature males are found from November to March and females from December to March (Krug, 1998, Menezes *et al.,* 2001). A similar pattern is described for the species off northwest Spain (ICES areas VI, VII, and VIII) (Sanchez, 1983).

Similar procedure followed for the age compositions was performed for females maturity and sex ratio. Female maturity and sex ratio at length from fishery data are available for three periods, 1982-1983, 1984-1986, and for 1991 (Krug, 1990, 1994, 1998). A resume of the information available was presented to the group (WD15h Pinho et al, 2006) (Fig. 10.3.3). Maturity data from surveys are available for the period 1995-1997 (Estácio *et al.,* 2001). Female sex-ratio at length from fishery data is also available for the same periods (WD15h Pinho et al, 2006) (Fig. 10.3.4).

Results from the comparison of the maturity curves suggest a statistically significant reduction in the length of first maturity during the three periods (WD15h Pinho et al, 2006). The estimated differences are large and biologically important. However, data for the period 1995-1997 is not compared with the others because they come from survey data covering a fixed period outside of the spawning period. Therefore samples may be not representative to construte a maturation ogive. For the assessment was decided to use the ogive for the year 1991 and considered equal for all years.

Results from the sex-ratio-at-length relationship show that there are not statistically significant differences ($p>0.05$) between the sex-ratio curves for the periods 1982-1983, 1984-1986, and 1991 but there are significant differences ($p<0.05$) for the period 1995-1997 (survey data). However, survey data for the period 1995-1997 may be biased because covered only a fixed period (post –spawning) of the year. For the assessment purpose data from the fishery was combined and a single logistic curve estimated for the sex ratio.

The natural mortality (M) of *Pagellus bogaraveo* is uncertain because there is no data available to estimate M directly. Estimation based on several empirical relationships using life history parameters (Quinn and Deriso, 1999) gives a range between 0.2 and 0.3 $year^{-1}$. A mortality rate of 0.2 $year^{-1}$ has been adopted by several authors in various studies (Silva, 1987; Silva *et al*., 1994; Krug, 1994, Pinho *et al.*, 1999, Pinho, 2003). Maximun age 15 years for the Azores also implies M of about 0.2 $year^{-1}$ is reasonable.

10.3.3.6 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 (WD15g Pereira, 2006) (Fig. 10.3.5). Factors year, month, boat class and target were used to adjust the nominal catch per unit of effort and all the explanatory variables were all categorical. A total number of 2884 trips where available for the period 1990 to 2004. From 1990 to 1997, the standardized blackspot seabream CPUE in number of fish per 1000 hooks fluctuated around the mean value, with a lower value for 1994, which could be due to a reduced number of observations. After 1998, when blackspot seabream became the target species in the fishery, the CPUE shows an increasing trend that can be explained by the conjunction of two factors, the increasing targeting on the species and by an increase in the catches of medium size fish.

The Azorean longline survey was conducted annually each spring (usually from Marsh to May) from 1995 to 2005. The survey followed a stratified design (6 statistical areas and 12 depth strata) and covered the Azores archipelago around the islands, banks, and major seamounts. The survey is design for abundance estimation of Red Blackspot seabream. Details of the survey design can be found in Pinho (2003). The catch per hook value (CPUE) was calculated for each species, area, and station stratum, and an index of relative abundance in number or “Relative Population Number” (RPN) was obtained by weighting each of these CPUE values by the corresponding area size. The average RPN value for each area and stratum was then calculated. The annual RPN values for each area and for the Azores were computed by summing the RPN values across strata and across areas, respectively. Abundance indices presented an increase trend with a high value every three years (WD15 Pinho, 2006; WD15h Pinho, 2006) (Fig. 10.3.6). 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.

Otoliths have been collected from surveys and age readings performed annually. Length growth curve at age estimated, for sex combined, from annual mean length at age for the period 1995-2004 is presented in Fig. 10.3.7.

Length composition from the survey is presented in Fig. 10.3.8 respectively.

10.3.4 Data analyses

For the assessment a standard ICES procedure was performed with a series of exploratory analysis using first the separable VPA, to test for catch data outliers and possible changes on the exploitation pattern. Then a Laurec-Shepherd ad hoc VPA tuning runs were carry out for each fleet (commercial fleet and survey) data sets independently in order to “screen” the fleet data sets. Finally the XSA was explored and options for a final run selected. A resume of the exploratory analysis followed for the assessment is presented in Table 10.3.2.

10.3.4.1 Separable VPA

Several SVPA runs were performed, starting with Recruitment at age 1, a plus group at age 10 (age 1-10 encompass more than 85% of the catches), terminal F=0.4 (average fishing mortalities of the last 10 years estimated from the catch curves) and terminal selectivity of 1 on age 5. Defaults were used for all the other options. Results show high residuals on the young and old fishes. A dome shape type for the selectivity was found, suggesting that ages seven and eight are not completely available to the fishery. Age 1 is not very well represented on the catches. Average Age composition suggests that age 4 is fully recruited. So, next runs explore different recruitment ages (age 1, 2 and 3), ages for the plus group (age 10, 9 and 8), terminal Fs and reference ages for unit selection (see Table 10.3.2).

Results show noisy residuals on the recruitment in all combinations but no significant trends on residuals were found for the other ages (Fig. 10.3.9).

10.3.4.2 Ad hoc VPA tuning

A Laurec Sheperd tuning VPA was run (without F shrinkage) for different recruitment ages (2 and 3), ages of plus group (10, 9 and 8) and adopting the defaults for the other program options. These runs were repeated adopting a shrinkage value of the Log(SE) for the mean of 0.5.

Results show also high residuals on recruitment and no significant trends for the other ages. Diagnostic for the base case show also significant slope and high CV of the mean F on Recruitment (Age 3) from the fishery as observed from the SVPA (Fig. 10.3.9).

10.3.4.3 XSA runs

For the XSA we explore also several options of recruitment ages (age 2 and 3) and age of plus group (age 10, 9 and 8). Different pairs of ages (age at which catchability is considered independent of the year class strength and age for which the catchability is considered independent of ages) were explored on runs without tapered time weighting. Default settings from the program were selected for all the other parameters.

Results show that recruitment at age 3 and a plus group at age 8 reduce the variability on the residuals particularly on the older ages, but always with noise in the recruitment age (Fig. 10.3.10). For this option a sensitive analysis were run for different pairs of ages (age at which catchability is considered independent of year classe strength and independent of ages). Residuals and time series outputs of the estimated recruitment, total biomass, spawning biomass and fishing mortality were plot and analysed. Based on diagnostic statistics and the plot of residuals the pairs of ages at which catchability is independent of year class strength at age 3 (meaning that we consider all ages independent of year class) and a catchability plateau at age 4 were selected. Another pair at which catchability was considered dependence of year class at age 5 and independent at age 6 was also selected (considering age 4 not completely recruited). For these two options sensitive analysis for different shrinkage levels was performed. Results show that for the latter option dependent ages (age 3 and 4) are estimated with a high contribution from the shrinkage, even at a low level (shrinkage=1.5). For the former, contribution from the shrinkage is reduced. Retrospective analyse was then performed for this option (all ages independent of year class and a q plateau at age 4) and for each level of shrinkage.

Retrospective analysis shows, for the stock estimates, a marked retrospective pattern in that they are consistently underestimated, independently of the shrinkage level we adopt (Fig. 10.3.11). There is also a lack of convergence of recruitment and total population estimates back in time. Some inconsistency is observed on the fishing mortality for each level of shrinkage. However, consistency is observed on the trends of the different shrinkage levels.

The pair of ages 3-4 with the lowest shrinkage level (Log(S.E.)=1.5) was selected for the final run because reduce the weight of shrinkage on the estimates, particularly on the young ages.

10.3.4.4 Conclusions drawn from the explanatory analyses

Exploratory analyses show that the recruitment estimates are always very imprecise suggesting that projections for forecasts must not be done.

Sensitive analyse for different levels of shrinkage show that is better to consider all ages independent of the stock size and a plateau at age 4 because reduce the contribution of the shrinkage on the estimates.

Retrospective analysis for this option shows, for the stock estimates, a marked retrospective pattern in that they are consistently underestimated, independently of the shrinkage level we adopt. There is also a lack of convergence of recruitment and total population estimates back in time. However, some consistency is observed on the trends.

10.3.4.5 Final assessment

A final run was made with the recruitment at age 3 and a plus group at age 8. Age independent of year class strength at age 3 and age independent of ages at age 4. The shrinkage was set at 1.5 and all the other options default settings of the program were selected. The diagnostic from the XSA is shown in Table 10.3.2. Annual Log catchability residuals by age is shown in Figure 10.3.10. Results from this analyse is shown in Figure 10.3.12.

10.3.5 Comments on the assessment

The results from this exploratory assessment should be treated with caution.

Data for the assessment improved considerable. However, survey data presents high inter annual variability on the abundance suggesting that there are year effects on the catchability (the resource may be less available to the fishery in some years). In a minor scale this dynamic is also observed on the landings but not observed at all on the standardized fishery CPUE. Stability on the fishery CPUE may be related with an increase of efficiency of the fisherman on a multispecies exploitation context that future work must address.

Although this assessment is uncertain, and is presented here to illustrate the work that have been done in this stock on area Xa2, results show a relatively stability on stock indicators. However, recruitment estimate is very uncertain as shown by the sensitive analysis at different levels of shrinkage. Although results of the retrospective pattern show consistency on the trends there is high uncertainty with stock estimates being underestimated and without convergence back on time.

10.3.6 Management considerations

The status of Red blackspot seabream is uncertain but there are signs of increases in indices of abundance from surveys and stable CPUE from the fishery CPUE. The catches of red black spot seabream have been increased until the actual TAC plateau level. Fishing mortality from the catch curve shows an increase trend, with high variability between years.

Considering the uncertainty of the assessment fishing mortality should not be increased beyond the actual level until validated assessments indicate that any harvest increase are sustainable.

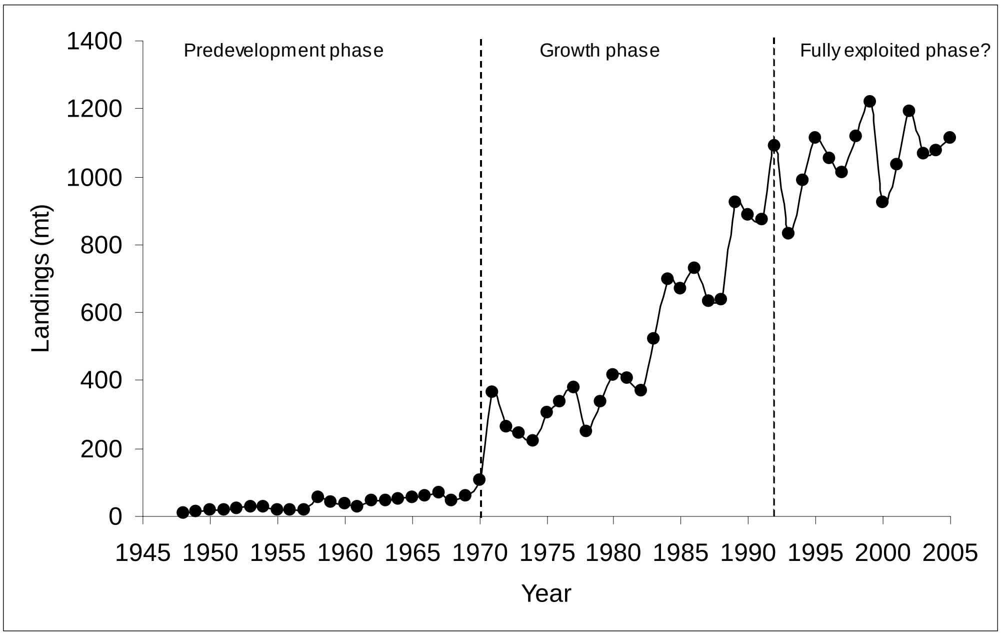
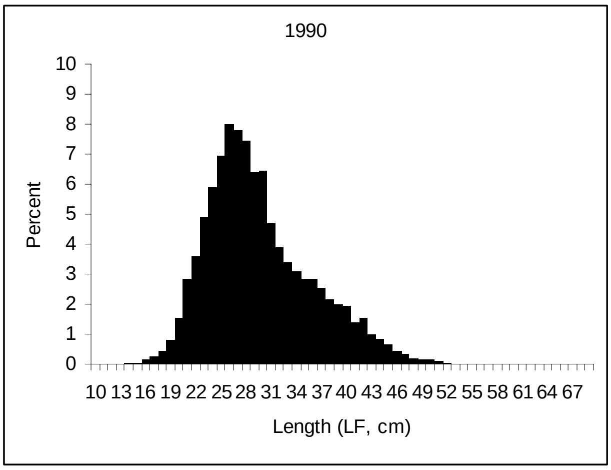
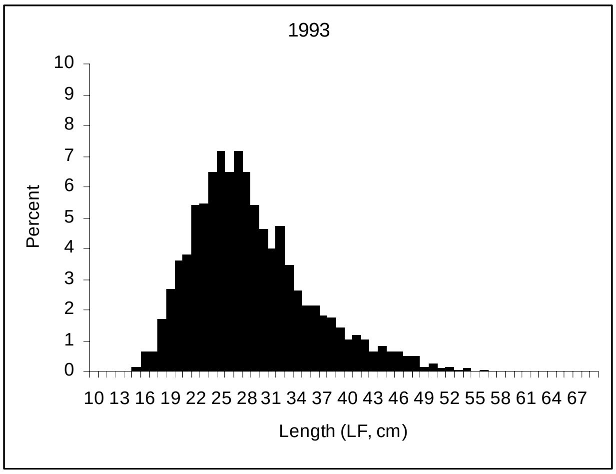
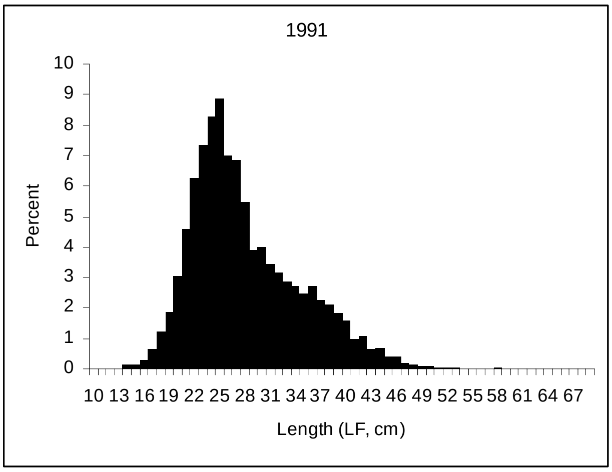
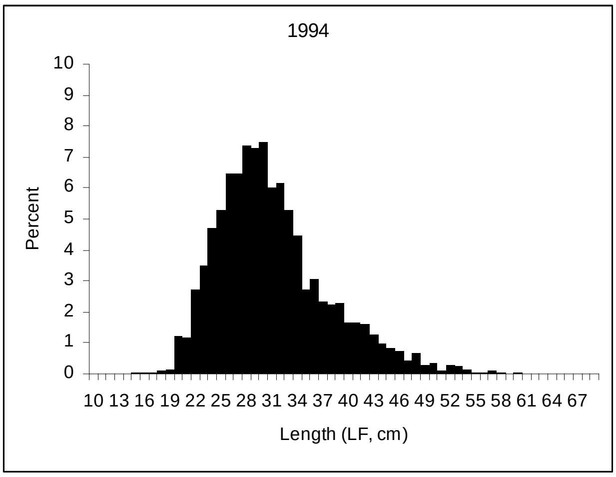


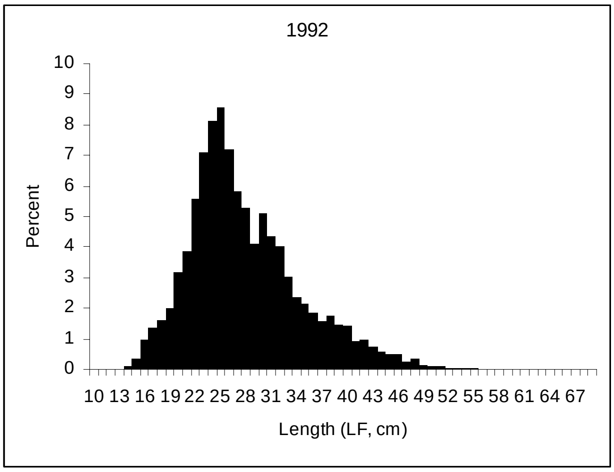
Figure 10.3.1. Historical landings of *Pagellus bogaraveo* from the Azores (ICES area Xa2).

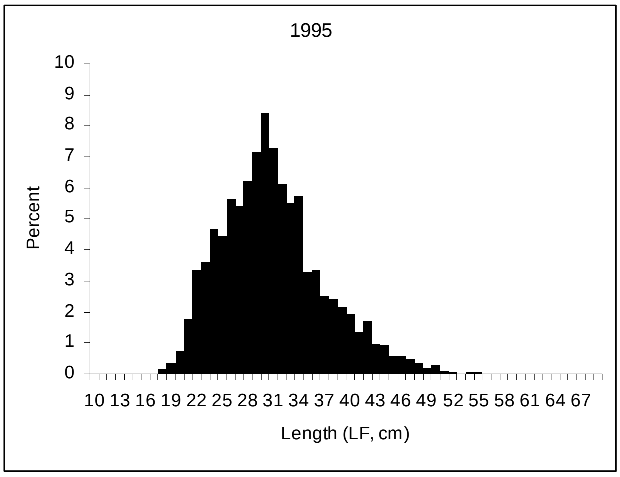

1990
Percent
Length (LF, cm)

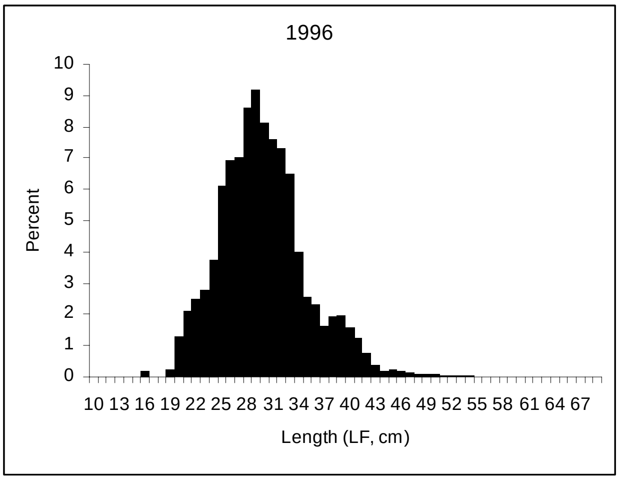

1993
Percent
Length (LF, cm)

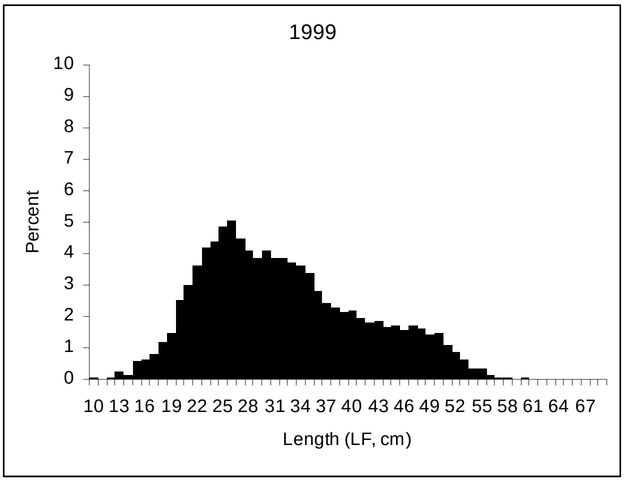

1991
Percent
Length (LF, cm)

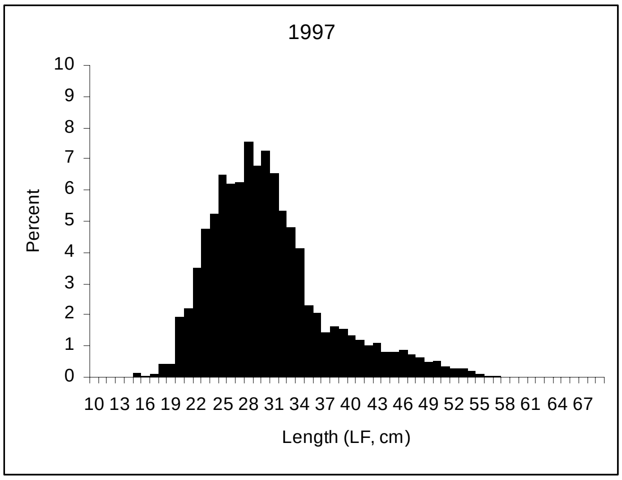

1994
Percent
Length (LF, cm)


1992
Percent
Length (LF, cm)


1995
Percent
Length (LF, cm)


1996
10
9
8
7
6
5
4
3
2
1
0
Percent
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


1999
10
9
8
7
6
5
4
3
2
1
0
Percent
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


1997
10
9
8
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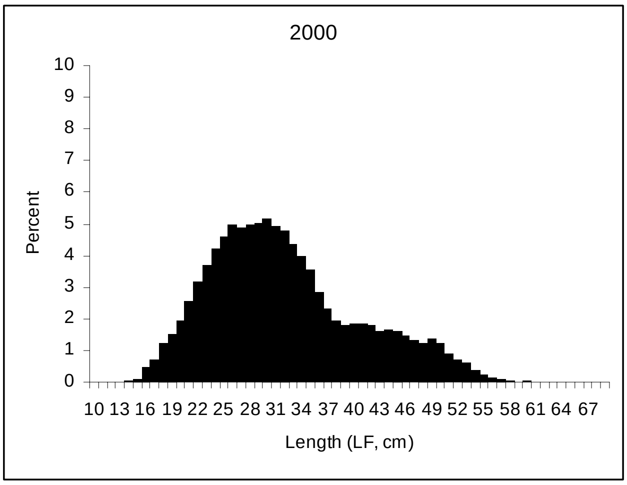
Percent
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


2000
10
9
8
7
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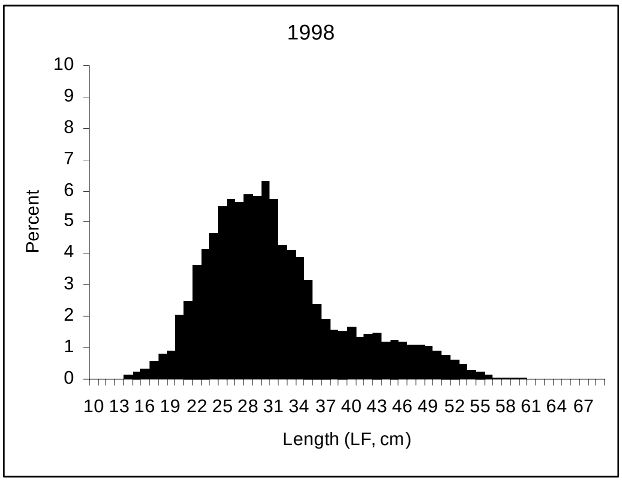
5
4
3
2
1
0
Percent
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


1998
10
9
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7
6
5
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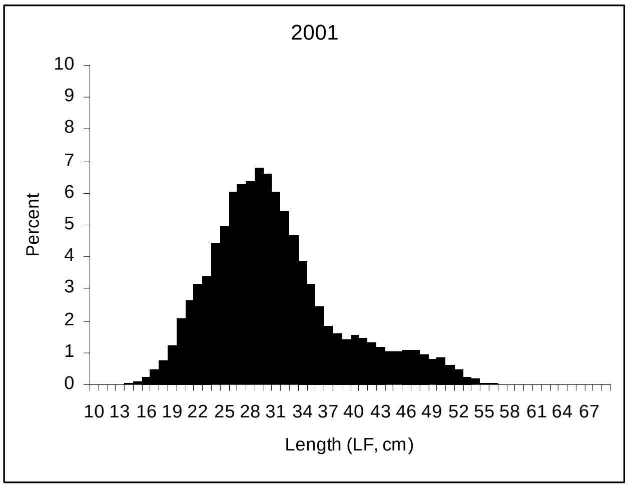
2
1
0
Percent
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)


2001
10
9
8
7
6
5
4
3
2
1
0
Percent
10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67
Length (LF, cm)

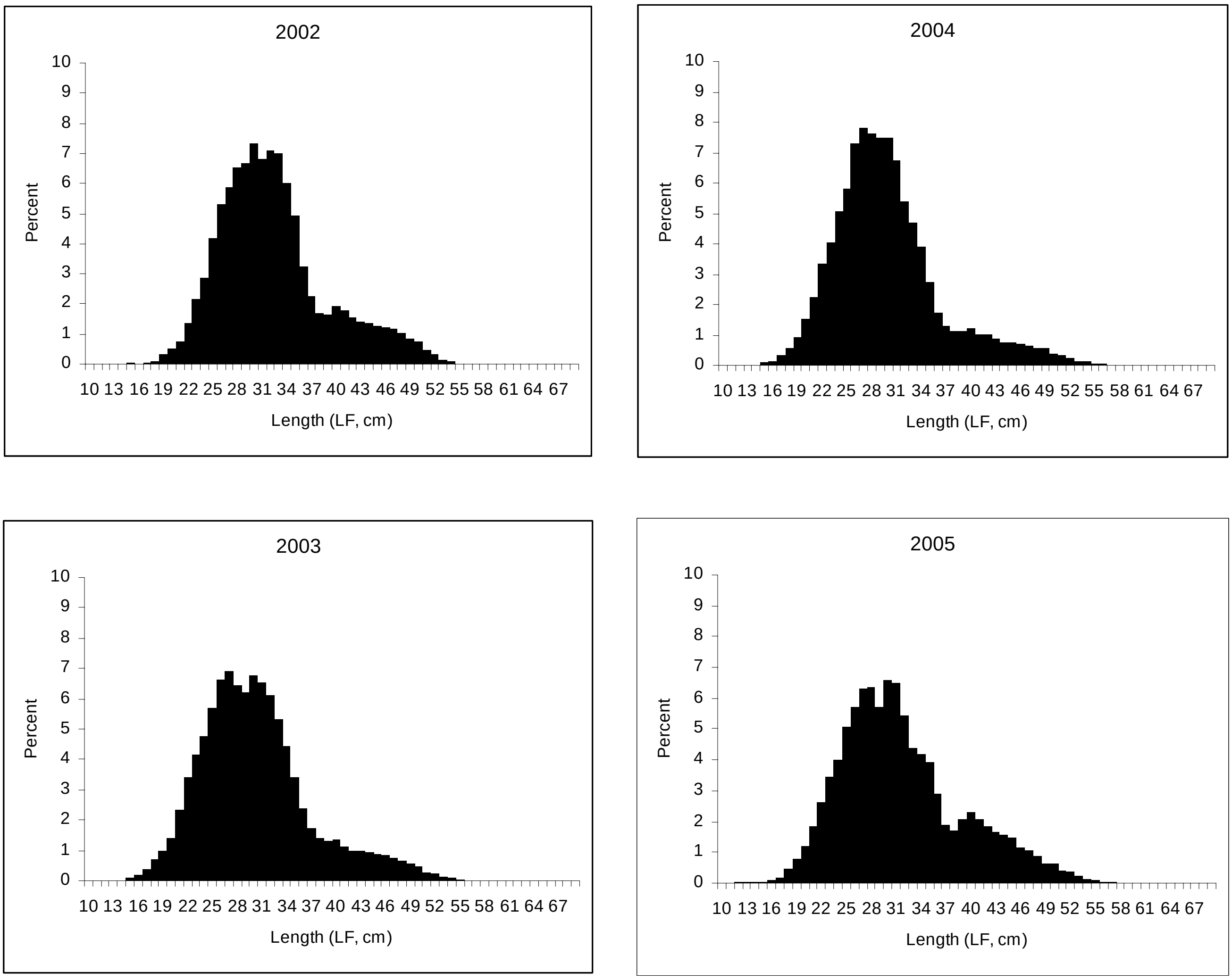


Figure 10.3.2. Fishery length composition of *Pagellus bogaraveo* from ICES area Xa2, (Azores).

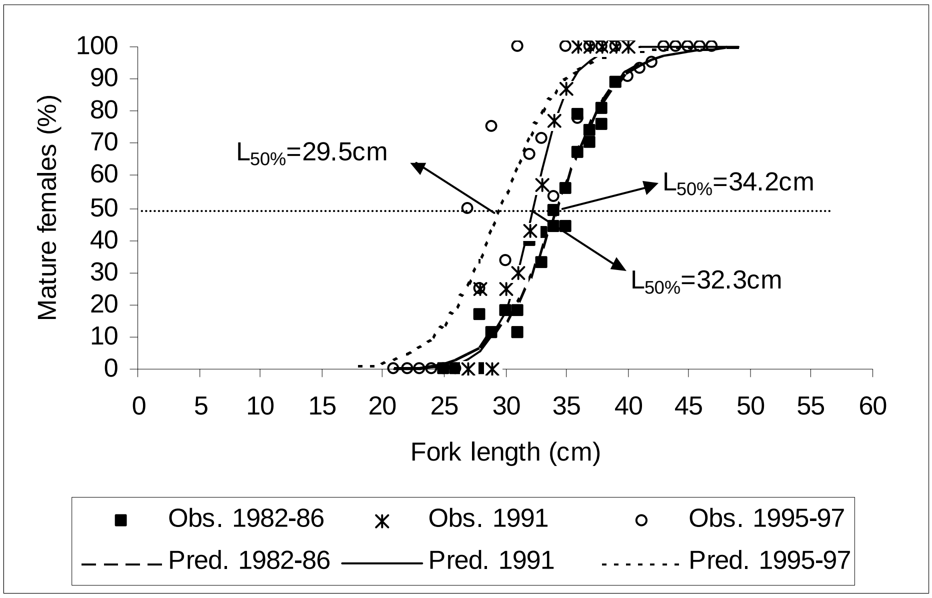


Figure 10.3.3. Maturity-at-length estimated for *Pagellus bogaraveo* from the Azores for the period 1982-1986, 1991, and 1995-1997. The lengths at which 50% of the females are mature are presented for each period.

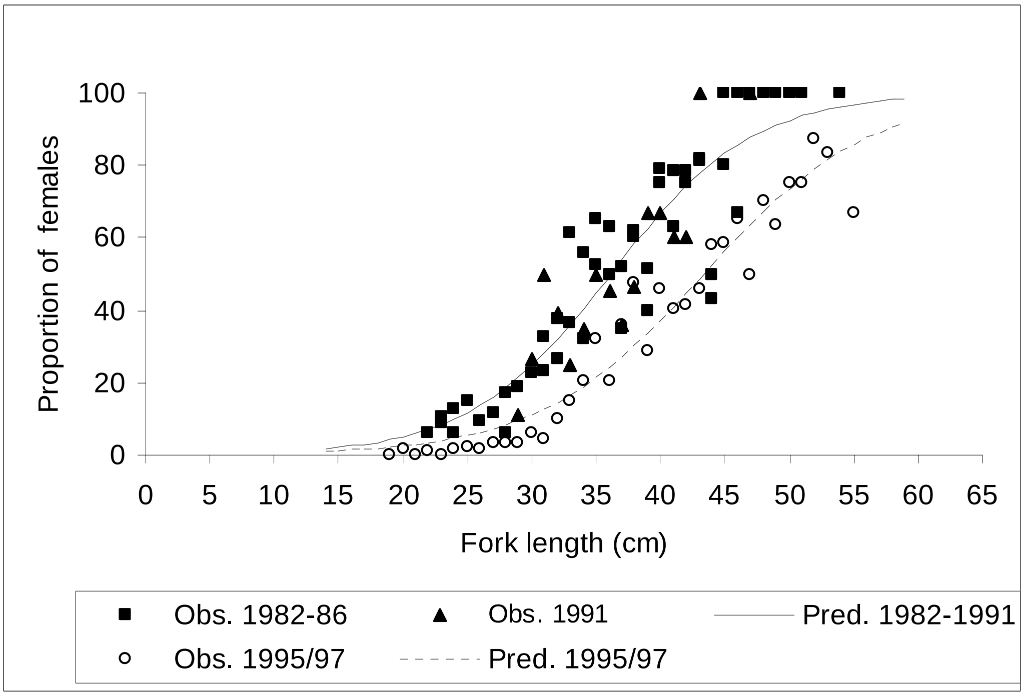


Figure 10.3.4. Observed females sex ratio for *Pagellus bogaraveo* from the Azores (ICES area Xa2), for the periods 1982-1986, 1991, and 1995-1997. Fitted curves for the periods 1982-1991 and 1995-1997 are also shown.

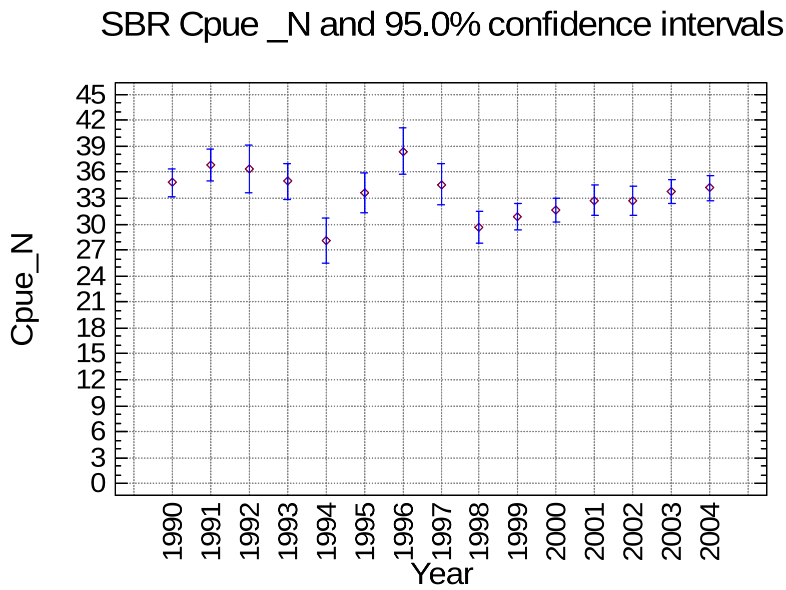


Figure 10.3.5. Annual standardized CPUE in number per thousand hooks and 95% confidence intervals for the Azores bottom longline blackspot seabream

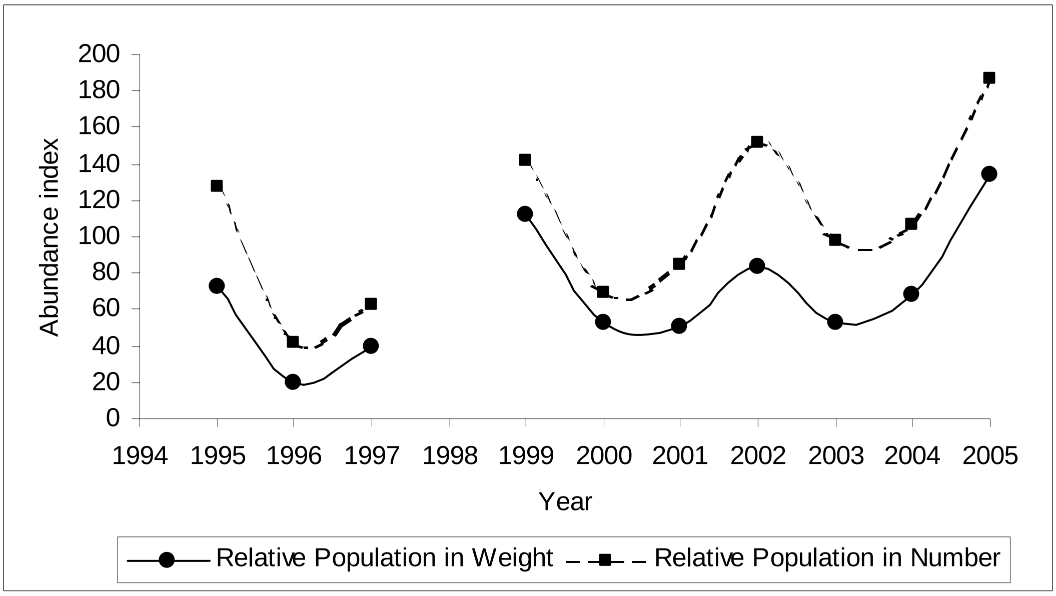


Figure 10.3.6. Annual abundance in number (Relative Population Number) and in weight (Relative population weight) of *Pagellus bogaraveo* from surveys for the ICES area Xa2.

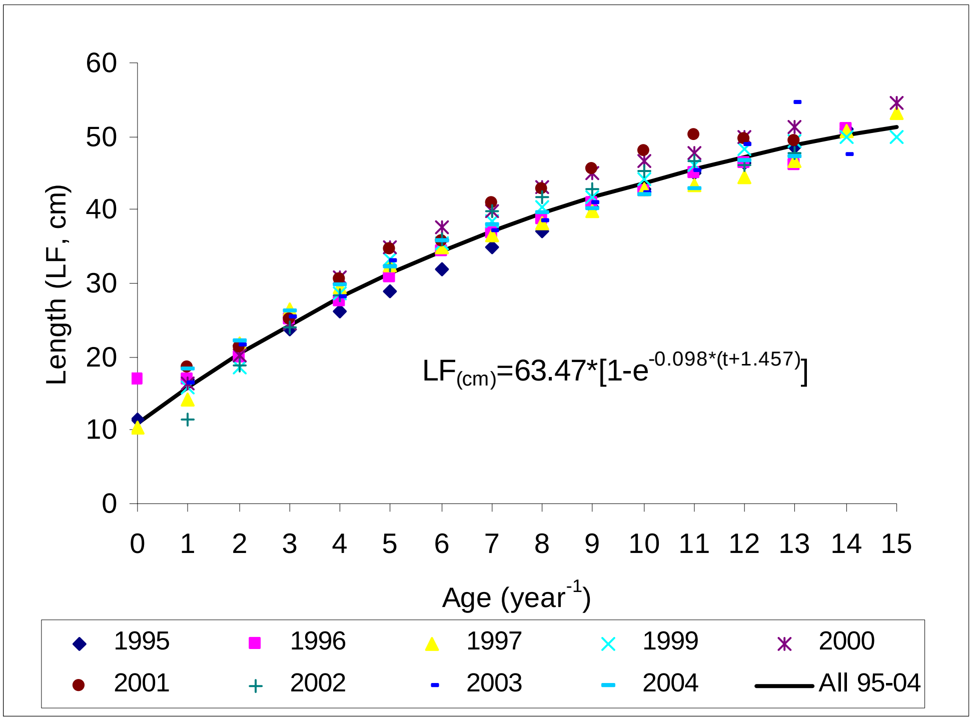


Figure 10.3.7. Estimated von Bertalanffy growth curve, for sexes combined, of *Pagellus bogaraveo* from the Azores (ICES area Xa2). Growth curves were obtained by combining mean length at age data for all survey years.

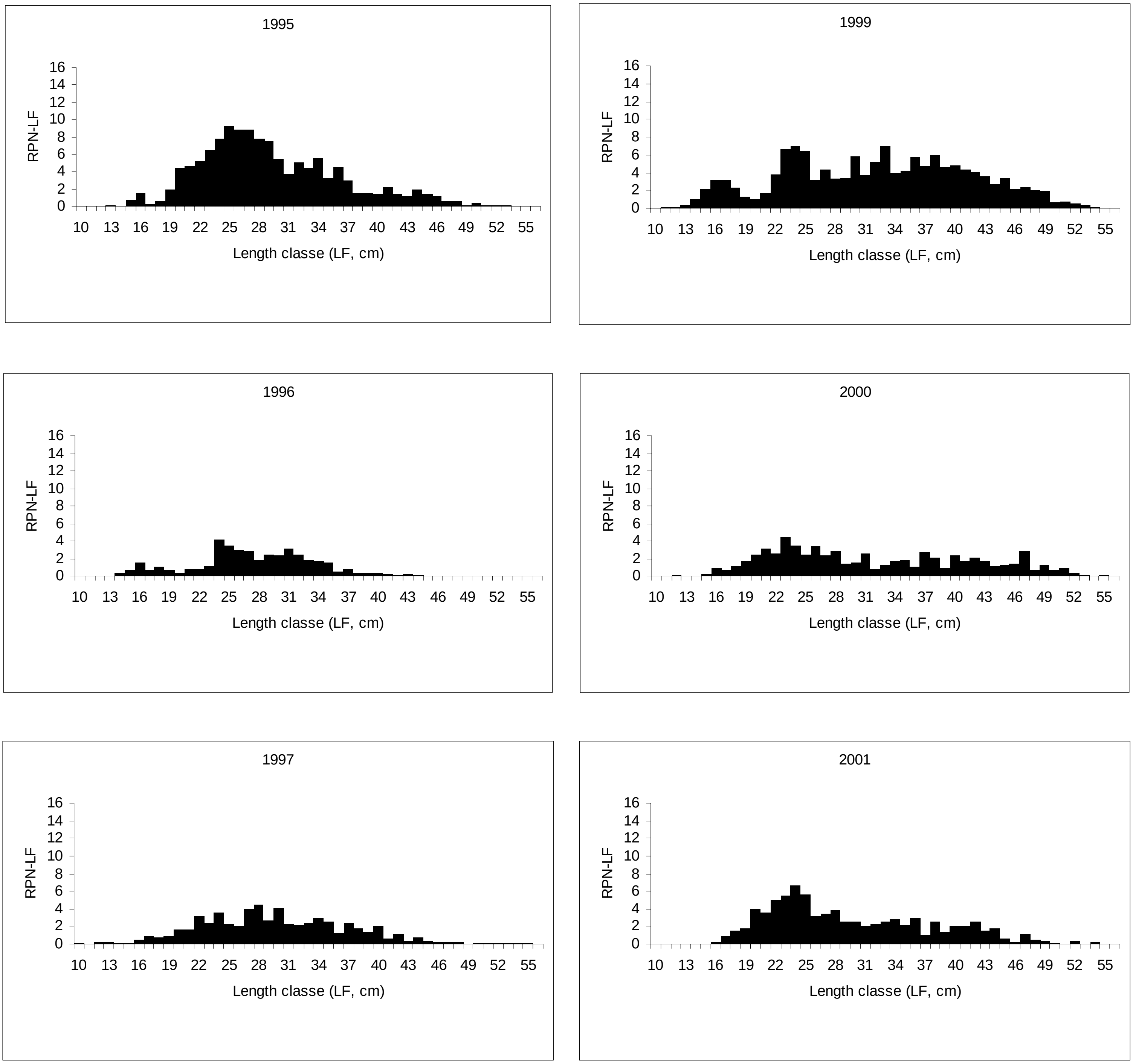


Figure 10.3.8. Annual length composition of *Pagellus bogaraveo* from the Azorean spring bottom longline survey for the period 1995-2005 (ICES area Xa2).

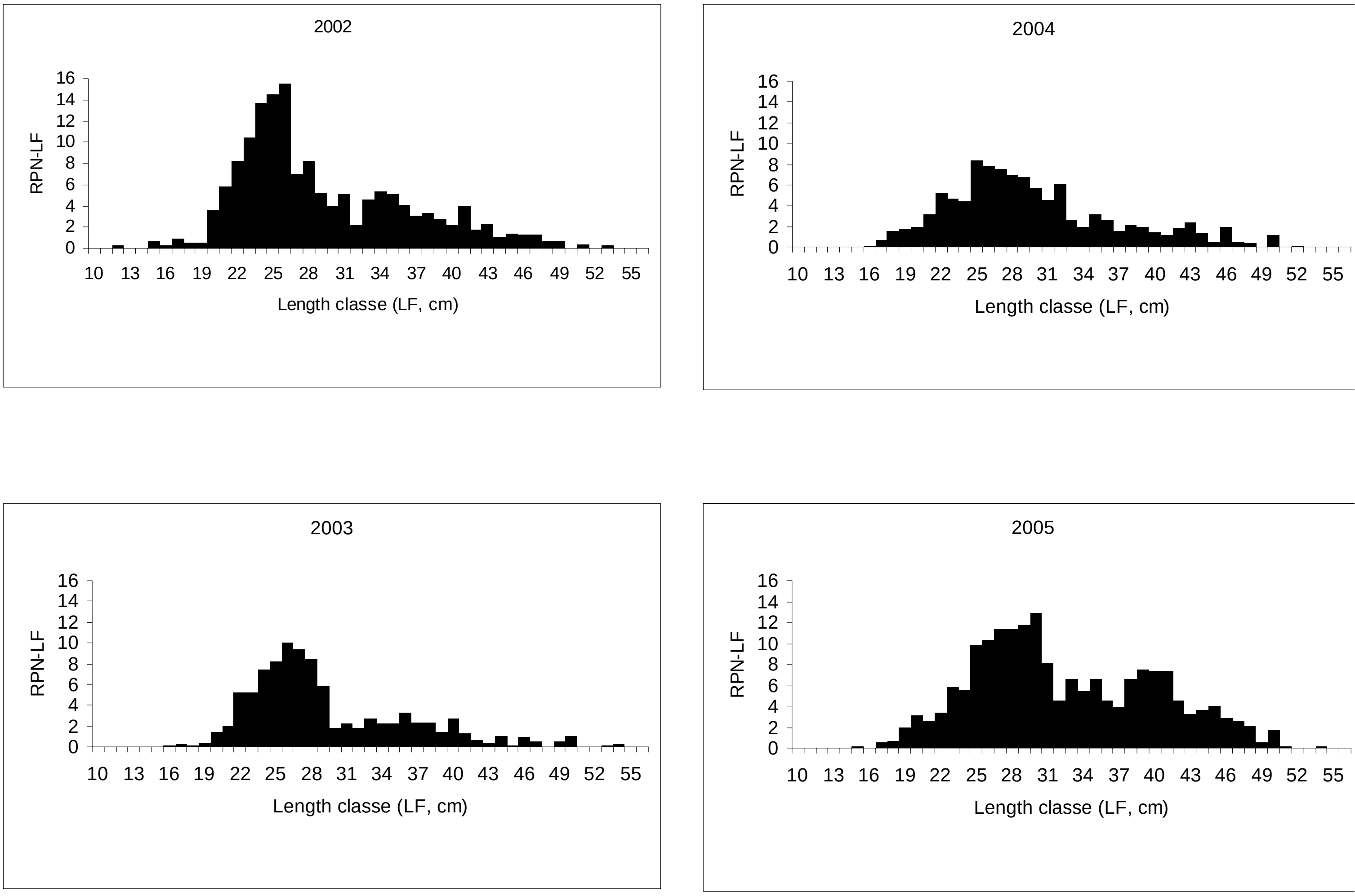


Figure 10.3.8. Cont. Annual length composition of *Pagellus bogaraveo* from the Azorean spring bottom longline survey for the period 1995-2005 (ICES area Xa2)

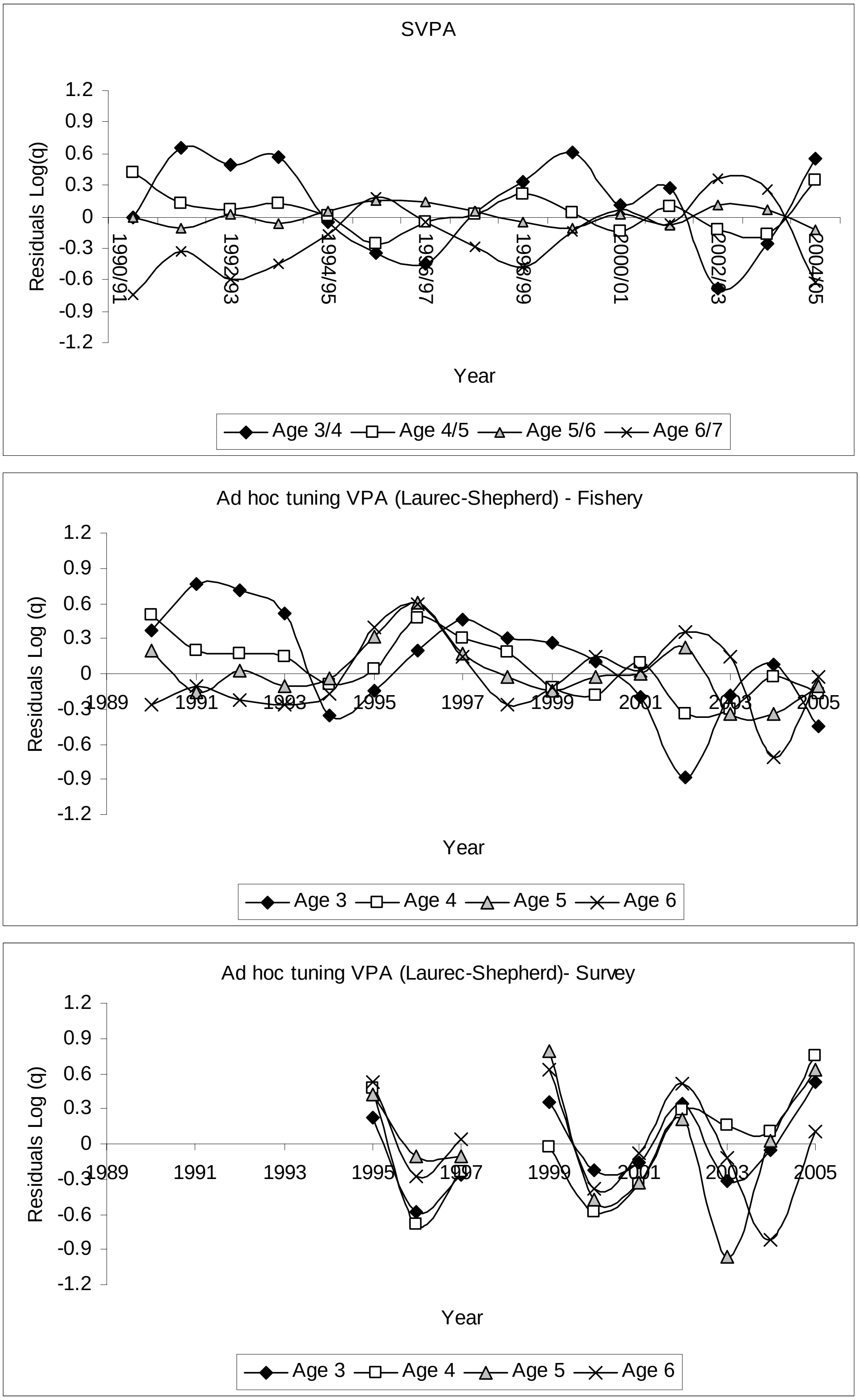
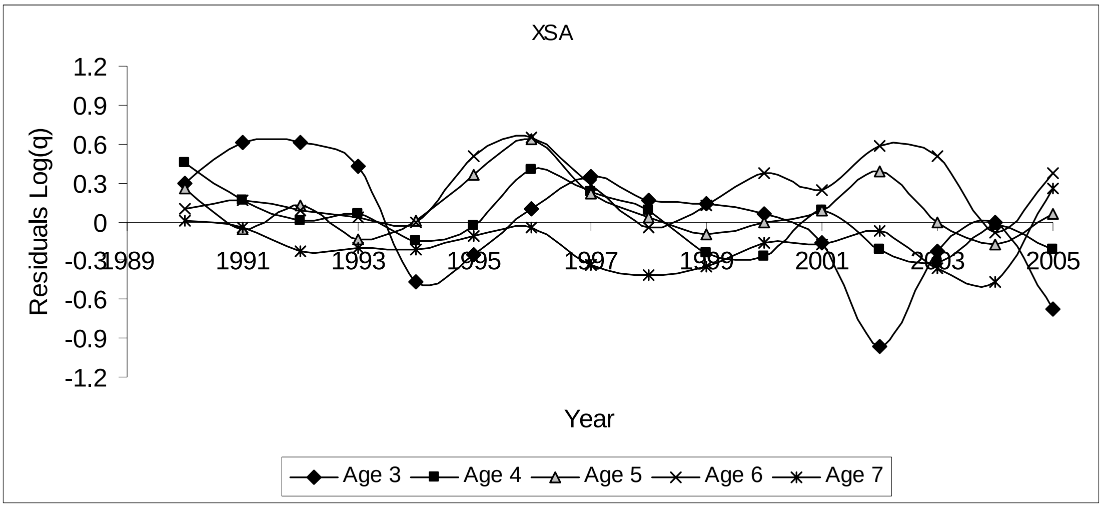


Figure 10.3.9. Log catchability residuals from SPVA (plus gr=8$^+$, R=3, Fter=0.4) and Ad hoc tuning VPA (fishery and survey fleets, plus gr=8$^+$, R=3, Shrinkage=0.5).



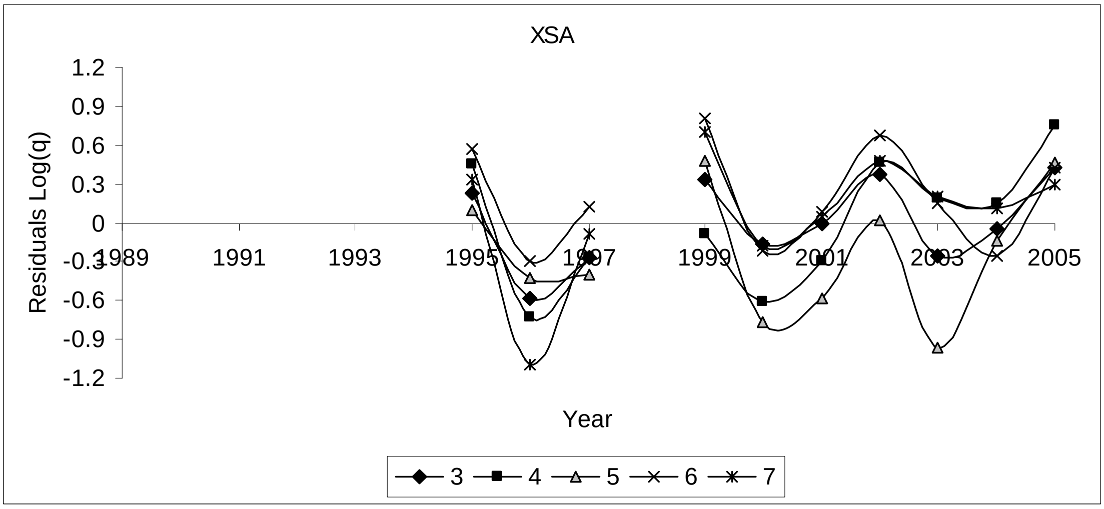


Figure 10.3.10. Log catchability residuals for the fishery and survey from XSA final run.

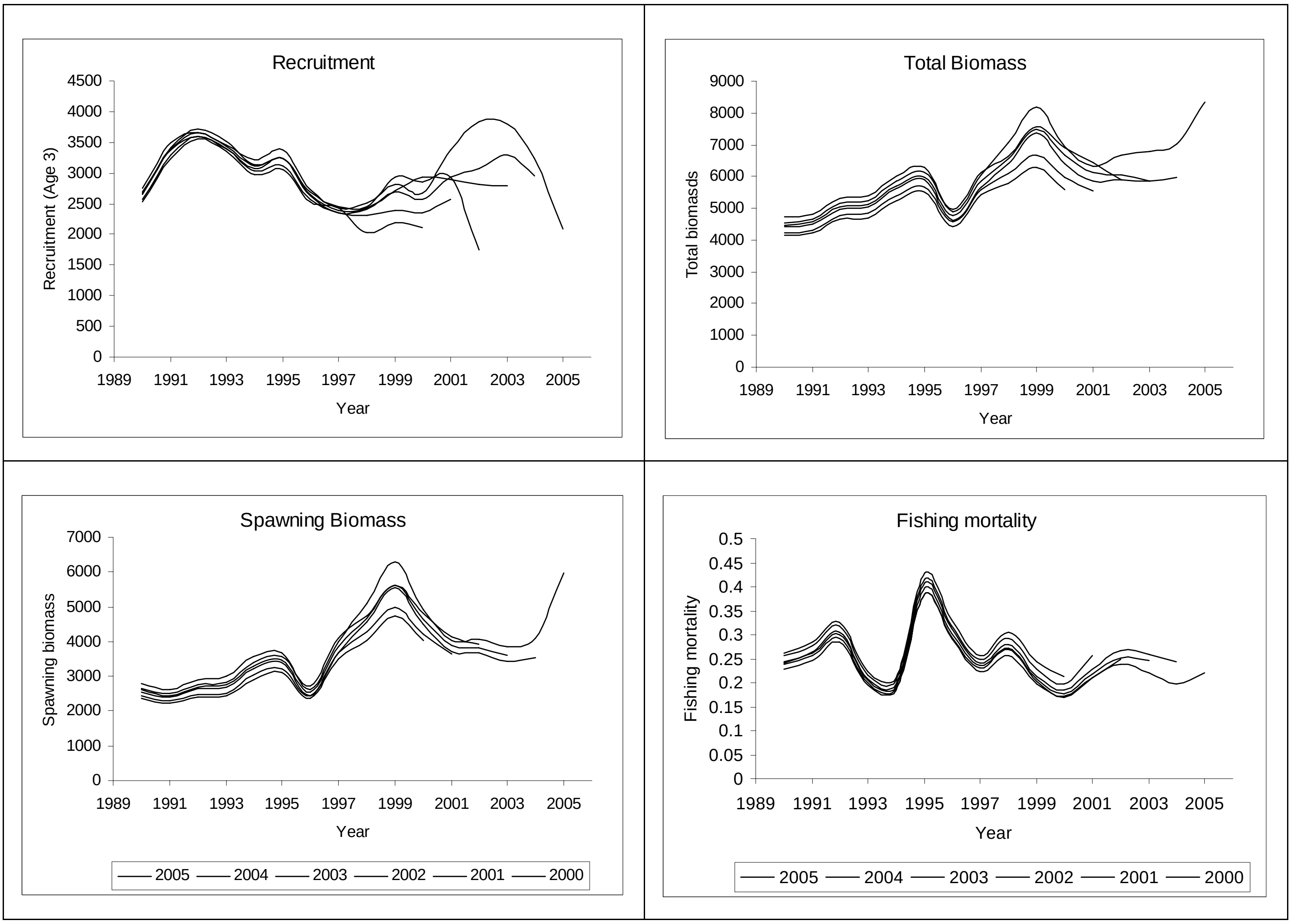


Figure 10.3.11. Retrospective analysis of estimates of recruitment, total stock biomass, total spawning biomass and fishing mortality from XSA

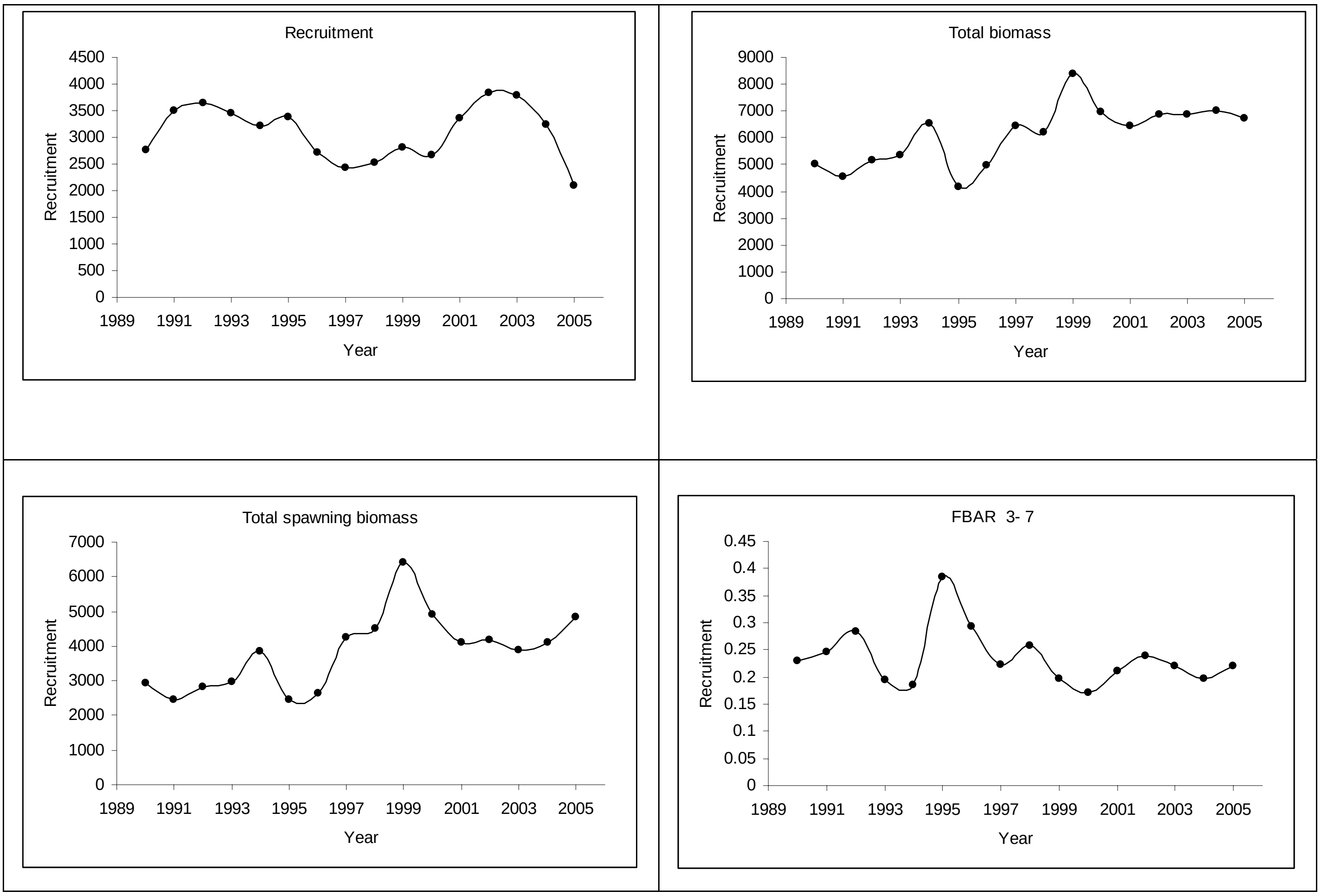


Figure 10.3.12. Stock summary for *Pagellus bogaraveo* from XSA..

Table 10.3.1. Pagellus bogaraveo landings in ICES division Xa2 since 1980.

Year	Azores	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

Table 10.3.2. Resume of the analysis performed on the assessment.

Method	Plus group	Age of Recruitment	Reference age s=1	Terminal Fs 0.4	Terminal Fs 0.5	Terminal Fs 0.6	Shrinkage Log (S.E)	Ages Dep-Indep	Retrospective analysis	Sensitive analysis
SVPA	8+, 9+ 10+	R=1	3	X						
			4	X	X	X				
			5	X						
			6	X						
		R=2	3	X						
			4	X	X	X				
			5	X						
			6	X						
		R=3	4	X	X	X				
			5	X						
			6	X						
Ad hoc tuning Laurec-Shepher	9+	R=2					NO - 0.5			
	8+	R=2					NO - 0.5			
	10+	R=3					NO - 0.5			
	9+	R=3					NO - 0.5			
	8+	R=3					NO - 0.5			
XSA	10+	R=2					NO - 0.5	4-7		
	9+	R=2					NO - 0.5	3-6		
	8+	R=3					0.5	5-6	X	X
	8+	R=3					1.0	5-6		X
	8+	R=3					1.5	5-6		X
	8+	R=3					0.5	3-3		X
	8+	R=3					0.5	3-4	X	X
	8+	R=3					1.0	3-4	X	X
	8+	R=3					1.5	3-4	X	X
	8+	R=3					0.5	3-5		X
	8+	R=3					0.5	3-6		X
	8+	R=3					0.5	4-4		X
	8+	R=3					0.5	4-5		X
	8+	R=3					0.5	4-6		X
Final Run	**8+**	**R=3**					**1.5**	**3-4**		

Table 10.3.3. XSA report file

```
Lowestoft VPA Version 3.1

   9/05/2006   8:30

 Extended Survivors Analysis

 Pagellus bogaraveo, AZORES -ICES (Xa2) WGDEEP 2006 Vigo

 CPUE data from file c:\vpa\SBRTUN.TXT

 Catch data for  16 years. 1990 to 2005. Ages  3 to   8.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                    ,    year, year,  age ,  age
 AZORESLL            ,   1990, 2005,   3,     7,   .000,  1.000
 LL Survey (RPN)     ,   1995, 2005,   3,     7,   .250,   .500


 Time series weights :

      Tapered time weighting not applied

 Catchability analysis :

      Catchability independent of stock size for all ages
      Catchability independent of age for ages >=    4

 Terminal population estimation :

      Survivor estimates shrunk towards the mean F
      of the final   5 years or the   4 oldest ages.

      S.E. of the mean to which the estimates  are shrunk =   1.500

      Minimum standard error for population
      estimates derived from each fleet =    .300

      Prior weighting not applied

 Tuning converged after   45 iterations

1
 Regression weights
       , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000

 Fishing mortalities
    Age,  1996,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005
      3,  .148,  .186,  .215,  .170,  .123,  .119,  .055,  .122,  .155,  .073
      4,  .314,  .258,  .312,  .182,  .139,  .239,  .182,  .175,  .238,  .178
      5,  .394,  .254,  .295,  .210,  .183,  .236,  .336,  .238,  .205,  .237
      6,  .403,  .272,  .276,  .261,  .263,  .279,  .408,  .400,  .227,  .324
      7,  .202,  .146,  .189,  .164,  .153,  .182,  .213,  .168,  .155,  .286

1
 XSA population numbers (Thousands)

                               AGE
 YEAR ,           3,           4,           5,           6,           7,
 1996 ,    2.72E+03, 2.33E+03, 1.40E+03, 7.76E+02, 4.23E+02,
 1997 ,    2.42E+03, 1.92E+03, 1.39E+03, 7.71E+02, 4.24E+02,
 1998 ,    2.51E+03, 1.65E+03, 1.22E+03, 8.84E+02, 4.81E+02,
 1999 ,    2.81E+03, 1.66E+03, 9.87E+02, 7.42E+02, 5.49E+02,
 2000 ,    2.66E+03, 1.94E+03, 1.13E+03, 6.55E+02, 4.68E+02,
 2001 ,    3.37E+03, 1.93E+03, 1.38E+03, 7.72E+02, 4.12E+02,
 2002 ,    3.83E+03, 2.45E+03, 1.24E+03, 8.94E+02, 4.78E+02,
 2003 ,    3.79E+03, 2.97E+03, 1.67E+03, 7.28E+02, 4.87E+02,
 2004 ,    3.24E+03, 2.75E+03, 2.04E+03, 1.08E+03, 3.99E+02,
 2005 ,    2.09E+03, 2.27E+03, 1.77E+03, 1.36E+03, 7.02E+02,
```

Table 10.3.3 (continued)

Estimated population abundance at 1st Jan 2006

,	0.00E+00,	1.59E+03,	1.56E+03,	1.14E+03,	8.06E+02,

Taper weighted geometric mean of the VPA populations:

,	3.04E+03,	2.13E+03,	1.34E+03,	8.18E+02,	4.76E+02,

Standard error of the weighted Log(VPA populations) :

,	.1782,	.1709,	.2016,	.1937,	.1520,

1

Log catchability residuals.

Fleet : AZORESLL

Age ,	1990,	1991,	1992,	1993,	1994,	1995
3 ,	.29,	.61,	.61,	.42,	-.46,	-.25
4 ,	.45,	.16,	.01,	.06,	-.15,	-.03
5 ,	.26,	-.06,	.12,	-.14,	.01,	.36
6 ,	.10,	.16,	.08,	.03,	-.01,	.51
7 ,	.01,	-.05,	-.23,	-.20,	-.21,	-.11

Age ,	1996,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005
3 ,	.10,	.35,	.16,	.14,	.06,	-.16,	-.97,	-.23,	-.01,	-.67
4 ,	.40,	.23,	.08,	-.24,	-.27,	.09,	-.22,	-.32,	-.03,	-.22
5 ,	.63,	.22,	.03,	-.10,	.00,	.08,	.39,	-.01,	-.18,	.06
6 ,	.65,	.28,	-.04,	.12,	.37,	.24,	.58,	.50,	-.08,	.37
7 ,	-.04,	-.34,	-.41,	-.35,	-.17,	-.18,	-.07,	-.36,	-.46,	.25

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age ,	3,	4,	5,	6,	7
Mean Log q,	-5.8452,	-5.3988,	-5.3988,	-5.3988,	-5.3988,
S.E(Log q),	.4418,	.2332,	.2421,	.3425,	.2614,

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
3,	1.02,	-.031,	5.80,	.13,	16,	.47,	-5.85,
4,	1.96,	-1.439,	3.22,	.14,	16,	.44,	-5.40,
5,	1.07,	-.219,	5.17,	.43,	16,	.24,	-5.29,
6,	1.00,	.011,	5.16,	.41,	16,	.24,	-5.16,
7,	.62,	2.258,	5.80,	.71,	16,	.10,	-5.58,

1

Fleet : LL Survey (RPN)

Age ,	1990,	1991,	1992,	1993,	1994,	1995
3 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.23
4 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.45
5 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.10
6 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.57
7 ,	99.99,	99.99,	99.99,	99.99,	99.99,	.34

Table 10.3.3 (continued)

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
3	-.59	-.27	99.99	.33	-.17	-.01	.37	-.26	-.05	.42
4	-.73	-.27	99.99	-.09	-.61	-.30	.46	.19	.15	.75
5	-.43	-.40	99.99	.48	-.77	-.59	.02	-.97	-.14	.46
6	-.29	.13	99.99	.81	-.21	.09	.67	.15	-.25	.43
7	-1.10	-.08	99.99	.70	-.18	.04	.48	.20	.11	.29

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7
Mean Log q	-4.4433	-4.5319	-4.5319	-4.5319	-4.5319
S.E(Log q)	.3323	.4828	.5470	.4545	.4976

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	.97	.061	4.57	.28	10	.34	-4.44
4	.46	1.362	6.24	.44	10	.21	-4.53
5	1.16	-.171	4.35	.12	10	.61	-4.76
6	.73	.574	4.97	.37	10	.30	-4.32
7	.43	1.603	5.44	.50	10	.20	-4.45

1

Terminal year survivor and F summaries :

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 2002

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
AZORESLL	816.	.455	.000	.00	1	.356	.138
LL Survey (RPN)	2409.	.349	.000	.00	1	.608	.049
F shrinkage mean	985.	1.50				.035	.115

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1587.	.27	.37	3	1.355	.073

1

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 2001

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
AZORESLL	1319.	.251	.092	.37	2	.570	.207
LL Survey (RPN)	1969.	.288	.381	1.32	2	.410	.144
F shrinkage mean	1408.	1.50				.020	.196

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1557.	.19	.16	5	.852	.178

Table 10.3.3 (continued)

```
 Age  5   Catchability constant w.r.t. time and age (fixed at the value for age)  4

 Year class = 2000

 Fleet,                     Estimated,     Int,        Ext,     Var,     N, Scaled,
Estimated
     ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 AZORESLL              ,      1128.,   .194,       .070,    .36,   3,  .652,     .240
 LL Survey (RPN)       ,      1178.,   .260,      .214,    .83,   3,  .333,     .231

   F shrinkage mean  ,      1127.,   1.50,,,,                        .016,     .241

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1144.,       .16,      .08,    7,    .509,   .237


 Age  6   Catchability constant w.r.t. time and age (fixed at the value for age)  4

 Year class = 1999

 Fleet,                     Estimated,     Int,        Ext,     Var,     N, Scaled,
Estimated
     ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 AZORESLL              ,       696.,   .171,       .233,   1.36,   4,  .642,     .367
 LL Survey (RPN)       ,    1059.,   .230,       .117,    .51,   4,  .344,     .256

   F shrinkage mean  ,       827.,   1.50,,,,                        .014,     .317

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       806.,       .14,      .14,    9,   1.025,   .324


 Age  7   Catchability constant w.r.t. time and age (fixed at the value for age)  4

 Year class = 1998

 Fleet,                     Estimated,     Int,        Ext,     Var,     N, Scaled,
Estimated
     ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 AZORESLL              ,       439.,   .153,       .090,    .59,   5,  .677,     .282
 LL Survey (RPN)       ,      410.,   .217,       .212,    .98,   5,  .311,     .299

   F shrinkage mean   ,        631.,   1.50,,,,                          .012,
.204

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       432.,       .12,      .09,   11,    .720,   .286
```

11 Stocks and fisheries of the Ionian and Aegean Seas

Deep-water fishery is not well developed in the Greek waters as a special branch of the Greek fishery. The fisheries that could be characterized as deep-water fisheries are those targeting *Pagellus bogaraveo*, *Merluccius merluccius* and *Polyprion americanus* using mainly long-lines, gill nets and trammel nets in waters >300m depth. These fishing activities are more intensive during winter, the closed period for swordfish fishery, when some vessels working on this type of fishery shift to other fisheries. The vessels exercising these fisheries are generally longer than 12 m. They are equipped with navigation instruments, depth recording devices, hydraulic winch and usually with freezer. The crew consists of 2 or 3 members and each trip lasts 1-3 days.

Bottom trawl fishing in waters deeper than 400 m is more or less sporadic and opportunistic. Target species of the bottom trawl fishery in deep waters are *M. merluccius* and *Nephrops norvegicus.* The last five years, as a result of the research activity of IMBR, *Aristaeomorpha foliacea* and *Aristeus antennatus* constitute also target species mainly at the end of the trawl fishing period, when coastal catches of bottom trawl become very reduced. Bottom trawl vessels operating in deep waters are generally longer than 24 m and their engines are more than 500 HP. They are equipped with radar, LORAN C, GPS, Sonic depth finder and winches of 16 mm diameter (2500 m long). Trips last 1-3 days.

Details for each type of fishery are described below. Although this information is not very recent, it could be considered that this overview present well the status of the deep-water fisheries in Greece since the conditions have remained almost the same. The following information has mainly been collected in the framework of the research projects EC FAIR CT 95-655 (Anon., 1999), INTERREG II GREECE-ITALY (Anon., 2001), DGXIV 00/46 (Petrakis et al., 2001), DGXIV 98/41 (Machias et al., 2001) and RESHIO DGXIV 99/29 (Mytilineou et al., 2003).

Red-Blackspot seabream (*P. bogaraveo*) deep-water fishery

The species is fished mainly in the Ionian, southern Aegean Sea and Cretan Sea with long-lines, gill nets and trammel nets on rocky banks in depths from 200 to 600 m. The fishery of *P. bogaraveo* started in early ’80s with long-lines. Recently, gill nets and trammel nets are also used. In the early years the catches were extremely high, but very soon they declined drastically. The main reasons of the decline seem to be overfishing, the introduction of gill nets, the recreational fishing and the ghost fishing (Petrakis et al., 2001). The annual landings of *P. bogaraveo* from passive gears (hooks, nets) for the years 1994-2003 are presented in Table 11.1, showing generally a declining trend (National Statistical Services-NSS data). The species is caught by hooks or nets almost uniquely in the deep waters, therefore the presented landings could be considered as the landings from the deep-water fishery of this species.

<u>Long-line</u>

This fishery, since the beginning of ’80s, is exercised in the Ionian, southern Aegean and Cretan Sea (Petrakis et al., 1999). Recently, this fishery has declined drastically in the Ionian Sea and replaced to a big extent by the gill net fishery (Petrakis et al., 2001). The length of long-line used for *P. bogaraveo* fishery is 200-500 m (smaller than those used for *M. merluccius* fishery). The total length of long-lines used per day is about 3500 m and the number of hooks is about 2500 (600-3000). The hooks are tied every 1.2-2 m. The hooks are of No 10 or 11. The bait is usually *Scomber scombrus, Trachurus spp, Sardina pilchardus* or *Sardinella aurita*. The practice is different than for hake fishery. Fishers firstly shoot one to three pieces. After 0.5-1 hour the hauling starts and when it is finished, they shoot other long-lines in the places where most fish were found during the first attempt. If the haul is successful, the long-line is destroyed because the distance between the hooks is small and the long-line is twisted. Fishing takes place on rocky banks during the day at depths from 180 to 700 m. The length of the specimens ranges mainly between 30 and 50 cm. The duration of the trip is one or two days.

The catch per day is variable. A total catch of about 80-100 Kg/day was common in the Ionian Sea in the past (Petrakis et al., 1999). The average days at sea used to be 106.4. Nowadays, the average catch is 61.7 Kg/day and the average days at sea 15.5 (Petrakis et al., 2001). *Squalus blainvillei*, *Helicolenus dactylopterus*, *M. merluccius* and *P. americanus* are reported as by catch species in this fishery.

In the southeastern Aegean Sea, at the end of ’90s, the reported in interviews catch ranged between 5-100 Kg/day and by catch species were *Squalus spp, Raja spp, M. merluccius, H. dactylopterus* and *P. americanus* (Petrakis et al., 1999).

In the Cretan Sea, during the late ’90s, the daily catch varied depending mainly on the abundance of the stock; the fishers stated that if fishing was carried out in a new ground the catch could reach 200 Kg/day, but after a few days it would decline. Nowadays, it is easy to detect the rocky banks due to the use of the depth finders and plotters, and almost all of them are known. Main by catch species in this area are *H. dactylopterus* and *Squalus spp.* In the Cretan Sea, this fishery is carried out more intensively during winter when the swordfish fishery is closed (Petrakis et al., 1999).

Gill net

This fishery, starting in 1996-97, is exercised only in the Ionian Sea. It is carried out from 200 to 600 m depth, near rocky banks, all year round, but it is more intensive during summer time, because the weather is better and the prices are higher. The mesh size of the gill nets is 80-100 mm (stretched). Each net is about 300 m long, and 6-10 pieces of nets are used per day, resulting to 1800-3500 m. Small bangs with bait are tied on the footrope of the net every 10 m. The bait is *S. pilchardus*, *S. aurita* or *Scomber spp.* The soaking time is about 4-5 hours. Considering the time that is needed for the nets to approach the bottom, the nets fish about 3-4 hours. For each piece of net, about 700 m of ropes are needed in order to connect the begging and the end of the net with buoy, and for this reason the space needed for storing the ropes is significant. Each trip lasts 1-3 days, depending on the distance of the fishing ground from the port. The proportion of the damaged nets is considered to be 25.5% and that of lost nets 12.3% (Petrakis et al., 2001).

The vessels are equipped with freezer and ice in order to keep the fish fresh. They are also equipped with depth recording devices in order to detect the rocky banks and with hydraulic winch in order to haul the nets. Their length ranges from 12-16 m. The crew is consisted of 2-3 persons.

The catch consisted almost exclusively of *P. bogaraveo* in the past. By catch species in this fishery now are mainly *S. blainvillei*, *M. merluccius*, *P. americanus* and *H. dactylopterus* (Petrakis et al., 2001). In the past, for a professional vessel the catch of *P. bogaraveo* ranged from 0-50 Kg per each piece of net (300 m). Catch ranged between 50-150 Kg/day (Petrakis et al., 1999). Recently, the estimated average catch was 65 Kg/day and the average total yearly catch was 7800 Kg. The estimated average days at sea were 57.3, whereas in the past they were 156.4 (Petrakis et al., 2001). As a response to this situation, some fishers quitted the metier, whereas others decreased the mesh size with negative consequences such as the increased quantities of discards, lower price in the market, higher pressure on the stock and reduction of the spawning biomass (Chilari et al., 2006).

Trammel net

This fishery is exercised in the central, southeastern and southwestern Aegean and the Cretan Sea. The bait used is *S. pilchardus* or *S. aurita*. Different characteristics exist in this fishery depending on the area as described below (Petrakis et al., 1999):

In the central Aegean Sea, the mesh size of the inner net is 80 mm; that of the outer net 360 cm. The height of the nets is about 1.5 m. The fishers tie small bags with bait on the footrope of the nets. Fishing is taking place in depths down to 550 m on rocky banks during the night. The most important by catch species is *H. dactylopterus.*

In the southeastern Aegean Sea, the mesh size of the inner net is 40 mm; that of the outer net 200 m. The length of each piece of net is about 300 m. Some fishers, before shooting the nets, shoot a short long-line, and if the catch is good, they start shooting the nets. Fishing takes place in depths ranging between 400-600 m.

In the southwestern Aegean Sea (eastern Peloponnissos), *P. bogaraveo* is fished in depths from 250-450 m on rocky banks with trammel nets during March to June, but this fishery is not intense.

In the Cretan Sea, the mesh size of the inner net is 90 mm; that of the outer net 450 mm. The nets are shot in depths from 150-550 m during daylight. The nets are short, about 500 m each piece. Sometimes bait is tied on the nets. Each day about 5000 m of netting is used, which is shot in pieces.

Hake (*M. merluccius*) deep-water fishery

The species is fished with long-lines all around the Greek deep-waters in depths down to 700 m. However, in the Aegean Sea, gillnets and trammel nets are also used to catch this species (Petrakis et al., 1999a). The annual landings of the species in total and per gear appear in Table 11.2, showing generally a declining trend during the last years (NSS data). No particular information could be extracted from the NSS data for the deep-water fishery landings of this species.

Long-line

The *M. merluccius* long-line fishery is carried out in depths from 400-700 m on muddy bottoms. The total length of the long-lines is 3000-6000 m depending on the capacity of the vessel. The number of the hooks ranges between 600-2000 (one hook per 5-6 m). The size of the hooks is No 6 to No 10. The bait is usually *S. pilchardus* or *Scomber spp*. The fishery is carried out all year round. Some vessel during summer are targeting *Xiphias gladius*, so during winter when the *X. gladius* fishery is closed, the effort for *M. merluccius* is higher. The time needed for shooting the long-lines is about 1-2 hours. Hauling starts 1-2 hours after the end of the shooting. The time needed for hauling is highly depended on the quantity of the catch and on possible problems when the long-lines get stuck on the bottom. The length of the vessels ranges from 5-16 m and they are equipped with navigation equipments, sonic depth finder, freezer and hydraulic winch. Each trip lasts 1-3 days. The crew of the vessels consists of 1 to 3 persons. Petrakis et al. (1999) mention also the following information:

In the Ionian Sea, during the late'90s, the reported catch of *M. merluccius* from this fishery was about 100-200 Kg/day, consisted generally of large specimens (>35 cm). Commercial by catch species in the area are *P. americanus, S. blainvillei, H. dactylopterus* and *Raja spp.* Non commercial by catch species are *Galeus melastomus, Lepidopus caudatus* and *Raja spp*. The catches of *L. caudatus* sometimes are very high and they destroy the long-lines.

In the southwestern Aegean Sea (east coast of Peloponissos), this is the only deep-water fishery that took place in quite high intensity. In the late '90s, the fishers claimed that their daily catches of hake ranged between 40-60 Kg. The main by catch species reported in the area were *H. dactylopterus*, *Phycis blennoides, Raja spp, G. melastomus, S. blainvillei,* sharks and *L. caudatus.*

In the northern Aegean Sea, the length of the long-lines used is 14000 m, the number of hooks is 2000 approximately and the distance between hooks is 7 meters. The catch, reported during the late ’90s, was up to 200 Kg per trip. Generally, the quantities of the discarded fish in the area are very low, consisted mainly of *G. melastomus.*

In the central Aegean Sea, the length of the long-lines used is 5000-6000 m and the distance between hooks 6-9 m. In the past, the hake catch was about 50-100 Kg/day. Reported by catch species in the area were *Squalus spp* and *P. americanus*.

In the southeastern Aegean Sea, the length of the long-lines is up to 20000 m and the number of hooks is about 2000 (one snood per 10 m). The hooks are of No 5-6. The fishery is extended in depths from 400 to 800 m. The bait is usual salted *S. pilchardus*. The catch, reported during the late ’90s, was 100-150 Kg/day.

In the Cretan Sea, this fishery is carried out with long-lines of 11000 m length mainly during winter. The number of hooks is approximately 1800. In the past, the catch varied between 40-120 Kg/day. As main by catch species in the area were reported *P. americanus, Raja spp, H. dactylopterus, Squalus spp* and *G. melastomus*.

<u>Gill net</u>

Gill nets are used in the Cretan Sea to catch *M. merluccius* in deep waters. The mesh size is 80 mm. Fishing is carried out on muddy bottoms at depth down to 600 m. The nets are shot in the morning and they are hauled late in the afternoon. 8-10 pieces of netting (each one 300-400 m) are used, so the total length of the net is about 2500-4000 m per day. The daily catch, reported during the late ’90s, was about 100-120 Kg/day (Petrakis et al., 1999).

<u>Trammel net</u>

Trammel nets are also used to catch *M. merluccius* in deep waters in the central Aegean all year round. The trammel nets are similar with the nets used for *P. bogaraveo.* The difference is that they place these nets on muddy bottoms during the night. In the late ’90s, the fishers claimed that their catch was about 10-15 Kg/day (Petrakis et al., 1999).

Wreckfish (*P. americanus*) deep-water fishery

The species is fished with long-lines mainly in the Ionian, southern Aegean and Cretan Sea (Petrakis et al., 1999). A variety of gears are used to catch wreckfish in the Isle of Crete (Greece). The main gears are longlines, as well as vertical lines (Machias et al., 2001). The main fishing fleet in this area targeting wreckfish consists of 34 vessels, 10-24 m long and 1400 mean gross tonnage. The wreckfish fishery in Crete seems to be also an alternate to that of the swordfish fishery; the same fleet operate on both resources, targeting wreckfish when swordfish production is low In the Cretan waters, the species is localised at specific fishing sites. These sites are characterised by seamounts, steep continental slopes and hard bottom. The fishing depth ranges between 300-1000 m; mainly between 500-850 m. Wreckfish might also be found over flat hard bottoms, but fishers seem to prefer fishing at areas of steep slope, because these are easy to locate and catches remain high (Machias et al., 2001).

The annual landings of *P. americanus* from passive gears (hooks, nets) according to NSS data for the period 1994-2003 are presented in Table 11.3, showing a peak in 1998 and a declining trend afterwards. The species is caught by hooks or nets almost uniquely in the deep waters, therefore the presented landings could be considered as landings from the deep-water fishery of this species.

Long-line

In the Ionian Sea, fishers target less and less *P. americanus,* because their catches are very low. In late '90s, the fishers claimed in interviews that if their catches are good in one area for a small period (1-2 weeks), a long time period (more than 3 years) is needed then in order to obtain good catches again. They suggested that the regeneration of *P. americanus* stocks is very slow (Petrakis et al., 1999).

In the southwestern Aegean Sea (eastern coast of Peloponisssos), fishers claimed that *P. americanus* stock declined and it almost disappeared the last years. Sporadically long-lines target *P. americanus,* but this is more experimental in order to see the situation of the stock. In the central and southeastern Aegean Sea, the species is mainly caught as by catch (Petrakis et al., 1999).

In the Cretan Sea, with regard to wreckfish, two distinct fisheries can be found: the fishery mainly targeting both big hake *(Merluccius merluccius*) and wreckfish and that mainly targeting wreckfish. In the former, long-lines cover a wide depth range, from shallow towards deep waters or vice versa; in the latter, fishers operate mainly between 500-850m. No difference was found in CPUE whenever the target species were both hake and wreckfish or only wreckfish. The difference between these two fisheries was only the contribution of wreckfish in the total catch. The by-catches of both fisheries ranged from 27–39% of the total catch. The CPUE declined as the number of hooks increased, although the total catch also increased. Furthermore, the total quantity of catches depended more on the fishing site than the fishing effort applied (number of hooks). The bottom-longlines in wreckfish fishery consist of 800 to 4,000 hooks, usually 2,500 hooks, bated with squid, mackerel, jack mackerel or gilt sardine. The main line of the gear is 2-3 mm thick, while each hook is fitted to the main line with two single lines 1.5 mm thick and 3-4 m in length. The inter-hook distance is 10-15 m (Machias et al., 2001). In 1999-2000, the mean CPUE for *P. americanus* was estimated 49.74 Kg/1000 hooks with a minimum of 10 Kg and a maximum of 116 Kg. The total landings were found 60 tons during 1999 and 47 tons in 2000. The number of fishing days per month for the vessels potentially operating on wreckfish presented a minimum value of 3 days during January 2000 and a max of 16 days in July 2000. During the period of the swordfish fishery (May-September), wreckfish landings declined. Landings during the winter months were low due to the weather conditions that do not allow long- line fishing in the open sea. The days of fishing at the wreckfish sites were few during the winter months. The wreckfish fishery seems to be highly site-specific. This means that fishermen fish in specific places whenever they target wreckfish. Consequently, the monitoring of fishing days is actually meaningless if someone do not now the target of the fishermen and the position of operation. No discarded species were found in the wreckfish fishery. Almost all by-catches were big fishes that were marketable. The main by-catches were *Conger conger, H. dactylopterus*, *P. bogaraveo*, *Raja spp, L. caudatus*, *Squallus acanthias*, *Scyliorhinus spp, Oxynotus centrina* (Machias et al., 2001).

Trammel net

In the early '90s, a trammel net fishery started in the Cretan Sea targeting *P. americanus*, but it has not be very developed. The mesh size of the inner net is 90 mm; that of the outer net 450 mm. The nets are shot in depths from 150 to 550 m during daylight. The nets are generally short (about 500 m each piece). Sometimes baits are tied on the nets (*Scomber spp* or *S. pilchardus*) (Petrakis et al., 1999).

Bottom trawl deep-water fishery

In Greece, bottom trawl deep-water fishery does not exist as a specific type of fishery. Trawlers operating in coastal waters may shift their activity in deeper waters. The deep-water bottom trawl fishing activity is exercised mainly between 400 and 500 m depth, targeting *N.*

norvegicus, M. merluccius, Trigla lyra, Lepidorhombus boscii and *Parapenaeus longirostris*. As main by catch species have been mentioned *Micromesistius poutassou* and a shrimp that seems to belong to the genus *Plesionika*. In the late ’90s, fishers stated that the catch of hake in these waters was up to 300 Kg/day, whereas the catch of this shrimps went up to 250 Kg/day. This shrimp had no commercial value in Greece and was exported mainly to Spain and Portugal. The quantity of the discarded fish was about 10% of the catch and it consisted mainly of no commercial species (Petrakis et al., 1999).

Recently, mainly after 2000, bottom trawling began to expand occasionally in waters down to 800 m. This activity occurs mainly at the end of the trawl fishing period (end of spring), when coastal catches decline. Target species in these waters are mainly *A. foliacea* and *A. antennatus*. By catch species are *Plesionika martia, Plesionika edwardsii, H. dactylopterus, L. boscii, G. melastomus* and *S. blainvillei* (Mytilineou et al., 2003).

The fishery in waters deeper than 500m depth was until now limited a) because of the inexperience of the fishers to work at these depths, b) because most of the fishers do not try to explore these areas wondering about the security of their gears and because they do not want to loose time, c) because many of the fishers do not know that important commercial stocks exist in these depths and d) because the price of the deep-water resources in the market is until now very low. During the last five years, due to the results obtained by IMBR research projects, fishing activity of trawlers in deeper waters (500-800 m) increased targeting red shrimps, *A. foliacea* and *A. antennatus* (Mytilineou et al., 2003).

Important disadvantages for the development of a Greek deep-water shrimp fishery are: a) the low commercial value of the red shrimps in Greece, as opposed to their high value in the Western and Central Mediterranean, b) concerning the fishers, the lack of knowledge on the geographical distribution of the target species and c) the lack of know how and of proper vessels, fishing gears and equipment for fishing in greater depths. Today, fishers point out that when they operate in deep-waters, the catch of red shrimps is 80 Kg/day (Mytilineou, unpublished data).

Bottom trawl vessels operating in deep waters are generally longer than 24 m and their engines are more than 500 HP. They are equipped with radar, LORAN C, GPS, Sonic depth finder and winches of 16 mm diameter (2500 m). The duration of the tows in deep waters is up to 4 hours.

Bottom trawl deep-water fishing activity down to 500 m is exercised all over the Greek waters, but mainly in the northern and central Aegean. Bottom trawl deep-water activity in waters down to 800 m is mainly exercised in the southern Ionian Sea, in the Cretan Sea and in the southeastern Aegean Sea. Three-four trawlers are operating in the deep Ionian waters. No information exists from the Aegean Sea. In the last years, Italian fishers, during the closed period for trawl in their country, operate in the deep international waters close to the Greek waters; they target deep-water red shrimps. Their Greek counterparts are also planning to follow the same practice during the prohibited period for trawl in Greece (Mytilineou, unpublished data).

Other deep-water fisheries

Long-line shark fishery

In the Cretan Sea, in the northern and southern coasts of the island, in depths from 600 to 1500 m, a fishery is carried out occasionally with long-lines targeting *Hexanchus griseus*. The species has a low commercial value, but the catch is quite high and the fishery is profitable. The length of the long-lines is about 15000-20000 m. The snood is about 2 m long. Half meter before the hook is made of wire to avoid cutting by the fish. The number of hooks is about 500. Anything available in the market is used as bait. The long-lines remain on the bottom about 12-20 hours. The duration of each trip is 1-5 days. This fishery is carried out during all year round. At the end of ’90s, fishers had pointed out that catch consisted of large specimens (100-200 Kg each one) and that catch would be 1000 Kg/day. *Conger conger* and *Squalus spp* have been mainly mentioned as by catch species (Petrakis et al., 1999). No recent information exists on this fishery.

In the central Aegean, during the late ’90s, a long-line fishery targeting a shark species was exercised even thought it was not intense. The identification of the species was not possible, but it was supposed that it belonged to the Hexanchidae family, and probably was *Hexanchus griseus* (Petrakis et al., 1999). The long-lines used were reported to be about 6000 m; the hooks were No6 and the distance between them 10 m. The snoods were of rope instead of nylon. The last part of the snoods, which is connected to the hooks, was of wire to avoid cutting by the teeth of the sharks. This fishery was extended in waters down to 1200 m. The price in the market was low, but the quantities were high, and the fishers had a sufficient income (Petrakis et al., 1999). No information about this fishery exists nowadays.

Management

The regulations existing so far for Greek waters that could be related to the deep water fisheries are mainly the following: a) those established by the national legislation, concerning the limit of fishing licenses (no more licenses are issued), a closed period for the bottom trawl fishery during summer time (June-September) and the closure of areas to trawl and b) those established by the EU, in the framework of the Common Fishery Policy in the Mediterranean Sea, concerning the minimum landing size for some species, the minimum mesh size of 40 mm for the trawl cod-end and finally a ban for fishing activities in more than 1000 depth. No measures exist for nets and long-lines.

Among the commercial species of deep-water fisheries in Greece, minimum landing size (MLS) exists for *P. bogaraveo*, *M. merluccius*, *P. americanus*, *Lophius budegassa*, *Lophius piscatorius*, *L. boscii*, *N. norvegicus*, *P. longirostris*, *A. foliacea* and *A. antennatus*,.

For all *Pagellus* species, the same MLS of 12 mm has been established. Considering *P. bogaraveo*, the catch from deep-water gill net fishery consists of fish larger than 15 cm (Petrakis et al., 2001); that from deep-water bottom trawl of larger than 13 cm (Mytilineou, unpublished data). Individuals of lower size segregate in shallow waters (Mytilineou & Papaconstantinou, 1995) exploited by coastal fishery; however, they do not constitute target of this fishery. No detailed studies concerning the reproductive biology of *P. bogaraveo* exist. Anyhow, the established minimum landing size seems to be very small for this species since female specimens smaller than 24 cm (age 5) were found to be immature (Chilari et al., 2006; Mytilineou, unpublished data). A specific minimum landing size should be defined for *P. bogaraveo* taking into account the biology (growth, first maturity, hermaphrodism) of this species.

The catch of *M. merluccius* from long-line or net fisheries in deep waters consists of larger than 20 cm TL specimens (Petrakis et al., 1999), which coincides with the established MLS; however, that from deep-water bottom-trawl consists of quite smaller specimens, beginning from 10 cm TL (Mytilineou, unpublished data). Length at first maturity has been estimated between 30-36 cm (Tsimenidis et al., 1978; Mytilineou & Vassilopoulou, 1988) that shows that part of the fished specimens are not reproductive for at least once in their life. Based on the above mentioned, established measures should be reassessed and a larger minimum landing size should be legislated for this species.

The MLS of *P. americanus* is 45 cm. The length at first maturity of this species has been estimated 70-80 cm (Machias et al., 2001). Taking into account the biology of the species, a larger minimum landing size should be applied for this species too. Since the size of fish caught in deep-water long-line fishery is larger than 70 cm (Machias et al., 2003), the problem seems to be related more with other fisheries (purse seine, FADS, drift nets) at which small specimens (<50 mm) are caught during the pelagic phase of the life cycle of the species. For this reason, it has been proposed the increase of MLS at least to 65 cm (the estimated upper end of the settlement range) to avoid catches of juvenile fish (Machias et al., 2003), which is also close to the length at first maturity.

Regarding all other species, caught by the deep-water bottom trawling, their MLS is in most of the cases (except for *P. longirostris*) lower than the length at first maturity. Minimum landing sizes should be reconsidered in order to protect the juveniles and the spawning stock.

Urgent measures should also be taken for *P. bogaraveo*, *M. merluccius* and *P. americanus* deep-water fisheries concerning long-lines, gill nets and trammel nets. *P. bogaraveo* and *P. americanus* catches have declined during the last years (Table 11.1 & 11.3). Moreover, *M. merluccius* stocks are generally overfished in the Greek waters (Papaconstantinou & Stergiou, 1995). Therefore, established measures should be reassessed and specific measures should be legislated for the used gears. The mesh size of 90mm and closure during the reproductive period have already been proposed for gill net red seabream fishery (Petrakis et al., 2001).

Bottom trawl deep-water fishery is not well developed in Greece. However, under the perspective of an inevitable future development of this fishery, studies focusing on pristine stocks (like red shrimps) and virgin deep-water environments should be promoted; such studies provide a rare opportunity in order to achieve a sustainable management, and we have to take advantage of that before their exploitation takes place. A precautionary approach should be applied to management. Measurements for cod-end mesh size, closed seasons and areas should be proposed. Selectivity studies for deep-water bottom trawl carried out in Italian waters showed that cod-end mesh size should be more than 50-60 mm (Carlucci et al., 2006). In addition, a closed period between spring - early summer for deep-water red shrimp fishery should be implemented (Anon., 2001; Mytilineou et al., 2003). In western and central Mediterranean, where bottom trawl fishery in deep waters is carried out for many years, some of the deep-water stocks are already overexploited (the case of *A. foliacea* in the Italian Ionian: D'Onghia et al., 1998; Mytilineou et al., 2001), and other almost disappeared (the case of *A. foliacea* in the Ligurian Sea: Orsi-Relini & Relini, 1985, and the Gulf of Lion: Campillo et al., 1999).

Taking into consideration the low growth rate, the low fecundity and the retarded reproduction characterising most of the deep-water resources, management of the deep-water fishery should be designed with precaution. Essential fish habitats, including nursery, feeding and spawning grounds should be defined. Closed areas and seasons should be established to protect the young of the year and the reproductive biomass. Minimum landing sizes should be adjusted according to the length at first maturity. Measures for the mesh sizes should be proposed according to selectivity studies.

Regulations for international deep waters in the Mediterranean Sea should also be defined since stocks are extended outside the geographical boundaries of the countries. Fishers operate in these waters without any particular regulation since these marine areas are not subjected to national legislations. Reduced catches of coastal species have increased fishing pressure on deep-water fishes. This increasing trend implies the requirement for management measures to be implemented for these stocks, especially if the hypothesis of shared stocks is taken into account.

Table 11.1. Annual landings (t) of *P. bogaraveo* from passive gears (hooks, nets) in the Greek waters for the years 1994-2003 (NSS data).

YEAR	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
t	437.6	568.1	317.6	375.4	510.8	444	314.5	261.9	242.9	294.1

Table.11.2. Annual landings (t) of *M. merluccius* in total and per gear in the Greek waters for the period 1994-2003 (National Statistical Services).

YEAR / GEAR	TRAWL	PURSE SEINE	BEACH SEINE	OTHER	TOTAL
1994	3,647.0	36.0	393.6	2,313.3	6,389.9
1995	2,806.0	47.6	318.1	2,196.6	5,368.3
1996	2,386.1	68.9	283.2	1,842.3	4,580.5
1997	2,111.3	42.7	217.0	1,846.3	4,217.3
1998	1,669.8	34.3	166.0	1,388.1	3,258.2
1999	1,751.5	55.3	213.5	1,106.6	3,126.9
2000	1,839.1	13.1	129.2	987.1	2,968.5
2001	1,588.2	38.8	136.5	989.6	2,753.1
2002	1,541.8	20.3	196.3	1,171.5	2,929.9
2003	1,817.8	9.6	153.4	1,180.6	3,161.4

Table 11.3. Annual landings (t) of *P. americanus* from passive gears (hooks, nets) in the Greek waters for the period 1994-2003 (NSS data).

YEAR	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
t	100	100.7	69.4	77.6	149.2	123	86.2	62.3	58.7	65.1

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 Sub-area 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 1988-2005 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 in the subsequent years to about half that level. The provisional figure for 2005 is 5747 tonnes.

In Division VIa the statistics are incomplete for the period 1989-1993. In the period 1994-2005 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 1994-2005, 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 2005 is only 3783 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).

Ling from several of these Subareas is included in an ongoing Norwegian population structure study using molecular genetics, and new data may thus be expected in the future.

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 *et al.* (WD4, 2006). 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 2000-2005. 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.

A first analyses based on these two sources of data was presented in a WD by Helle and Bergstad (2006). 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 1992-2005.

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 (WD3, 2006). The number of high-seas longliners has declined in recent years (Table 12.1.1), from 72 to 39 in the period 2000-2005. The remaining vessels have maintained a annual landing level of 300-500 kg/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 2000-2005 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 2000-2005 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.

12.1.5 Comments on the assessment

The CPUE series of the main fleet landing ling (Norwegian longliners) suggest that the abundance has remained at a reduced level after the decline in the 1970s to 1990s. An upward trend in most Subareas in the most recent years may indicate a certain increase in abundance.

The Danish and Basque CPUE series from trawlers extending back to the 1990s display variation without any trends.

12.1.6 Management considerations

A major fleet in the ling fishery is the Norwegian high-seas longliners. The number of vessels has declined markedly in recent years. Although estimates suggest a decline in number of hooks set per year in Subareas IV, VI, VII, and VIII, it is uncertain if the current management has effectively reduced effort by 30% compared with the level in 1998 (ref. ICES advice from 2004). It is furthermore uncertain if the current management of by-catch fisheries by e.g. trawlers is in accordance with ICES advice from 2004. Based on the current perception of status and trends in the stock(s), there is no basis to suggest amendment of the advice statement from 2004.

Reference points that were previously assigned to ling were:

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

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

where U is a smoothed relative abundance index. If the CPUE from Norwegian long liners is accepted as a valid abundance index, an evaluation in relation to reference points may be proposed. The CPUE estimates from the 1970s were rather variable, but the average CPUE was probably around 200, 350, and 160kg/1000 hooks in Division IVa, VIa, and VIb respectively. By comparison, the 2000-2005 mean CPUEs were 50-60kg/1000 hooks, thus below $U_{pa,}$. In Division VIa the recent CPUE may also be below U_{lim}. Considering that ling in IVa, VIa and VIb was fully exploited and perhaps overexploited prior to 1970, this assessment is probably reasonable.

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**

*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	3	47	55		4067	4	12		861	**5747**

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

LING IVb,c

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		986			100	187	106	45		**1424**
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	27	17	6	13		**152**

Table 12.1.0. (continued)

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*				421		89	1389	61	1			747	**2708**

*Preliminary. [1] Includes VIb until 1996 [2] Includes minor landings from VIb.

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*		30	4	17	628		9		48	356	**1092**

*Preliminary. [1] Includes XII. [2] Until 1966 included in VIa. [3] Included in Ling VIa.

Table 12.1.0. (continued)

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	

Table 7.1. 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			14	**60**

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

LING VIIb,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*	140	11	208			17		41	**417**

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		667		236			**914**

Table 7.1. continued
LING VIIf

Year	Belgium	France (1)	Ireland	E & W	Scotland	**Total**
1988	77	-1	-	367	-	**444**
1989	42	-1	-	265	3	**310**
1990	23	-1	3	207	-	**233**
1991	34	-1	5	259	4	**302**
1992	9	-1	1	127	-	**137**
1993	8	-1	-	215	+	**223**
1994	21	-1	-	379	-	**400**
1995	36	110	-	456	0	**602**
1996	40	121	-	238	0	**399**
1997	30	204	-	313		**547**
1998	29	204	-	328		**561**
1999	16	108	-	188		**312**
2000	15	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	304	7	82		**429**

*Preliminary. (1) See Ling VII.

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		598	12	539		484	313			2	**1963**

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

Table 12.1.0. (continued)

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*		327		141	19		**487**

*Preliminary

Table 7.1. 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**

*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*							

*Preliminary.

Table 7.1. continued
Ling, total landings by Sub-areas 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	1424	8577	1124		210	2201	1477	399	6850	1041		2	0	36412
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	5747	152	2708	1092		60	417	914	429	1963	487		1	0	14180

*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 2000-2005.

All species	2000	2001	2002	2003	2004	2005
IIIa	+			1		
IVa	20	23	22	18	29	15
IVb	1	1	1	1		
VIa	13	13	6	10	15	19
VIb	5	4	5	3	5	16
VIIc	2	1			3	1
XII	+	3		2		
XIVb	6	4	6	5	11	15

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 2000-2005. n= the total number of days with hook information contained in the logbooks.

	2000		2001		2002		2003		2004		2005	
	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	32756	287	34224	107
IVb	30263	38	31478	23	33867	15	32559	34				
VIa	22808	433	24599	435	21465	185	29517	290	25927	151	23962	131
VIb	31023	178	30772	127	31597	149	31325	97	29000	46	35956	114
VIIc	29383	81	33108	37					35518	27	33427	7
XII	13500	4	15389	108			12510	51				
XIVa	28333	6										
XIVb	2815	191	2465	135	13177	162	15480	157	12474	105		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 2000-2005 in the fishery for ling (with a by-catch of tusk and blue ling).

	2000	2001	2002	2003	2004	2005
IIIa	256			1599		
IVa	41333	45176	40764	30621	40424	20402
IVb	2435	1426	1016	1985		
VIa	20914	21077	7942	15349	16834	17489
VIb	11694	7698	9416	5448	5736	22837
VIIc	5040	2413			4124	1304
XII	114	3274		1144		
XIVb	1139	655	4269	4358	5632	

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:

	2000			2001			2002			2003			2004			2005		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
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	86.9	284	1.8	71.6	107	3.7
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	107	151	2.5	122.7	131	3.3
VIb	45.9	127	2.4	35.8	114	2.1	37.6	149	1.5	67.9	85	2.2	80.1	45	4.7	68.4	114	3.6
VIIc	82.9	78	3	78.4	37	3.7							123.3	27	6.0	66.4	7	14.4
XIVa	3.75	6	11.1															

Reference fleet data:

	2001			2002			2003			2004			2005		
Area	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se	CPUE	n	se
IVa							31.1	40	3.71	99.8	83	3.66	82.6	99	4
VIa							83.3	43	3.58						
VIb				59.4	5	8.71	31.1	34	4.02						

Table 12.1.5. 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		
	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	45	305	1.8	57.3	481	1.7

Reference vessels:

	2001			2002			2003			2004			2005		
	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

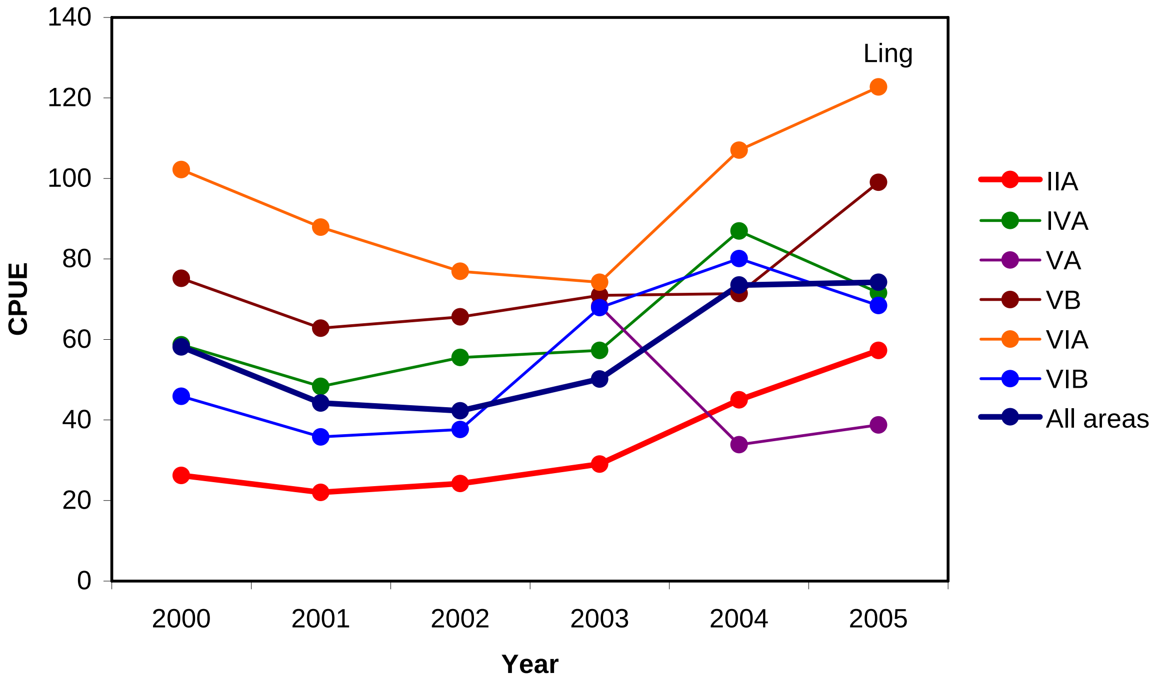


Figure 12.1.1. Estimated mean CPUE ([kg/hook]x1000) based on data from the official log books for tusk and ling in each ICES Subarea and all areas combined for the years 2000- 2005.

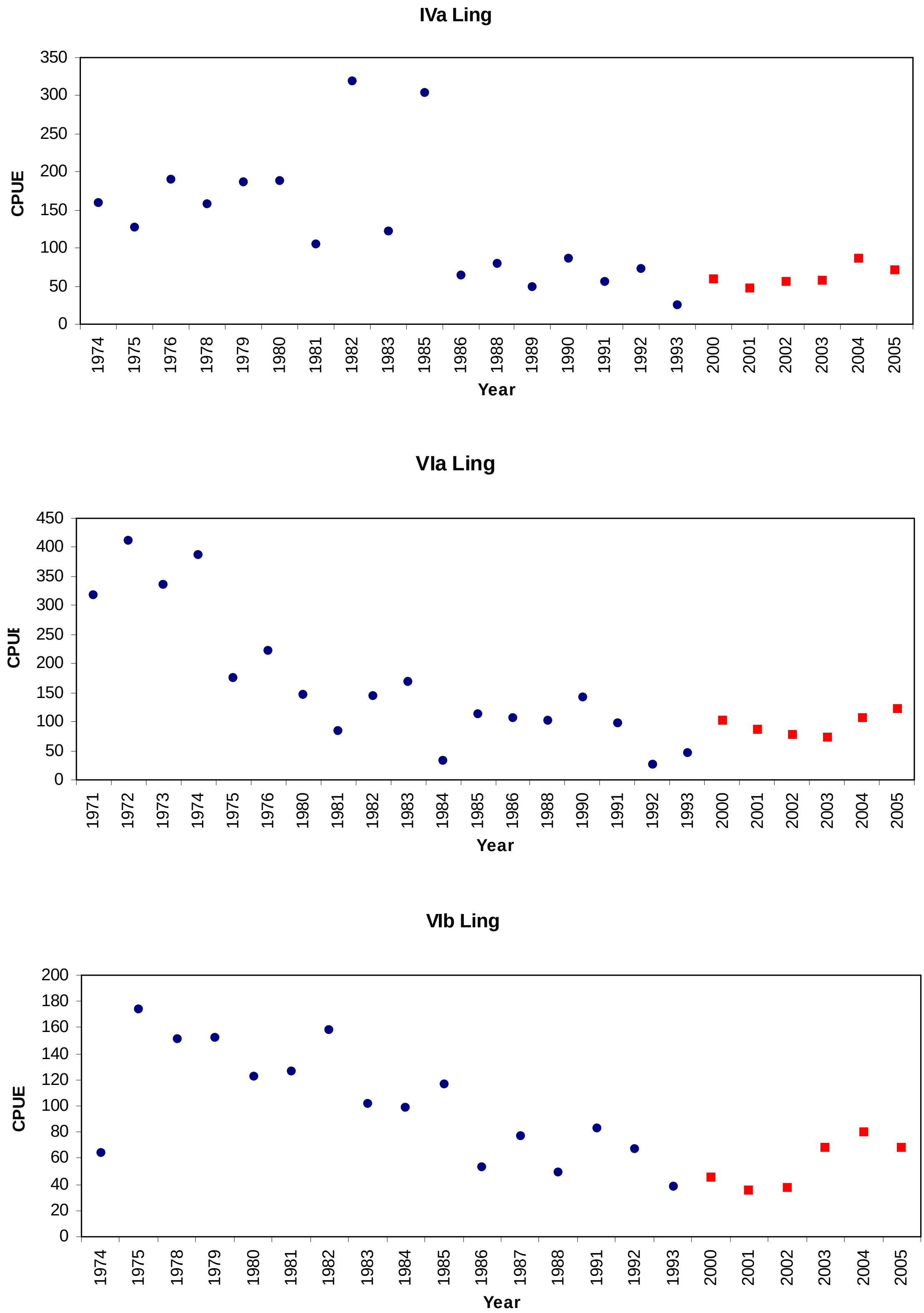


Figure 12.1.2. Estimates of CPUE (kg/1000 hooks) of ling based on skipper's logbooks (pre-2000, dots) and official logbooks (post 2000, squares). Combination of data from Bergstad and Hareide (1996) and WD3 by Helle (2006). Note gap in time series between 1993 and 2000, and the differences in CPUE scale between areas.

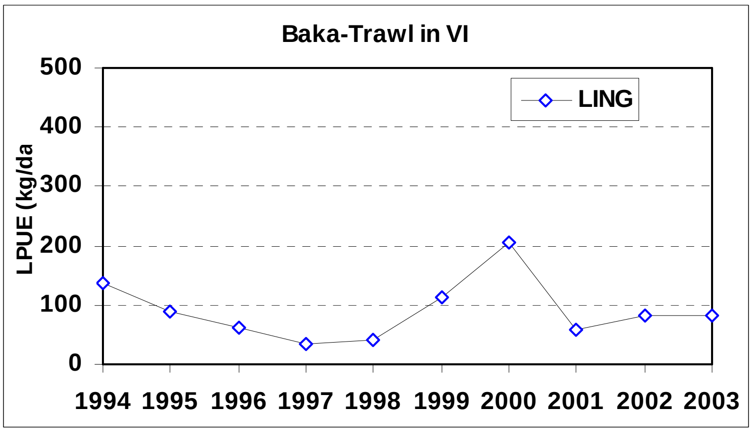


Figure 12.1.3. Landings per fishing effort of ling in ICES Sub-area VI, of "Baka" trawlers of the Basque Country, in 1994-2003. (Data on 2003 are preliminary). LPUE = kg/(Nº trip*(mean fishing days/trip) = kg/day)

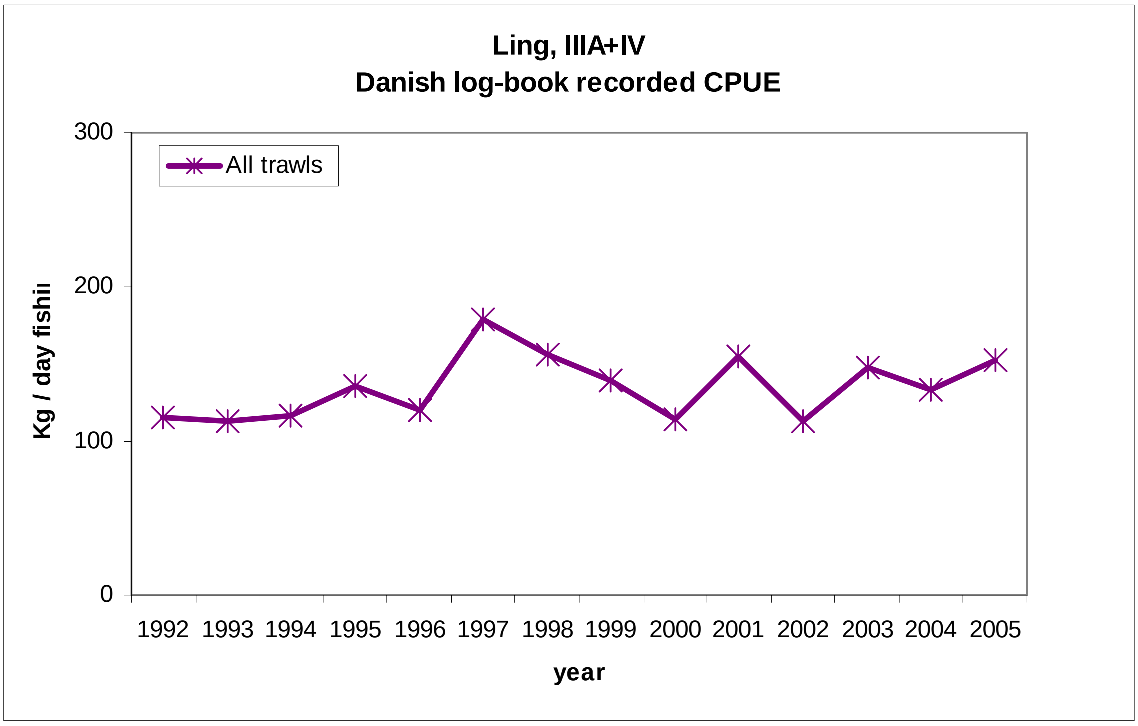


Figure 12.1.4. CPUE of ling for Danish trawlers in Subareas IIIa and IV. Based on logbook data.

12.2 BLUE LING (*MOLVA DYPTERYGIA*) IN I, II, IIIa, IV, VIII, IX, X, XII

12.2.1 The fishery

Blue ling has been an important by-catch in trawlers fisheries for mixed deep-water species on Hatton bank (Sub-area XII). In other ICES areas, blue ling is taken in small quantities.

12.2.1.1 Landings trends

Annual landings from Sub-area XII have fluctuated from just a few tonnes to over 3000t. Annual landings from Sub-area II have declined from around 3500t in 1988 to around 200t in 2005 (Table 12.2.0). Landings in III, although still small, have increased in recent years and are a by-catch in the Danish fishery for roundnose grenadier in this area.

12.2.1.2 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.

12.2.1.3 Management

In 2005 there was an EC TAC for EU vessels fishing for blue ling in EU and international waters in II, IV and V of 119 t per annum 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	23 (in II and IV)
III	25	48

12.2.2 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 one in Sub-area XIV and Division Va with a small component in Vb, and a southern one 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 must be that the 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. Sub-area VI comprises part of Hatton Bank and for future assessments it is suggested that this stock area be expanded to include the remainder of Hatton Bank (new ICES area XIIb). This will require the collation of historical landings data for this new area.

12.2.3 Data availability

Almost all available biological data has been derived from Spanish investigations on the part of Hatton Bank in XII (new ICES area XIIb). It is proposed that Hatton Bank in its entirety be included in the stock of blue ling in Vb, VI and VII and all biological data from this area has been included in Chapter 10.

12.2.3.1 Landings and discards

Landings data are given in Table 12.2.0. There is no information available on discards.

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 maturity data are available.

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

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

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

12.2.3.6 Catch, effort and RV data

No data are available.

12.2.4 Data analyses

No data analyses were carried out

12.2.5 Comments on assessment

Not applicable

12.2.6 Management considerations

Fisheries on blue ling in these areas should be permitted only when they are accompanied by programmes to collect data. Apart from this, there is no need to amend to current ICES advice for blue ling in these areas.

Table 12.2.0. Blue ling I, II, IIIa, IV, VIII, IX, X, XII. WG estimates of landings.

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**

*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*	21	3			144	1			2	**171**

*Preliminary.

Table 12.2.0 (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

*Preliminary.

Table 12.2.0 (continued).

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	3	2		**69**

*Preliminary

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**

*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*			

*Preliminary.

Table 12.2.0 (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**

*Preliminary.

Blue ling XII

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

*Preliminary.

Blue ling. Total landings by Subarea/division and grand total. (Landings from areas VIIIIX and X given in previous reports are now considerd to represent Molva macrophthal

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**

*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 1988-2005 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.

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 2003 fish 5000 tonnes and in 2006 fish 4000 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 are forthcoming that appear to show geographical heterogeneity within the ICES area at a scale that may require a revision of the current perception of population structure.

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 *et al*. (WD4, 2006). 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 1994-2005. 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 2000-2005. 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.

A first analyses based on these two sources of data was presented in a WD by Helle and Bergstad (2006).

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 1992-2005.

Data from Faroese summer and autumn surveys were available for the period 1994 onwards. CPUE from the Faroese longliners (>100 GRT) for the period 1987-2005 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 Bergstad (2006). The number of longliners has declined in recent years, from 72 to 39 in the period 2000-2005. However, the number of fishing days with tusk catch 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 2000-2005 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 2000-2005 period. There is an apparent increase in 2005 for all areas except in Division VIa, 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 1992-2005 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).

12.3.5 Comments on the assessment

The CPUE series of the main fleet landing tusk (Norwegian long liners) suggest that the abundance has remained at a reduced level after a probable decline in the 1970s to 1990s. This is strictly only valid for the Divisions for which there is sufficient data (IVa, Vb, VIa, VIb). There was an increase in 2005, but the estimate for that year was based on input from few logbooks and is unreliable.

The Danish CPUE for VIa trawlers for the last two decades show a recent levelling off of the and this corresponds with the Norwegian long line data from the same period and area.

In Vb the groundfish survey series indicate a recent increase in abundance, but this is not reflected in the long line CPUE series for commercial vessels. Norwegian long liner data suggest that the CPUE is currently about 50kg/1000 hooks compared with around 125kg/1000 hooks in the 1970s.

The only CPUE series available for VIa and VIb are the Norwegian longliners, and these show a a very variable pattern and the declining trend is not as pronounced as in other areas.

12.3.6 Management considerations

Although the number of hooks set per year has declined somewhat since 2000-2001, it is uncertain if current management has effectively reduced effort in the main fleets, i.e. Norwegian longliners and Faroese vessels compared with the level in 1998 (ref. ICES advice from 2004). Management may thus not be in accordance with ICES advice from 2004. Albeit that positive signs of recovery are seen in some areas, the current perception of status and trends remains that stock(s) is at reduced levels and hence there is no basis to suggest amendment of the advice statement from 2004.

Recent CPUE in IVa may be around half that in the 1970s or somewhat higher, hence around or higher than U_{pa} if CPUE in the 1970s is taken as a reference $U_{max.}$

If the Norwegian longliner CPUE for Vb are accepted as an index of abundance, then the current level is below U_{pa} but above U_{lim} .

For VIa and VIb, it is likely that the tusk is above $U_{pa,}$ mainly because the CPUE appear never to have declined to the same degree as in other Subareas/Divisions.

Considering that tusk in the relevant Subareas/Divisions was probably fully exploited prior to 1970, this assessment in relation to reference points is probably reasonable.

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**

*Preliminary

e 9.1. continued

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		11	4	1559	1	2		75		**1775**

des IVb 1988-1993

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**

Table 12.3.0 (continued).

TUSK Vb1

Year	Denmark	Faroes(4)	France	Germany	Norway	E & W	Scotland (1)	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*		1822	12		1398		6	**3238**

. (3)Reported as Vb.(4) 2000-2003 Vb1 ans Vb2 combined

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*		306			**306**

(2)See Vb_1. (3)Included in Vb_1.

Table 12.3.0 (continued).

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*		2	202		7	702			89	16	**1018**

d by divisions before 1993.
*Preliminary

e 9.1. 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		31	137	**690**

Table 12.3.0 (continued).

TUSK VIIa

Year	France	E & W	Scotland	**Total**
1988	n.a.	-	+	+
1989	2	-	+	**2**
1990	4	+	+	**4**
1991	1	-	1	**2**
1992	1	+	2	**3**
1993	-	+	+	+
1994	-	-	+	+
1995	-	-	1	**1**
1996	-	-		
1997	-	-	1	**1**
1998	-	-	1	**1**
1999	-	-	+	+
2000		-	+	+
2001		-	1	1
2002	n/a	-	-	-
2003		-	-	-
2004				
2005*				

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**

*Preliminary

e 9.1. continued

TUSK VIIg-k

Year	France	Germany	Ireland	Norway	E & W	Scotland	Spain	**Total**
1988	n.a.		-	-	5	-		**5**
1989	3		-	82	1	-		**86**
1990	6		-	27	0	+		**33**
1991	4		-	-	8	2		**14**
1992	9		-	-	38	-		**47**
1993	5		17	-	7	3		**32**
1994	4		12	-	12	3		**31**
1995	3		8	-	18	8		**37**
1996	3		20	-	3	3		**29**
1997	4	4	11	-		+	0	**19**
1998	2	3	4	-		1	0	**10**
1999	1	1	-	-		+	6	**8**
2000	3		5	-	-	+	6	**14**
2001	3		-	9	-	+	2	**14**

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*			

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*		1					**1**

*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

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*	1		36		8	**45**

*Preliminary

Table 9.1. 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

Table 12.3.1. 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 2000-2005.

TUSK	2000	2001	2002	2003	2004	2005
IVa	18	21	21	16	29	15
IVb	1			2		
Vb	11	16	16	17	32	22
VIa	12	12	6	10	15	19
VIb	4	4	5	3	5	16
VIIc	2	1			2	1
XII	1	2				
XIVb	2	1	+	1	6	
All areas	88	116	116	105	151	160

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 2000-2005. n= the total number of days with hook information contained in the logbooks.

	2000		2001		2002		2003		2004		2005	
	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	32756	287	34224	107
IVb	30263	38	31478	23	33867	15	32559	34				
VIa	22808	433	24599	435	21465	185	29517	290	25927	151	23962	131
VIb	31023	178	30772	127	31597	149	31325	97	29000	46	35956	114
VIIc	29383	81	33108	37					35518	27	33427	7
XII	13500	4	15389	108			12510	51				
XIVa	28333	6										
XIVb	2815	191	2465	135	13177	162	15480	157	12474	105		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 2000-2005 in the fishery for ling, tusk and blue ling.

	2000	**2001**	**2002**	**2003**	**2004**	**2005**
IIIa	256			1599		
IVa	41333	45176	40764	30621	40424	20402
IVb	2435	1426	1016	1985		
VIa	20914	21077	7942	15349	16834	17489
VIb	11694	7698	9416	5448	5736	22837
VIIc	5040	2413			4124	1304
XII	114	3274		1144		
XIVb	1139	655	4269	4358	5632	

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.

Tusk	2000			2001			2002			2003			2004			2005		
Area	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	1.9	63	3.8	3.2	8	13.2
IIa	62	1172	0.9	53.2	1903	0.6	47.14	1806	0.5	40.3	1453	0.5	33.3	528	1.3	60.6	562	1.6
IIb	48.7	17	8	2.5	1	29.4				5.3	5	8.6	1.7	9	10.0	3.3	6	15.2
IVa	32.6	596	1.4	33.2	686	1.1	25.6	615	0.8	27.1	450	0.9	33.8	286	1.8	44.7	107	3.6
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	202.4	28	5.7	184	30	6.8
Vb	53.1	375	1.7	50.6	539	1.3	50.1	473	0.9	54.0	478	0.9	55.2	323	1.7	69	156	3
VIa	47.6	420	1.6	45.6	398	0.8	45.5	185	1.5	36.4	288	1.1	46.8	150	2.5	45.4	131	3.2
VIb	89.9	137	2.8	53.5	116	2.7	55.6	149	1.6	44.8	94	2	49.5	46	4.4	71.4	114	3.5
VIIc	62.7	60	4.3	5	24	6							5.33	22	6.4	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	16	13	8.3			

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, ling and blue ling.

Tusk	2001			2002			2003			2004			2005		
Area	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
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
IIb										8.74	2	23.2	0.55	4	19.4
IVa							73.73	40	4.52	13.7	83	3.61	21.76	99	3.9
Va										104.81	32	5.81			
Vb							60.08	12	8.25	71.63	71	3.9	57.26	84	4.24
VIa							13.07	45	4.26						
VIb				36.7	29	7.34	31.19	61	3.66						
XII							2.11	6	11.6						
XIV										13.63	5	14.7	10.11	14	10.3

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			

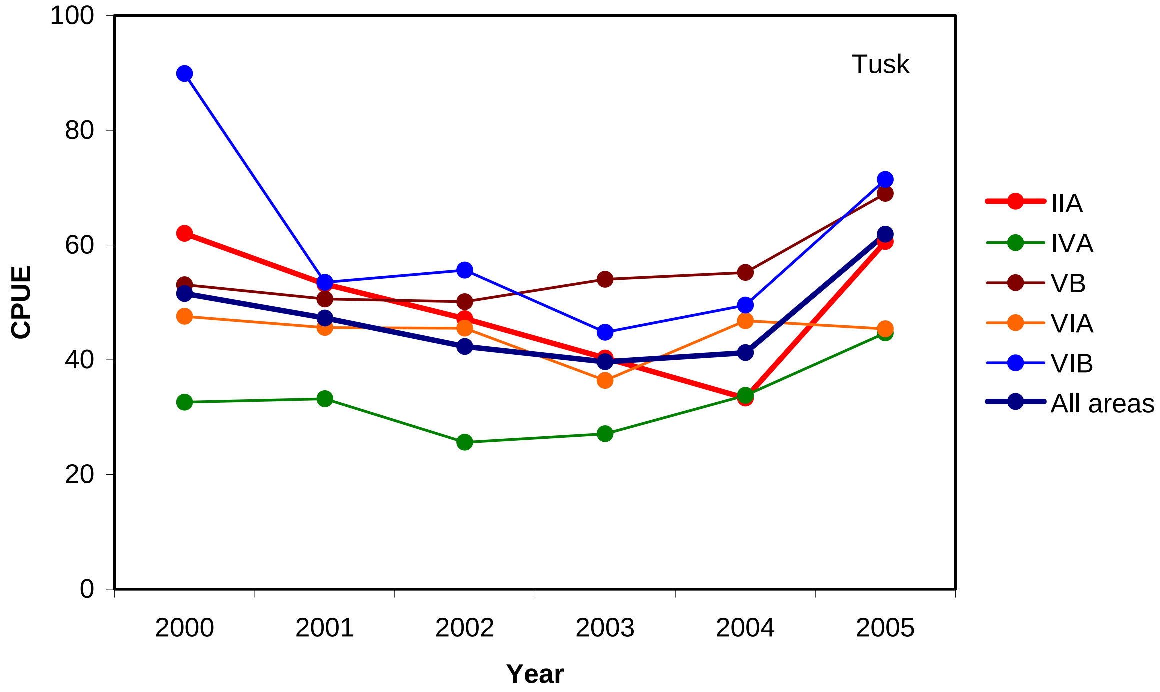


Figure 12.3.1. Estimated mean CPUE ([kg/hook]x1000) based on data from the log books for tusk in each ICES subarea and all areas combined for the years 2000- 2005.

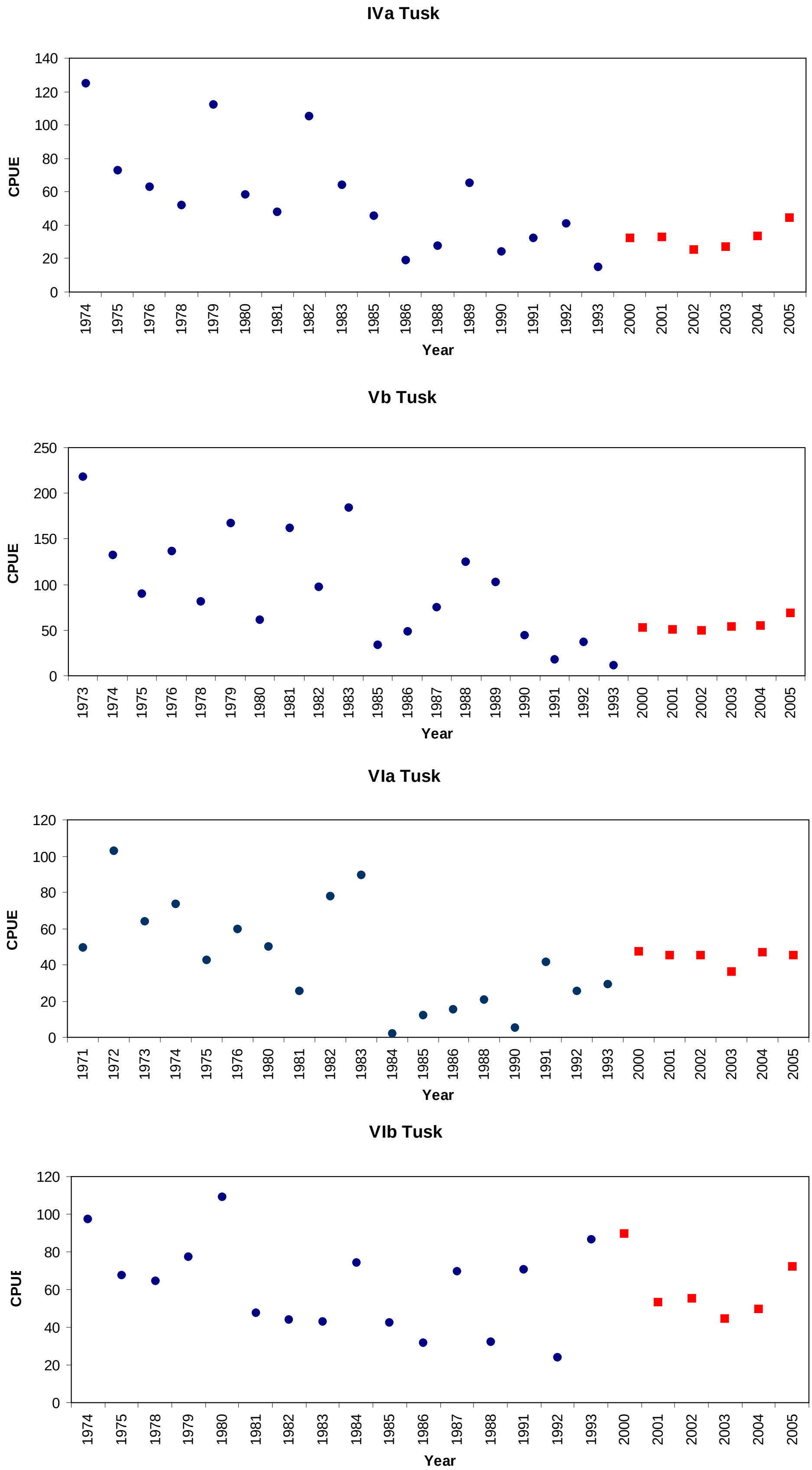


Figure 12.3.2. Estimates of CPUE (kg/1000 hooks) of ling based on skipper's logbooks (pre-2000, blue dots) and official logbooks (post 2000, red squares). Combination of data from Bergstad and Hareide (1996) and WD by Helle and Bergstad (2006). Note gap in time series between 1993 and 2000, and the differences in CPUE scale between areas.

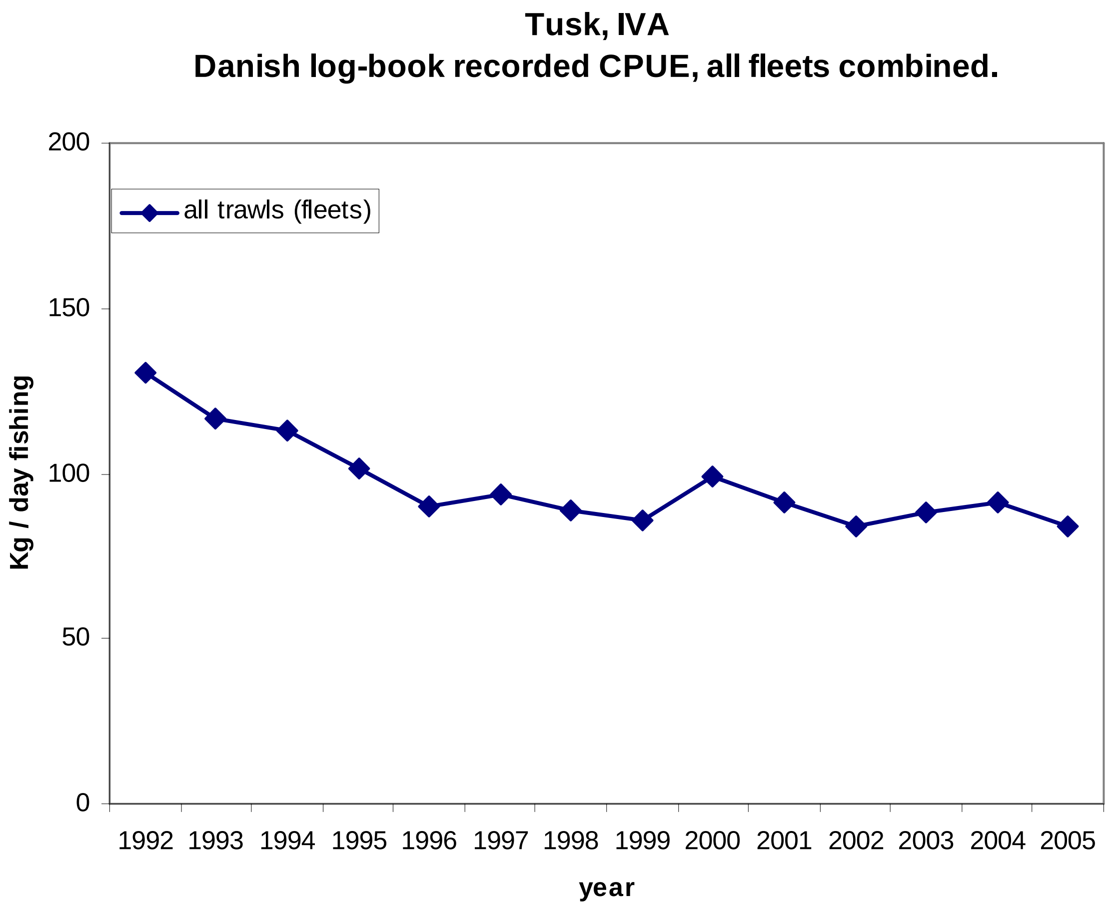


Figure 12.3.3. Tusk in IVa. CPUE of tusk for Danish. Based on logbook data.

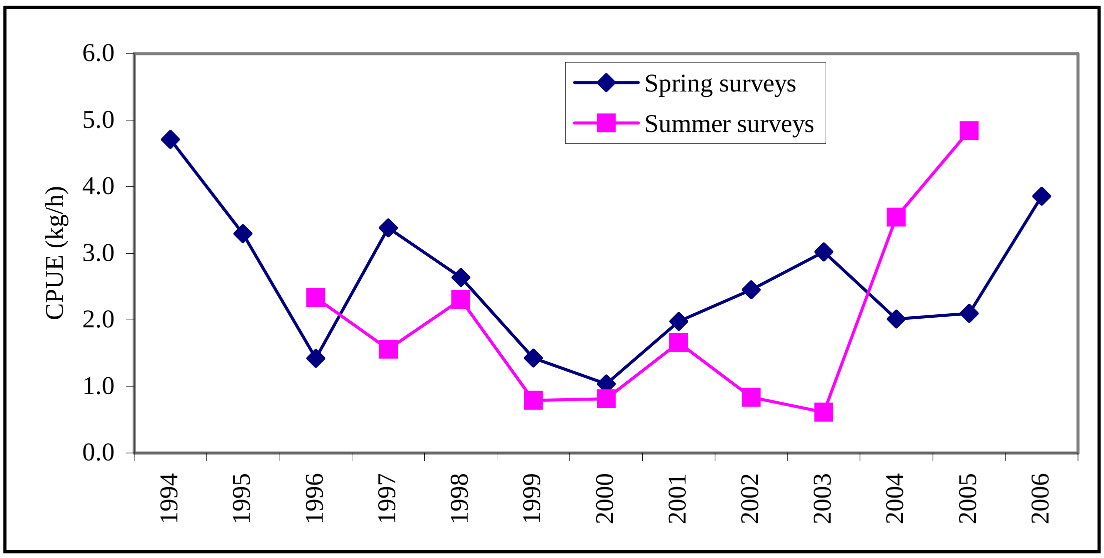


Figure 12.3.4. Tusk in Vb (Faroes). CPUE in spring and autumn bottom trawl survey.

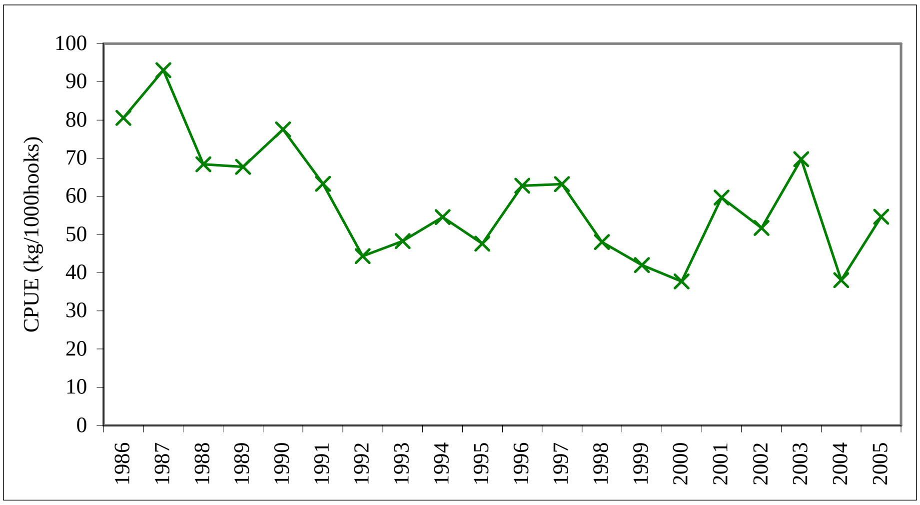


Figure 12.3.5. Tusk in Vb (Faroes). CPUE (kg/1000hooks) from long liners > 100 GRT.

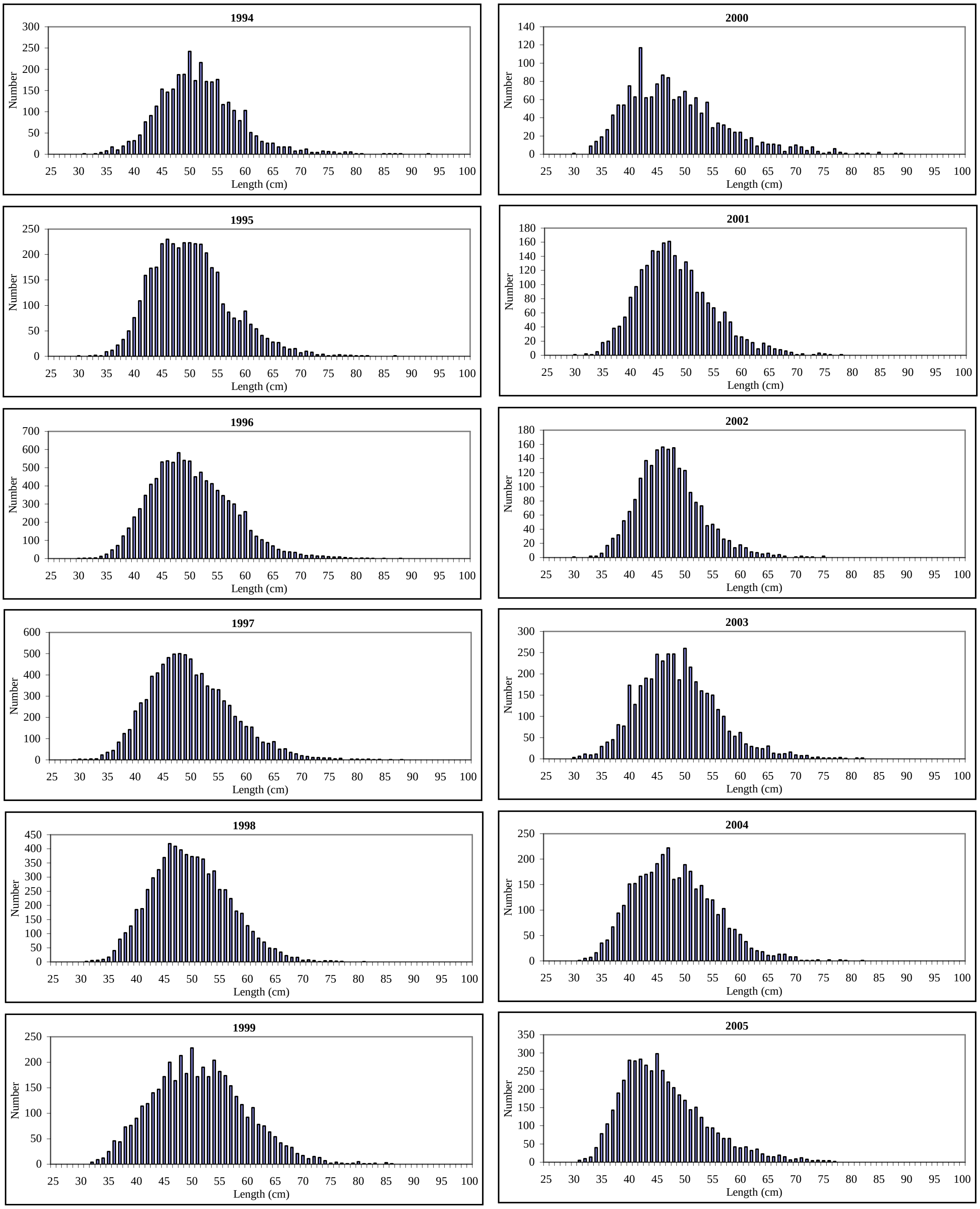


Figure 12.3.6. Tusk in Vb (Faroes). Length distribution in the landings from long liners >100 GRT.

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 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.

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.*

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 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. 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 preliminary landing figure for 2005 is only 3554 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 and Bokhanov (2006).

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, but a licencing system that regulates number of trawlers that can take part in the aimed fishery.

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
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 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 2005 were also presented in WD8, Vinnichenko &. Bokhanov, 2006. In Faroese waters (area Vb), in April, the greater silver smelt were captured in small numbers in fishery for haddock conducted by pelagic trawl. Individuals of 30-42 cm in length occurred in catches (Figure 12.4.2), males mainly 36-38 cm long, females – 37-39 cm long. In September on the Outer Bailey Bank and Bill Baileys Bank, individuals of 29-52 cm in length were caught at the depths of 510-680 m. On the Outer Bailey Bank, the bulk of catches consisted of fish 37-42 cm in length, on the Bill Baileys Bank – 34-40 cm (Figure 12.4.3).

In The Rockall Bank (Subarea VIb), in March-September, greater silver smelt occurred in catches taken at the depths of 150- 600 m. Individuals of 15-45 cm in length were fished (Figure 12.4.4). Mean length of males was 21-24 and 35-38 cm, females were 21-24 and 39-41 cm in length. In March, greater silver smelt were registered as a small by-catch during trawl-acoustic survey for haddock. Length of individuals ranged within 7-42 cm, mostly was 20-22 cm, average length was 21,8 cm.

The Hatton Bank (Division XIIb, Subdivision VIb1), in April, 6 individuals (5 males and 1 female) of 32-40 cm in length were caught by bottom trawl at the depths of 580-600 m in the northern area of the Hatton Bank.

The Norwegian Sea (Subdivision IIa2, IIb2), in April-November, the greater silver smelt were captured in small numbers by bottom trawl. Individuals of 19-49 cm in length occurred in Subdivision IIa2, mean length of males was 27,7 cm and that of females 28,4 cm. In Subdivision IIb2, single individuals of greater silver smelt were caught. The length varied from 35 to 43 cm, mean length of males was 38,3 cm, that of females 38,0 cm.

The Barents Sea (Sub area I), in August, one individual of 10 cm in length was taken by bottom trawl in the southern Sea.

Figure 12.4.5 presents the comparison between length frequency distributions from the 2001-2005 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 for 2005 it seems to be a mode at about 16 cm and another at 24 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 12.4.6). This could reflect a natural reaction for a virgin stock to an introduced fishery, but a clearer analysis is needed to investigate this reduction for the sustainability of the fishery.

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, sex ratios and diet composition from various areas are presented in WD8, Vinnichenko &. Bokhanov, 2006.

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 1992-2003 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 (Ofstad, 2006, WD 1).

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 (Figure 12.4.11). 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 2005 (Velasco F., pers. com.). Figure 12.4.12 and 12.4.13 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 12.4.12).

12.4.5 Comments on the assessment

Catch trends and CPUE in different areas are unlikely to reflect the level of abundance of this benthopelagic species, therefore it is difficult to evaluate the stock status with the available information.

12.4.6 Management considerations

In 2002 the WG expressed concern about the apparent increase in the directed fishery in several Subareas and especially the increased landings in Sub-area VI. It was noted that the age range had been truncated which suggested high levels of exploitation. No new data could be used to determine if that trend had continued. Following years of very high landings, the reported landings dropped considerably in 2003, actually below the quota set for those areas. The Irish fleet discontinued target fisheries due to the restricted quota. Other fleets continued to pursue the fishery.

In 2003 quota management was introduced in EU waters. The total landing by EU vessels from Subareas V, VI and VII in 2004 was 6770 tonnes, somewhat exceeding the TAC of 6247t. In addition, a very exceptional 4600 tonnes was taken by EU-vessels in IIa where no TAC applied. The group was unable to determine if this was misreporting or landings produced by a fishery in the Norwegian EEZ not restricted by the EU TAC or Norwegian regulations. In 2005 there was only a very minor EU landing from IIa.

A licencing scheme has been in place for several years in Norway and the Faroes. In IIa the current management has been in place for more than a decade and the fishery appears to be sustainable and essentially regulated by market demand.

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 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						**16158**
2005*			15682		16				**15698**

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		36	**1147**
2005*	733				28	2			18	**781**

Table 12.4.0 (continued).

Greater silver smelt (Argentina silus) Vb

Year	Faroes	Russia/US	UK (Scot)	UK(EWNI)	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*	6908	59					11	**6978**

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		**2444**
2004		147		46	3731			526		12		**4462**
2005*		9		1	3465			75		4		**3554**

Greater silver smelt (Argentina silus) VIII

Year	Netherlan	**TOTAL**
2002	191	**191**
2003	37	**37**
2004	23	**23**
2005*	202	**202**

SPA WG data zero in all years 97-2001

Table 12.4.0 (continued).

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*				278	**278**

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*			

Greater silver smelt (Argentina silus) (all areas)

Year	I + II	III + IV	Vb	VI + VII	VIII	XII	XIV	Total
1988	11351	2718	287	10438				24794
1989	8390	3786	227	25559				37962
1990	9120	2321	2888	7294			6	21629
1991	7741	2554	60	5197				15552
1992	8234	5319	1443	5906				20902
1993	7913	3269	1063	1577		6		13828
1994	6807	1508	960	5707				14982
1995	6775	1082	12286	7546				27689
1996	6604	3300	9498	5863		1		25266
1997	4463	2598	8433	7301				22795
1998	8261	3982	17570	5555				35368
1999	7163	4319	8214	8856		2		28554
2000	6293	2471	5209	13866			217	28056
2001	14369	2925	10081	19050			66	46491
2002	7407	1811	7471	15985	191			32865
2003	8917	1188	6549	2444	37			19135
2004	16158	1147	6451	4462	23	4		28245
2005*	15698	781	6978	3554	202	278		27491

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 2005. Data from logbooks do not represent the entire landings.

Year	Mesh size in Trawl: 70 - 100 mm			34 - 69 mm			< 34 mm			All trawls
	Kg	days	CPUE	Kg	days	CPUE	Kg	days	CPUE	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

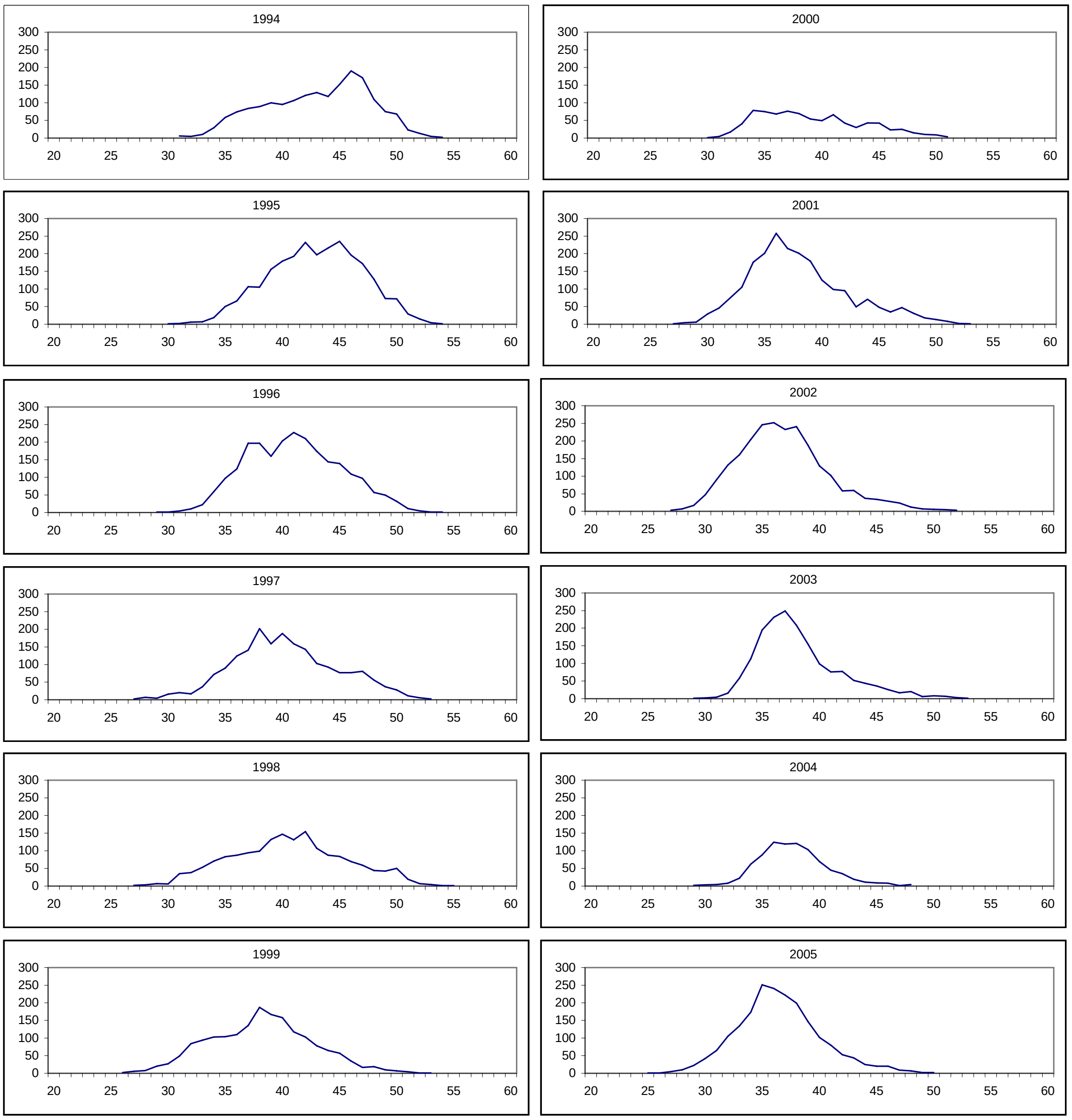


Figure 12.4.1. Length distribution of greater silver smelt in Faroese landings (area Vb) in the period 1994 to 2005 (length (cm) on x-axis and number on y-axis).

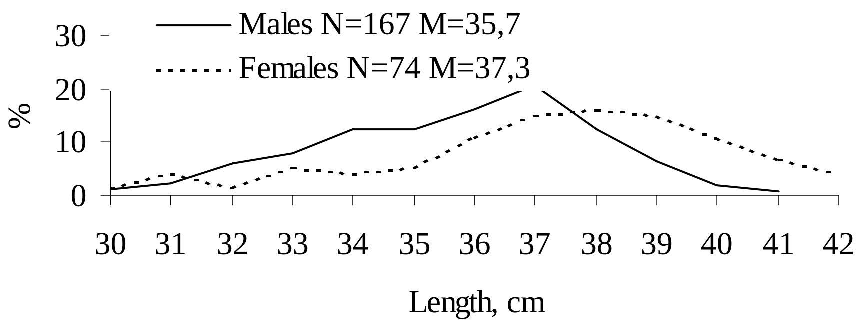


Figure 12.4.2. Length composition of greater silver smelt in Faroese zone (Div. Vb) in April 2005.

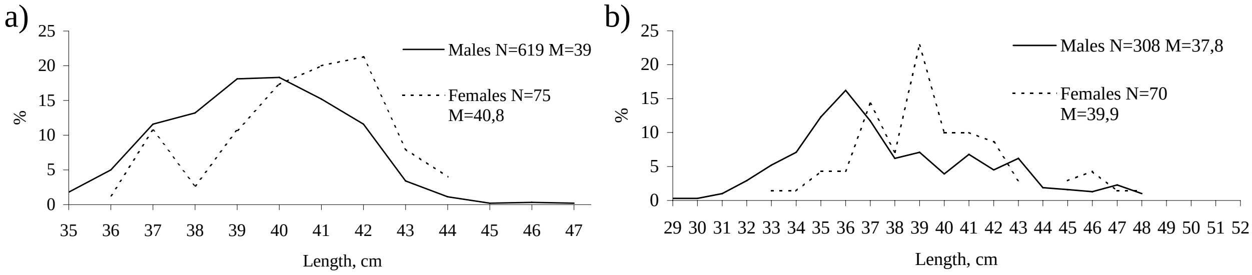


Figure 12.4.3. Length composition of greater silver smelt on a) Outer Bailey Bank and b) Bill Baileys Bank, (Div. Vb) in September 2005.

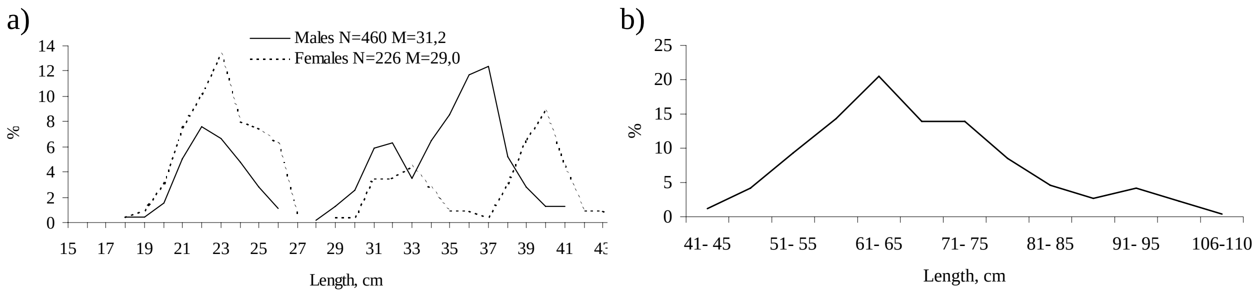


Figure 12.4.4. Length composition of greater silver smelt on Rockall Bank (Subarea VIb) a) in March-September 2005 (catch of fishing trawlers) and b) in March 2005 (catch of research vessel).

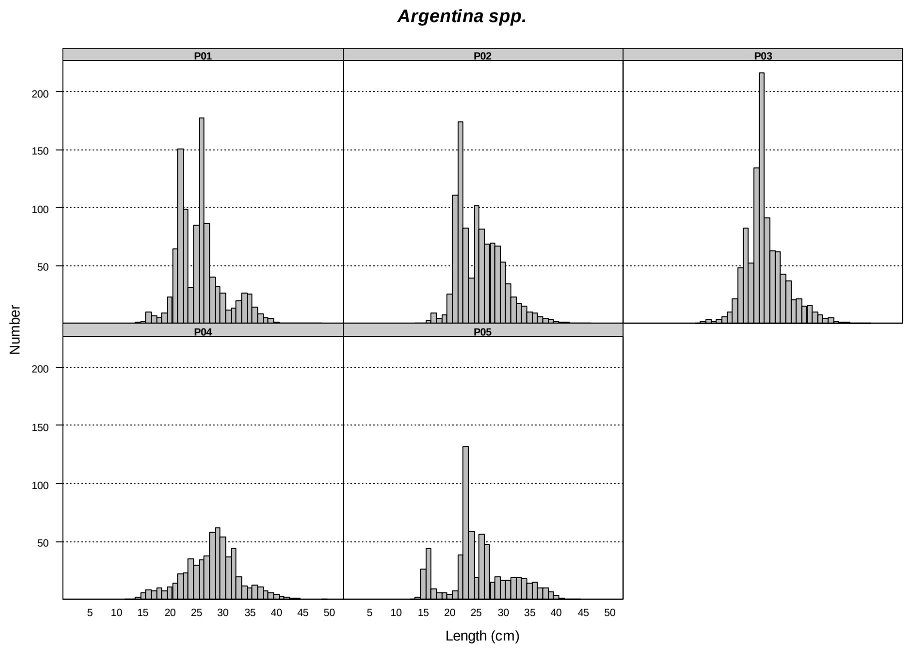


Figure 12.4.5. Mean stratified length distributions of *Argentina* spp. in Porcupine surveys (2001-2005) (F. Velasco, *pers. com.*).

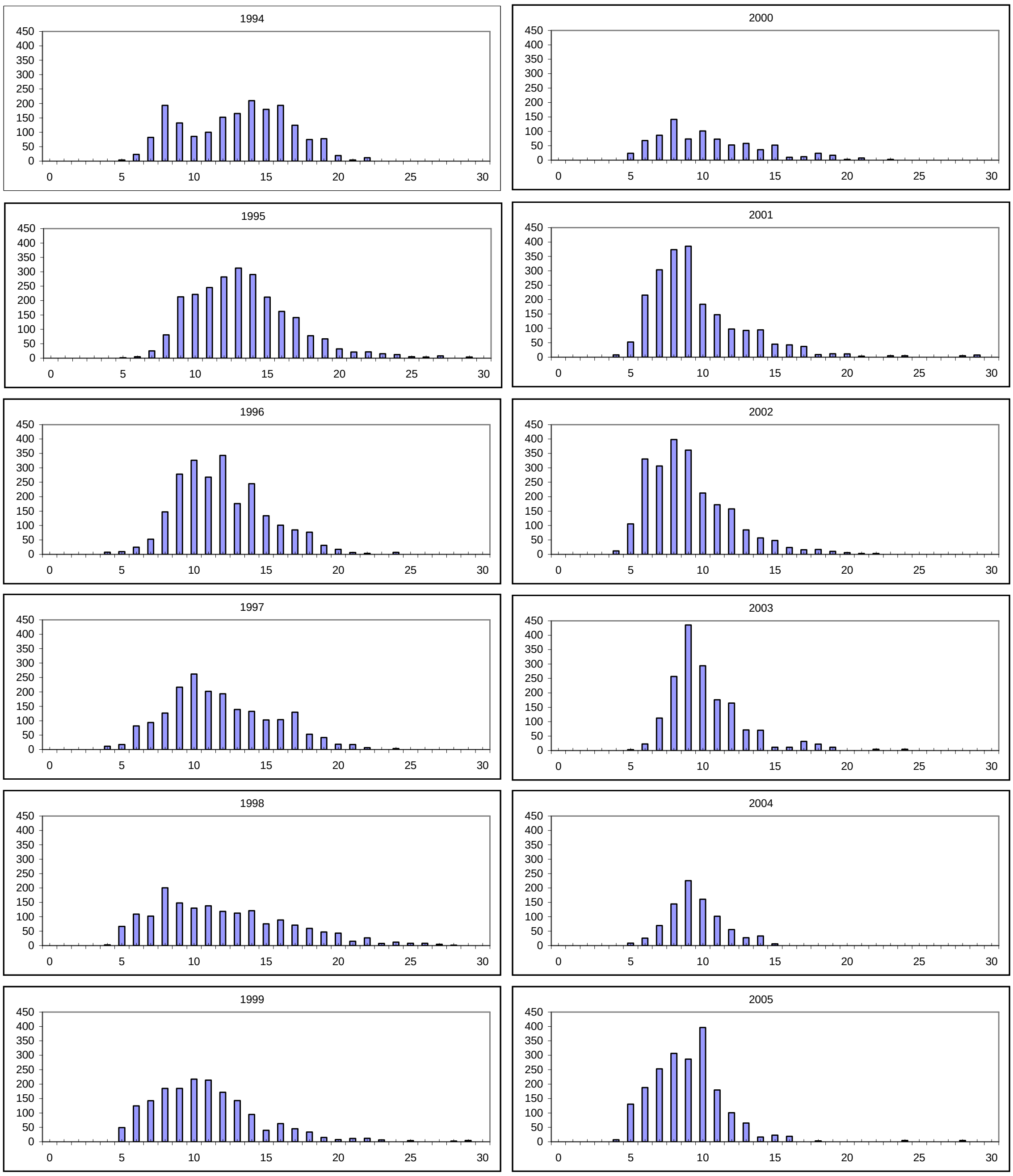


Figure 12.4.6. Age distribution of greater silver smelt in Faroese landings (area Vb) in the period 1994 to 2005 (age (year) on x-axis and number on y-axis).

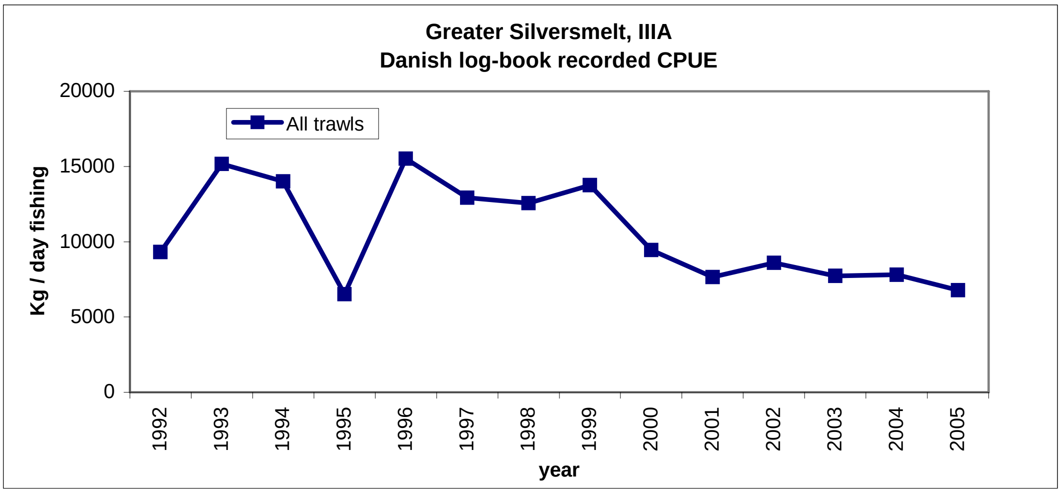


Figure 12.4.7. CPUE from Danish trawl fisheries in Division IIIa.

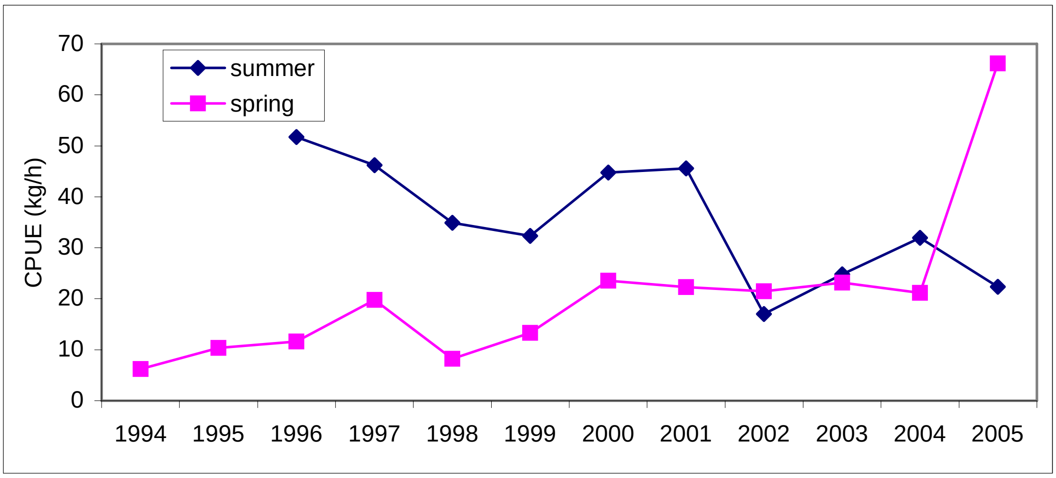


Figure 12.4.8. CPUE from Faroese surveys in Vb.

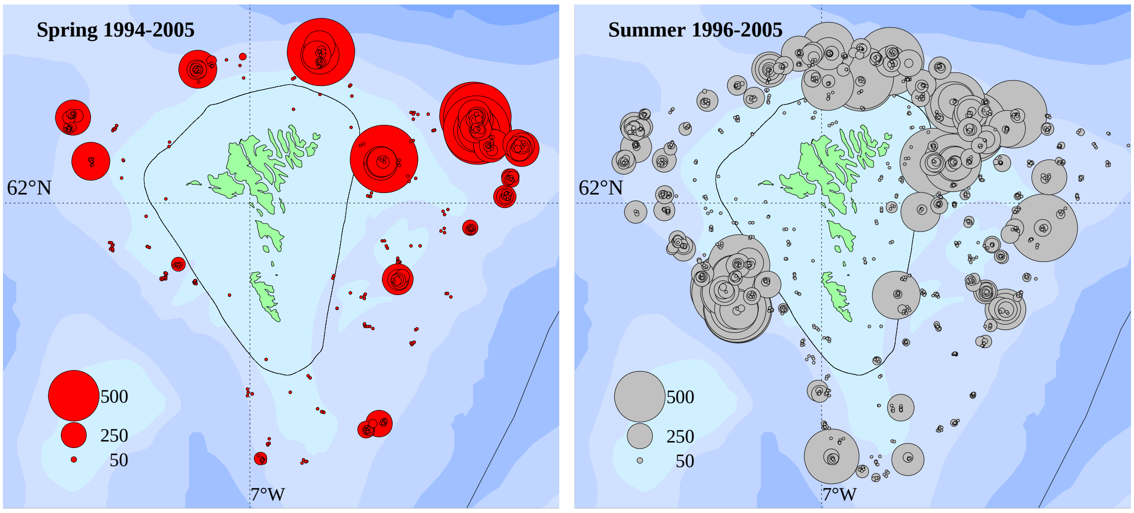


Figure 12.4.9. Distribution of greater silver smelt (kg/h) on the Faroe plateau (area Vb) from spring- (1994-2005) and summer survey for cod, haddock and saithe (1996-2005).

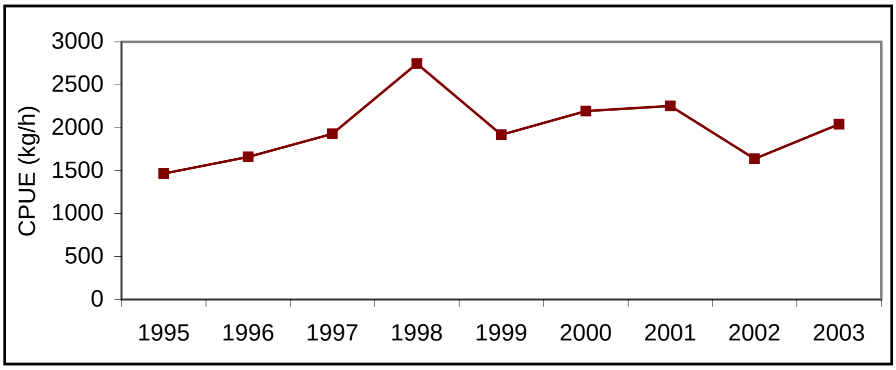


Figure 12.4.10. Catch per unit effort (kg/h) for a pair of Faroese pair-trawlers (area Vb) in the period 1995 to 2003. Only hauls where greater silver smelt is more that 50% of the total catch are used.

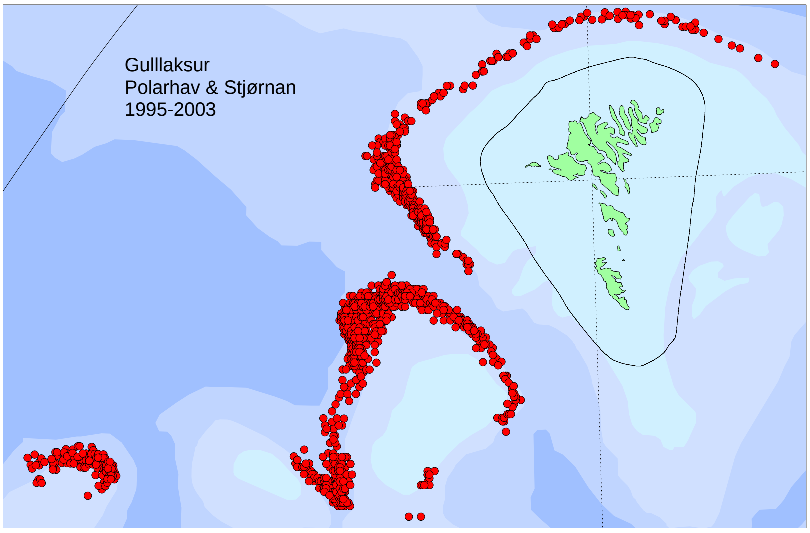


Figure 12.4.11. Start positions for all hauls in area Vb, in the period from 1995 to 2003, from one pair of pair-trawlers, where catches of greater silver smelt contributed more that 50% of total catches.

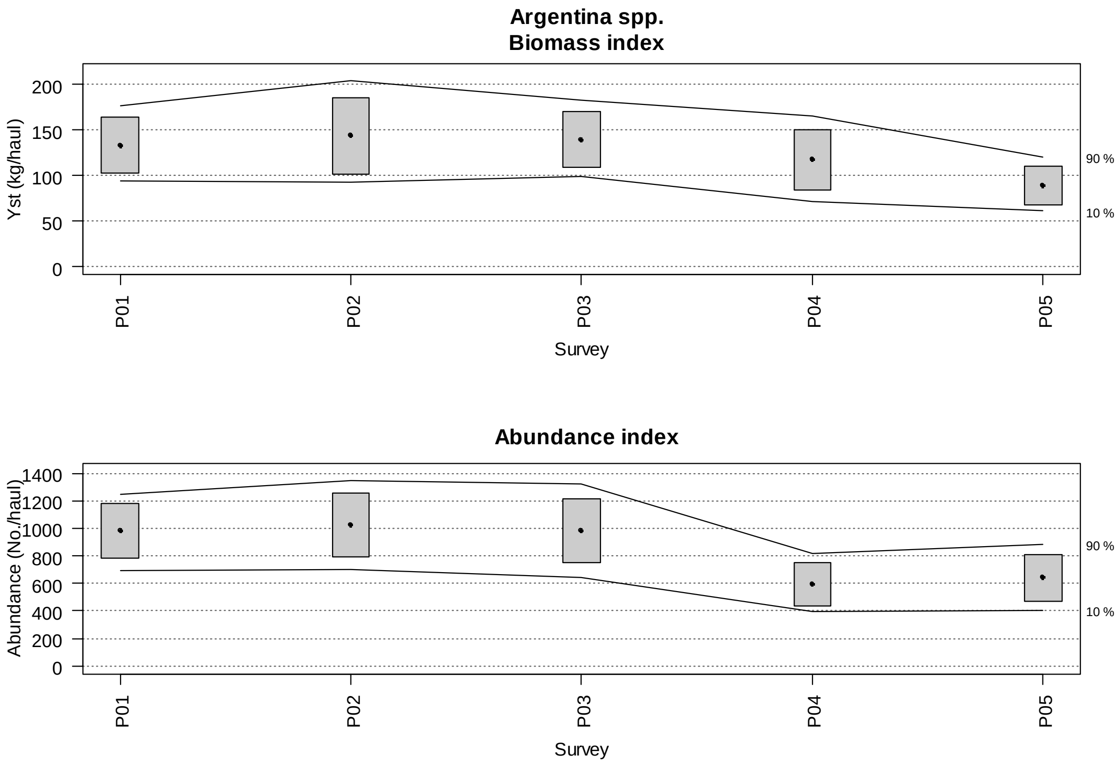


Figure 12.4.12. Changes in *Argentina* spp. biomass and abundance index during Porcupine Survey (area VII) time series (2001-2005). Rectangles indicate. Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000) (F. Velasco, *pers. com.*).

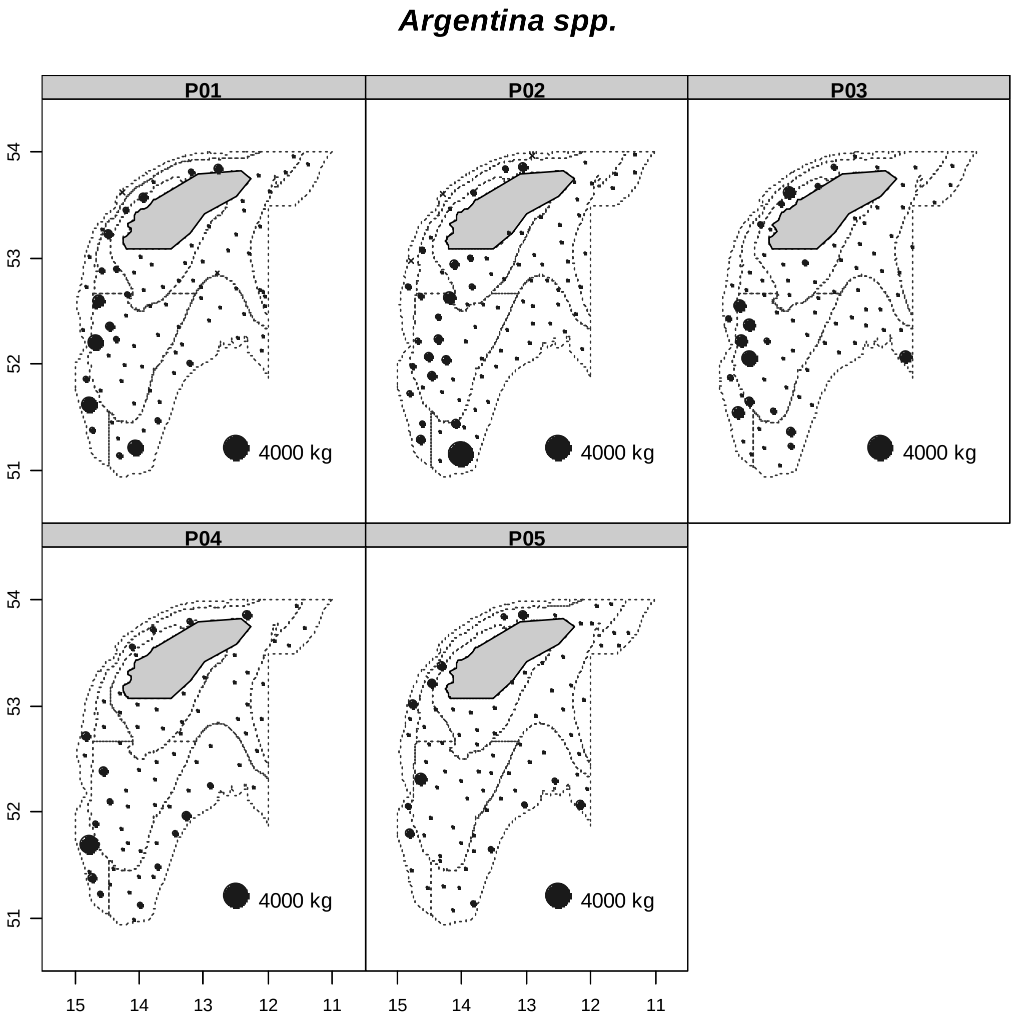


Figure 12.4.13. Geographic distribution of *Argentina* spp. catches (kg/30 min haul) in Porcupine surveys (area VII) between 2001 and 2005 (F. Velasco, *pers. com.*).

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.

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.

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 Sub-area 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 2004 was:

"Orange roughy stocks can only sustain very low rates of exploitation. ICES recommends catches be reduced and further efforts be made to assess the state of stock units in all areas. Fisheries for orange roughy should not be allowed to proceed unless there is adequate information to define sustainable exploitation levels."

12.5.1.3 Management measures

For 2005, an overall TAC of 102 t was set for EC vessels that covered the zones: I, II, III, IV, V, VIII, IX, X, XII, XIV. The TAC applies to Community waters and international waters. Landings in relation to TAC were as follows,

		Landing (t)	
Year	TAC (t)	EC vessels	Total
2005	102	71	278

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

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 Sub-area 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

WGDEEP was not able to make a stock assessment on any of these orange roughy stocks in 2006. This is due to a number of factors. Firstly effort data are urgently required at the level of spatial resolution required for meaningful stock assessment. It is at least necessary to have access to catches by statistical rectangle, and observer data can be used to validate such information. Finally, total international removals by aggregation area are needed.

WGDEEP recommends that concerted efforts are essential to collate available data with which to assess the status of the individual stocks or aggregation areas. Furthermore, the current management units (essentially ICES Sub-areas) are completely inadequate for orange roughy. Experience from around the world shows that management units need to be small, as aggregations on topographical areas are usually considered to be discrete stocks. WGDEEP recommend that current information be used to define smaller and more meaningful management units. WGDEEP further recommend that where such information is lacking, in international waters for instance, specific typographical features are a more meaningful spatial management unit.

In Division VIII, X and XII catch and effort data are urgently required, in order to assess the stocks. Given the experience of the declining CPUE in VII and depletion of the stock on the Hebrides Terrace Seamount. Therefore international waters fisheries for orange roughy should not be allowed to proceed until accurate assessments are available to advise on sustainable catch levels.

12.5.7 Comments on the assessment

No assessments were carried out.

12.5.8 Management considerations

WGDEEP considers that given the experience of fisheries in VI (Hebrides Terrace Seamount), high catch rates will not be sustainable.

Contrary to ACFM's advice in 2004, orange roughy fisheries have proceeded and WGDEEP was of the opinion that this advice should be followed more stringently.

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

*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*	0	7	7

*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*	27			27

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

*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*	81	2					83

*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*	111	35					0		146

*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	27	0	83	146	**278**
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

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 2005 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, on the Reykjanes Ridge and northern Mid-Atlantic Ridge (ICES Subarea XII). For the first time substantial catches (799 t) were taken on the southern Mid-Atlantic Ridge (Division Xb) that is described in previous chapter. In other areas catches of roundnose grenadier were insignificant.

12.6.1.1 Landings trends

Landing statistics by nations in the period 1988-2005 are presented in Table 12.6.0.

In the Subareas I and II, the total catch of roundnose grenadier in 2005 amounted 27 t only. During 1988-2005 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 2005 comprised 18 t which was taken by French fleet as by-catch in the fishery for saithe. During 1988-2005 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 2005 amounted 76 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 1988-2005 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 1998-2005 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. 22.1.1). 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. 22.3). 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 12.6.0. 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.

12.6.5 Comments on the assessment

Catch trends in different areas likely do not reflect the level of species' abundance and therefore it is difficult to make any assumptions regarding stocks condition and assessment.

12.6.6 Management considerations

In the Subareas I, II, IV, VIII, IX, XIV and Division Va there have been no almost directed fisheries on roundnose grenadier for many years. The majority of the catches are taken as occasional by-catch mostly in bottom trawl fisheries targeting other demersal species (saithe, Greenland halibut, redfish, deepwater species, etc.). Therefore no any special management considerations can be suggested. However, taking in account the lack of effort and biological data and necessity to manage the stocks in compliance with precautionary approach, the general recommendation of working group for roundnose grenadier in other areas is that the expansion of its fisheries should not be allowed until reliable assessments indicate that increased harvests are sustainable.

Since the stock structure of roundnose grenadier in the North Atlantic is still uncertain, genetic studies based on samples covered all major ICES management areas required.

As long as any biological data (length, age, maturity, etc.) from the areas considered are unavailable for many years, it is important to obtain basic biological information on roundnose grenadier inhabited Subareas I, II, IV, VIII, IX, XIV and Division Va that hopefully will improve the understanding of species' stock structure.

Table 12.6.0. 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		9					**10**

* Preliminary data

Table 14.1 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					**18**

* Preliminary data

Table 12.6.0 (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**

* Preliminary data

** includes other grenadiers from 1988 to 1996

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**

* Preliminary data

Table 12.6.0 (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**

* Preliminary data

Table 14.1 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		3					**10**

* Preliminary data

** includes other grenadiers from 1988 to 1996

ROUNDNOSE GRENADIER (*Coryphaenoides rupestris*)
All sea areas

Year	I+II	IV	Va	VIII +IX	X	XIV	**Total**
1988	0	1	2	0	0	52	**55**
1989	22	170	4	0	0	45	**241**
1990	49	372	7	5	0	47	**480**
1991	72	525	48	1	0	29	**675**
1992	52	426	210	12	0	31	**731**
1993	15	283	276	18	0	26	**618**
1994	15	212	210	5	0	15	**457**
1995	7	84	398	0	0	27	**516**
1996	2	71	140	1	3	25	**242**
1997	106	11	198	0	1	395	**711**
1998	100	35	120	20	1	126	**402**
1999	46	61	129	16	6	124	**382**
2000	0	2	54	5	74	62	**197**
2001	2	19	40	7	0	166	**234**
2002	12	38	60	3	0	286	**399**
2003	4	17	57	2	1	293	**374**
2004	27	377	181	2	1	50	**638**
2005*	10	18	76	7	799	10	**920**

* Preliminary data

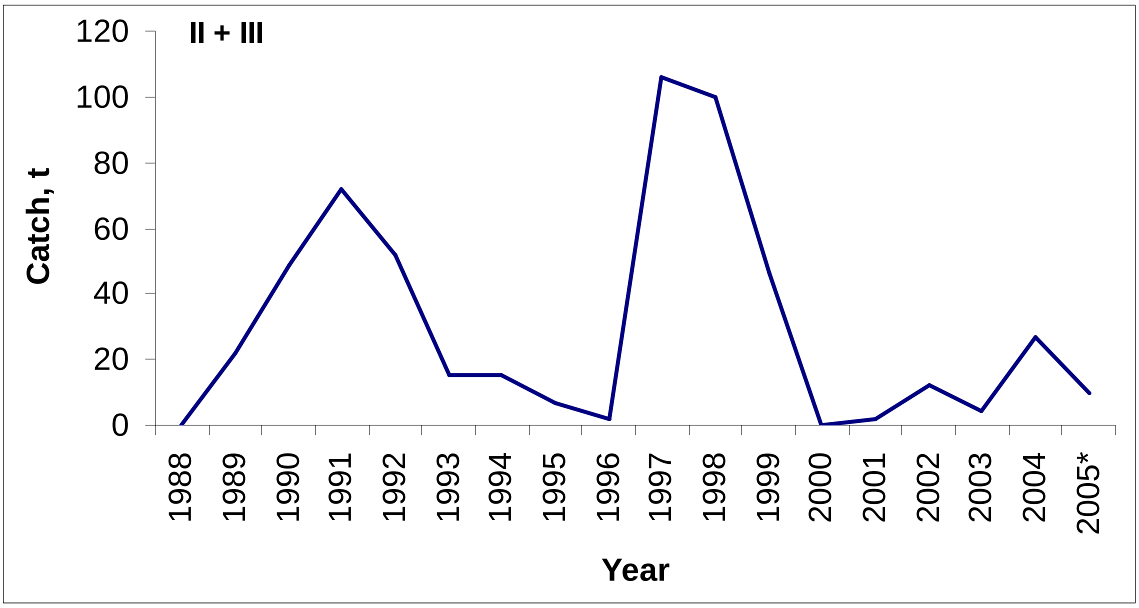


Figure 12.6.1. Roundnose grenadier catches in Subareas I and II, 1988-2005 (data for 2005 is preliminary).

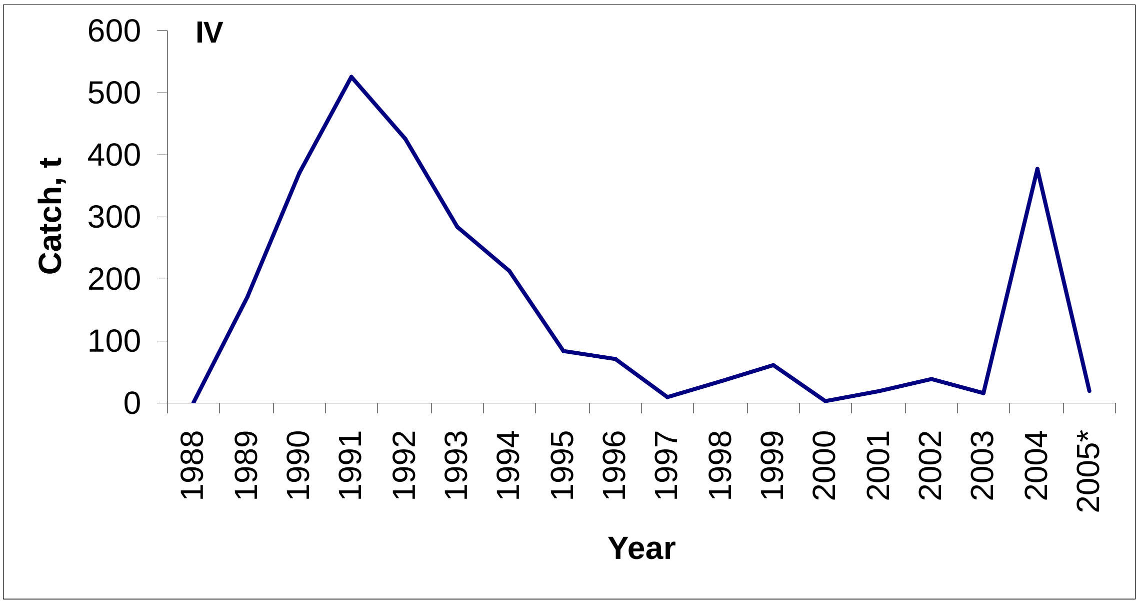


Figure 12.6.2. Roundnose grenadier catches in Subarea IV, 1988-2005 (data for 2005 is preliminary).

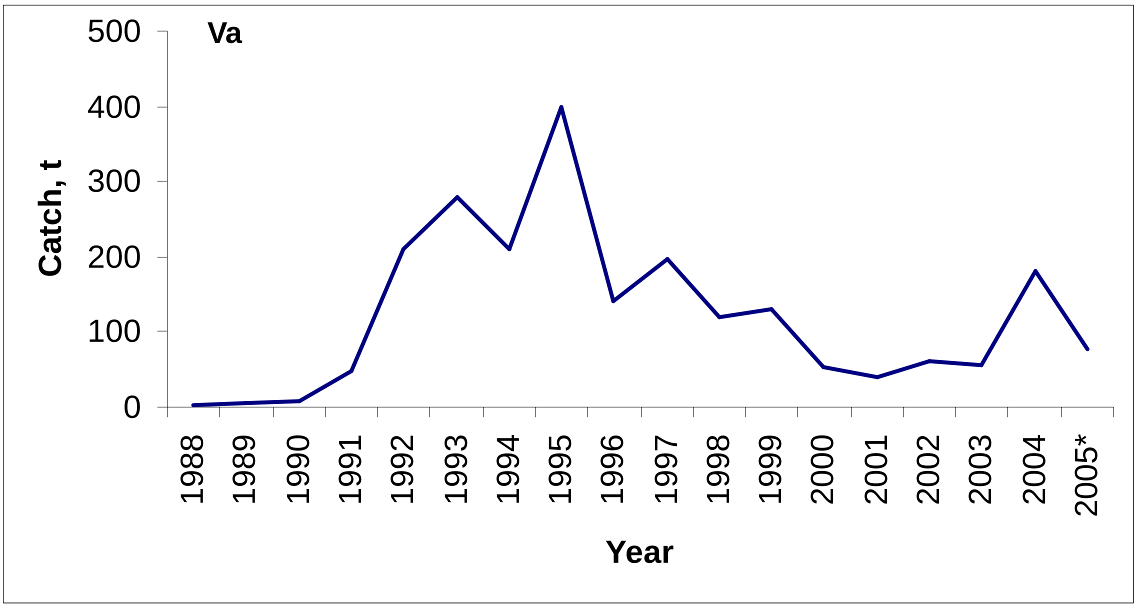


Figure 12.6.3. Roundnose grenadier catches in Division Va, 1988-2005 (data for 2005 is preliminary).

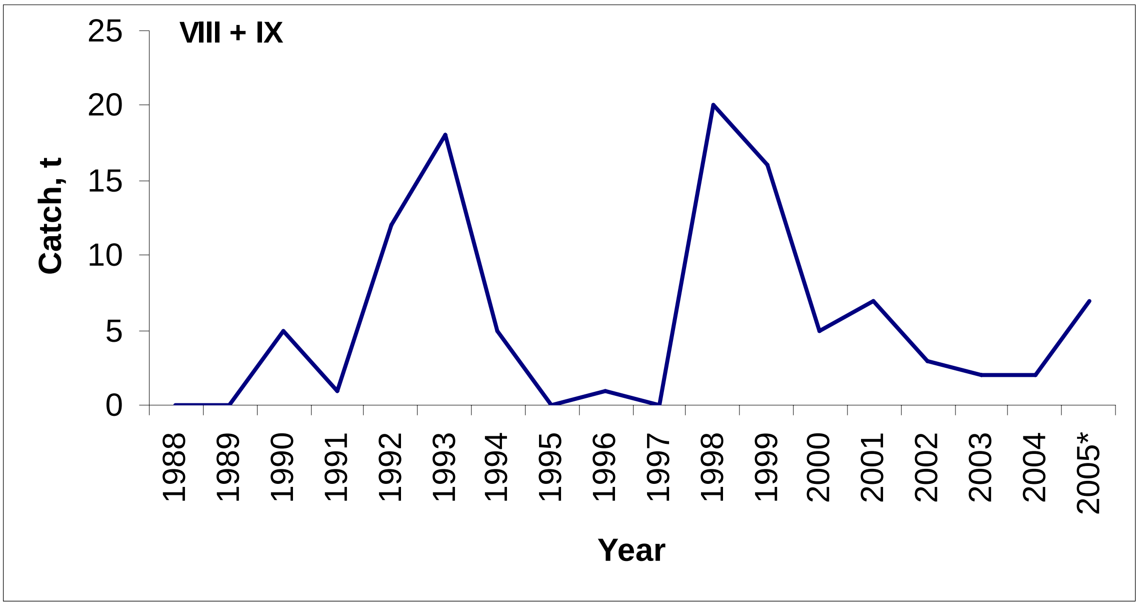


Figure 12.6.4. Roundnose grenadier catches in Subareas VIII and IX, 1988-2005 (data for 2005 is preliminary).

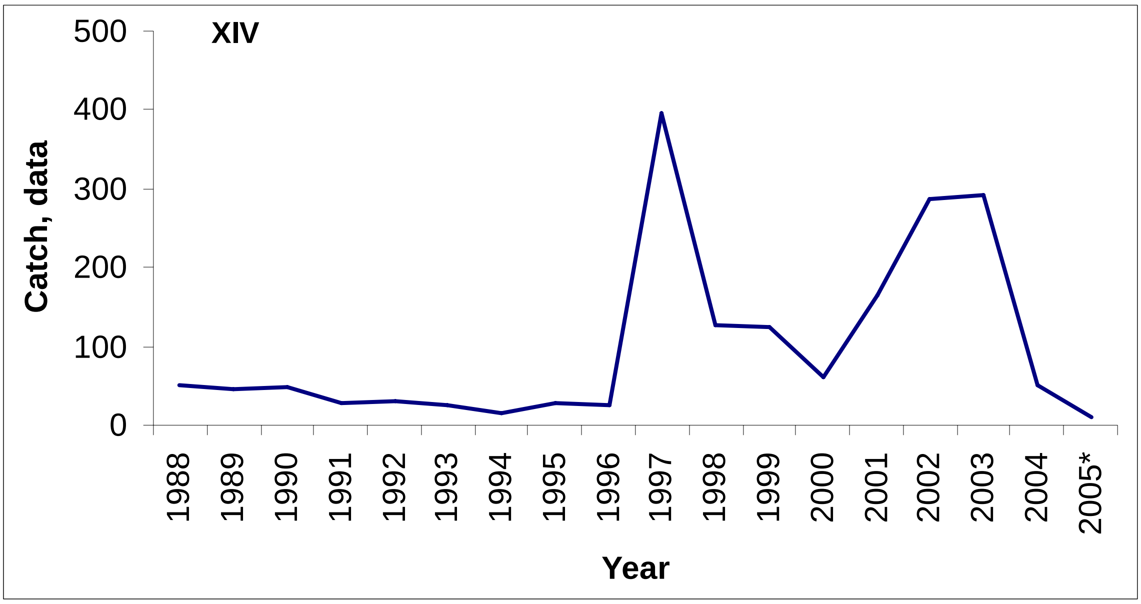


Figure 12.6.5. Roundnose grenadier catches in Subarea XIV, 1988-2005 (data for 2005 is preliminary).

12.7 BLACK SCABBARDFISH (*APHANOPUS CARBO*) IN I, II, IIIa, IV, Va, X, XIV

12.7.1 The fishery

Iceland deepwater fisheries are only conducted in Icelandic waters (Va). Tusk, ling and blue ling remain the most important species. In recent years, about 120 vessels, longliners and bottom trawlers were engaged in these fisheries with registered catches from less than 100 kg to nearly 1000 tonnes. Discarding is prohibited on Icelandic vessels and information on prohibited discards is not available (Sigurdsson, 2006).

The Azorean fishery (subarea X) is clearly a small-scale one predominating small vessels, <12m (90% of the total fleet) using mainly traditional bottom long-line and several types of hand lines. The ecosystem is a seamount type with fishing operations occurring in all available areas (coastal and seamounts within the Azorean EEZ) until 1000 m depth, catching species from different assemblages, with a mode on the 200-600 m strata (intermediate strata where the most commercially important species occur). Under the EU CFP TACs where introduced for some species, i.e. blackspot seabream, black scabbardfish, alfonsinos and deep-water sharks.

Although most of Spanish stern bottom freezer trawlers operate in international waters of the Hatton Bank area (ICES XII & VIb), at least one trawler occasionally fished blue ling during few days in international waters of ICES XIV (Munoz, 2005).

12.7.1.1 Landings trends

Catches from Subarea X have fluctuated greatly over the years, mainly as a result of Portuguese exploratory surveys carried out in this area. The increase on landings in 2004 and 2005 are mainly due to Portugal.

In Subarea XII landings have also fluctuated over the years and are mainly derived from Spain and Faroes. Excluding 2002 Spanish landing, in subarea XIV landings seldom reach 2 ton.

12.7.1.2 ICES advice

The advice statement from 2004 was: Fisheries on these stocks 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.

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 and 2006 by subareas are next presented

	TAC (2005 & 2006)
I, II, III & IV	30
V, VI, VII, XII	3042
VII, IX & X	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.

Information on the size composition by black scabbardfish in the NE Atlantic was presented by SGDEEP 2000 for the various fisheries exploiting this species, (ICES, 2000). Differences in length structure and optimal depth range of black scabbardfish landings between the northern and southern areas were evident. Those differences could be partially explained by the different size selectivity patterns of the fishing gears used; trawl and longline.

In northern areas bottom longline is more efficient in catching black scabbardfish than longlines. In 2005 Spain carried out several investigations at the Hatton Bank and adjacent waters several fishing gears in which both longline (Norwegian Automatic and manual) and bottom trawl were used black scabbardfish catches using bottom longline were insignificant while black scabbardfish catches using bottom trawl attained 16 kg/h (Durán Muñoz 2006). The same was observed during previous Irish survey experiments in which the two fishing gears were used (Kelly et al., 1998).

In northern areas length frequency distributions of bottom trawl landings are similar ranging from 80-110 cm being in addition dominated by juveniles (ICES, 2005). Fishery independent information from Scottish trawl is in agreement with this situation (Table 24.1.1 and Figure 24.1.4).

In southern area longliners mainly operate at depths ranging from 800 to 1200 m. In this area the length structure of the exploited population have been stable.

Previous information on length frequency distributions by quarter of specimens caught by bottom trawl in the Rockall Trough and by longline off mainland Portugal and at Madeira (ICES, 2001) suggested the entrance of smaller specimens in Rockall Trough during the last quarter of the year (Figure 24.1.5).

It is thus 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

Landings were available for all relevant fleets. Length frequency distribution from Azorean survey was available. No CPUE no discard data were available.

12.7.3.1 Landings and discards

Landings are shown in Table 12.7.0. No discards data were available.

12.7.3.2 Length compositions

Length frequency distribution of black scabbardfish based on samples collected during Azorean longline exploratory fishing surveys in Subarea X in 2004 and 2005 is presented in Figure 12.7.1.

During 2005 Russian exploratory survey that took place in August two males of black scabbardfish (total length: 96 and 97 cm) were caught by vertical long-line at Reykjanes Ridge, Subdivision XIVb1 (Vinnichenko and Bokhanov, 2006).

12.7.3.3 Age compositions

No data available.

12.7.3.4 Weight at age

No data available.

12.7.3.5 Maturity and natural mortality

In Azorean waters females in spawning condition (GSI > 3 up to 9) with total lengths between 108 and 137 cm occurred predominantly in October and in November (J. Pereira, pers comm.). The length 108 cm corresponds to the estimate of first maturity determined for for Madeira specimens. Spawners were observed around the Azores from November to April (Vinnichenko, 2002).

12.7.3.6 Catch, effort and research vessel data

No data available.

12.7.4 Data analyses

Length frequency distribution of black scabbardfish based on samples collected during Azorean longline exploratory fishing surveys in Subarea X in 2004 and 2005 showed that the length range of specimens was quite wide, varying from about 50 cm up to 135 cm.

For comparison purposes the length ranges of the species in northern and southern areas are presented:

AREA	LENGTH RANGE (CM)
Northern areas	70 – 110 cm
Southern areas	89 – 132cm

12.7.5 Comments on the assessment

Not applicable.

12.7.6 Management considerations

No new relevant information is available, so the 2004 advice “Fisheries on these stocks 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” is maintained.

Table 12.7.0. Black scabbardfish I, II, IIIa, IV, Va, X, XIV. WG estimates of landings.

Black scabbardfish in Sub-areas II

Year	France	Faroes	**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	0	**0**

Black scabbardfish in Sub-area IV

Year	France	**Total**
1988		**0**
1989	3	**3**
1990	70	**70**
1991	107	**107**
1992	219	**219**
1993	34	**34**
1994	45	**45**
1995	6	**6**
1996	6	**6**
1997	0	**0**
1998	2	**2**
1999	4	**4**
2000	2	**2**
2001	1	**1**
2002	0	**0**
2003	0	**0**
2004	5	**5**
2005	2	**2**

Black scabbardfish in Sub-areas III and IV

Year	Germany	Scotland	E&W&NI	**Total**
1988	-	-	-	**0**
1989	-	-	-	**0**
1990	-	-	-	**0**
1991	-	-	-	**0**
1992	-	-	-	**0**
1993	-	-	-	**0**
1994	3	-	-	**3**
1995	-	2	-	**2**
1996	-	1	-	**1**
1997	-	2	-	**2**
1998	-	9	-	**9**
1999	-	3	-	**3**
2000	0	3	-	**3**
2001	0	10	1	**11**
2002		24		**24**
2003		4		**4**
2004		0		**0**
2005		0		**0**

* Preliminary.

Table 12.7.0 (continued).

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**

* Preliminary.

Table 12.7.0 (continued).

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*	47	323	0	0	**370**

* Preliminary.

Black scabbardfish in Sub-area XII

Year	Faroes	France	Germany	Spain	Scotland	Ireland	E&W&NI	Lituania	**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	-				**447**
1997	102	1	-	98	-				**201**
1998	20	0	-	134	-				**154**
1999	-	3	-	109	0				**112**
2000	1	6	0	237	-				**244**
2001		3	0	115	-				**118**
2002		0	0	1059	1		0		**1060**
2003		7		403		1			**412**
2004	95	10		165	1				**271**
2005*	127	14		0	0	0		1	**142**

* Preliminary [(1)] Includes VIb.

Table 12.7.0 (continued).

Black scabbardfish in Sub-area XIV

Year	Faroes	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**

* Preliminary.

Black Scabbardfish (*Aphanopus carbo*) All ICES areas

	II	IV	III + IV	Va	X	XII	XIV	**Total**
1988	0	0	0	0	0	0	0	**0**
1989	0	3	3	0	0	0	0	**6**
1990	1	70	70	0	0	0	0	**141**
1991	0	107	107	0	166	2	0	**383**
1992	0	219	219	0	370	7	0	**814**
1993	0	34	34	0	2	1168	0	**1239**
1994	0	45	48	1	0	833	0	**927**
1995	1	6	8	0	3	309	0	**326**
1996	0	6	7	0	11	447	0	**470**
1997	0	0	2	1	3	201	0	**207**
1998	0	2	11	0	99	154	2	**267**
1999	0	4	7	9	112	112	0	**243**
2000	0	2	5	10	113	244	90	**464**
2001	0	1	12	5	16	118	0	**152**
2002	0	0	24	13	2	1060	8	**1107**
2003	0	0	4	14	91	412	2	**524**
2004	0	5	5	19	113	271	0	**412**
2005*	0	2	2	19	370	142	0	**536**

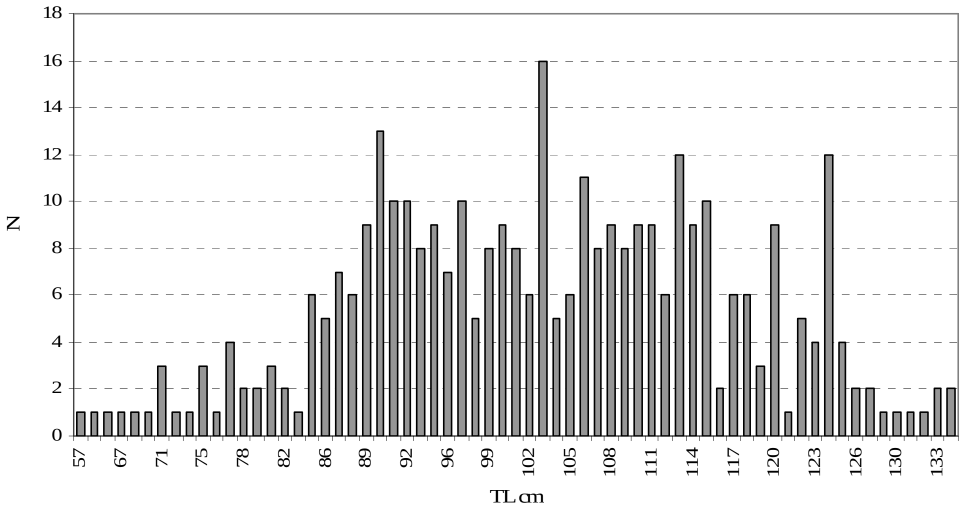


Figure 12.7.1 - Length frequency distribution (in numbers) from samples obtained during Azorean longline exploratory fishing surveys in Subarea X (2004 and 2005)

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 more than 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. Landings for most species are lower than 2004, but greater forkbeard is the third more important species in 2005 landings. Also, 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.

The rest of landings in last 18 years (11%) come from Subareas VIII and IX (mainly from VIII) by the trawler and longline 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 50 tonnes of *P. blennoides* in last 10 years, but the more important lands are recorded of *Phycis spp.*

Minor quantities of *P. blennoides* from X subdivision and Vb sub-area 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. In this subarea Norway greater forkbeard landings mainly come from a Norway commercial longline targeting Greenland Halibut at Hatton Bank.

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 2005 only 1731 tons are recorded. That is a value similar to the landings recorded in years from1988 to 1993 (Figure 12.8.1).

Landings by subarea and gear of Spanish fleet from 2003 to 2005 are shown in Table 12.8.2. In this period the 66 % of total landings of *Phycis spp* of Spanish fleet comes from bottom trawler and longliner fleet (66% and 28%) operating mainly in Subareas VII and VIII.

In subdivision VIII and IX the historical series of landings since 1993 remains quite stable ranking from 320 to 494 tonnes. An exception of this period can be observed in 1999 in which the highest value is reached (664 tons).

In the subarea X landings shows ups and downs which is not a target species of the Portuguese demersal fleet

Even though the maximum landings in VIII and IX are reached in 2001 and in III, IV and Vb in 2002, the overall trend in all subdivisions shows an important decrease of landings since 2000.

In Sub-areas I & II, the landings registered mainly by Norway have declined since1993. 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 t of landings. However a strongly decrease in landings is observed since 2003 (153 t) to 2005 (51 t).

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 2270/2004 established in 2004 the first international *Phycis blennoides* TAC in Community waters for 2005 and 2006. In the next table a summary of *P. blennoides* international TAC and landings by subareas is shown. Due to in some cases international landings are not available by species, the landings in the table reflects the total combined landings for *Phycis spp.* Noticed that except in Subareas X and XII the landings reported are always above the TAC

Phycis blennoides	**2005**	
SUBAREA	TAC	Landing (*)
I, II, III y IV	36	133
V, VI , VII	2028	2495
VIII, IX	267	337
X , XII	63	25
Total	2394	2991

(*) Includes *Phycis spp* landings

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

There is an historical series of *Phycis blennoides* landings data by subarea since 1988. Disaggregated landing data of *Phycis spp.* by gear and subarea are available by the Spanish fleets since 2003. The only sources of discard and length composition and abundance indexes are the discard trips carried out in Irish waters in 2004 and the Spanish trawler surveys in Porcupine since 2001. Length data are available from Spanish bottom trawl surveys in Porcupine since 2001, from commercial fleets of Portuguese bottom longline in subarea X and Russian trawl in the Hatton Plateau and West area of Scotland. No information about age compositions, weight at age, maturity and natural mortality is available.

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.

There is a little information about discards of greater forkbeard, but a recent trip carried out in June 2004 in Irish waters shown that the discard rate for greater forkbeard (0.3%) was one of the lowers in the list species composition (WD 14). The species with the highest discard rate were roundnose grenadier (45.4%) and bairds smoothead (36.9%).

12.8.3.2 Length compositions

The Figure 12.8.2 presents the comparison between length frequency distributions from 2001-2005 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. The great forkbeard mean catch length from these surveys is: 37.7, 34.6, 30.4, 34.8 and 39.8 cm for the years 2001 to 2005, respectively.

Size distribution from the a Russian trawl in the Hatton Plateau comprises fish from 45 to 52 cm with a mean length of 48,0 cm for males and 50,0 cm for females. Also Greater forkbeard, ranged 20-55 cm length were observed in single bottom trawl catches at 410-490 m depth in the West area of Scotland (WGDEEP 2004)

A historical catch at size series of Portuguese bottom longline and hand line fleet in subarea X is available since 1998. The interannual rank size of catches goes from 28 cm to 86 cm, but the mode changes every year. According to the length/weight relationship (J. G. Pereira *pers. com.*) the interannual mean weight of the landings is shown in Table 12.8.3. The annual catch at size graphs show a peak of catches in 2000 and an important decrease in 2001 and 2002. In 2002 is noticeable the reduction of small individual catches. The landing levels in 2003 and 2004 were very similar to 1998, but a new decrease is observed in 2005 (Figure 12.8.3).

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

A historical CPUE series of Portuguese bottom longline and hand line fleet in subarea X is available since 1998. Due to the landings of greater forkbeard in Azorean waters is considered as a by-catch, and standardization of nominal CPUE was carried out in order to get a best understanding of the real situation of catches and efforts. This calculation has considered as categorical factors in the general linear model, and the year, month and vessel class as qualitative factors. In order to take in account the species targeting effect, the percentage of Greater forkbeard in the total catch in each trip was used has a quatitative factor in the GLM procedure. In the Figure 12.8.4 a comparison between nominal (kg/1000 hooks) and standardized CPUE shows higher standardized CPUE values in all the period except in 1994-1995 (WD 15F).

Data of abundance of Greater forkbeard are provided for first time from 2001-2005 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, and the Abundance index reaches the maximun in 2003 with 99,4 individuals/haul (Figure 12.8.5). The WG recomended to follow with the collection on biomass and abundand indexes for this species because a more extent series could be very useful in future assessment of

A geographic representation of *Phycis blennoides* catches in Porcupine bank is shown in Figure 12.8.6 and 7. 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.

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.

12.8.5 Comments on the assessment

Not applicable.

12.8.6 Management considerations

The management considerations must be same mentioned in the previous report.

The general character of this fishery as a by-catch means that CPUE data are unreliable. This fact makes it no manageable according to a single-species regulation. They are no advances in the recommendation to distinguish between the landings of species *Phycis blennoides*, *Phycis phycis* and *Phycis spp.* and also with Morids. Also there is a total absence of data on biological parameters such as age compositions, weigth at age, maturity and natural mortality.

No stock exploitation boundary can be suggested due to lack of assessment. Furthermore, the knowledge of the biology of the species is insufficient, and it is unclear how vulnerable it is to exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data.

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**

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**

* Preliminary data

(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)	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*	5	39		0,3	**45**

* Preliminary data

[1] Includes Moridae, in 2005 only data from January to June

Table 30.1 continued

GREATER FORKBEARD (*Phycis blennoides*) VI and VII

Year	France	Ireland	Norway	Spain[1]	UK (EWNI)	UK (Scot)[2]	Germany	Russia	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	319	237	128	979	179	164		5	**2011**

[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	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	11	14	312	0	**337**

[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**

[1] Includes Moridae

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	63	**63**

[(1)] Includes Moridae, in 2005 only data from January to June

[(2)] *Phycis spp* .

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	45	2011	337	22	63	**2612**

Table 12.8.2. *Phycis spp* Spanish landings (t) by Subarea and gear in the period 2003-2005

Phycis spp

	2003						2004						2005					
Gear	**VI**	**VII**	**VIII**	**IX**	**XII**	**XIV**	**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	1	180	148	0	0	0
Gillnets	0	43	37	1	0	0	0	26	28	0	0	0	0	10	8	0	0	0
Bottom trawl	66	541	167	34	71	0	57	891	112	32	34	0	88	699	97	39	60	0
Others	0	27	10	31	0	0	0	0	0	30	0	0	0	0	0	18	0	0

Table 12.8.3. Interannual biometric data of *P. blennoides* landings of Portuguese fleet in subarea X.

$W=0.00271*LT^{3.28464}$

$R^2= 0.96499$

n= 42

	1998	1999	2000	2001	2002	2003	2004	2005
nº of fishes	20650	29723	53922	36720	11632	18394	21809	12889
mean length (cm)	51,7	52,8	56,8	57,7	65,4	62,3	55,5	55,1
rank length (cm)	(20-76)	(30-83)	(32-83)	(28-78)	(39-86)	(34-85)	(30-83)	(28-81)
mean weight (g)	1.154	1.237	1.572	1.654	2.497	2.127	1.453	1.419

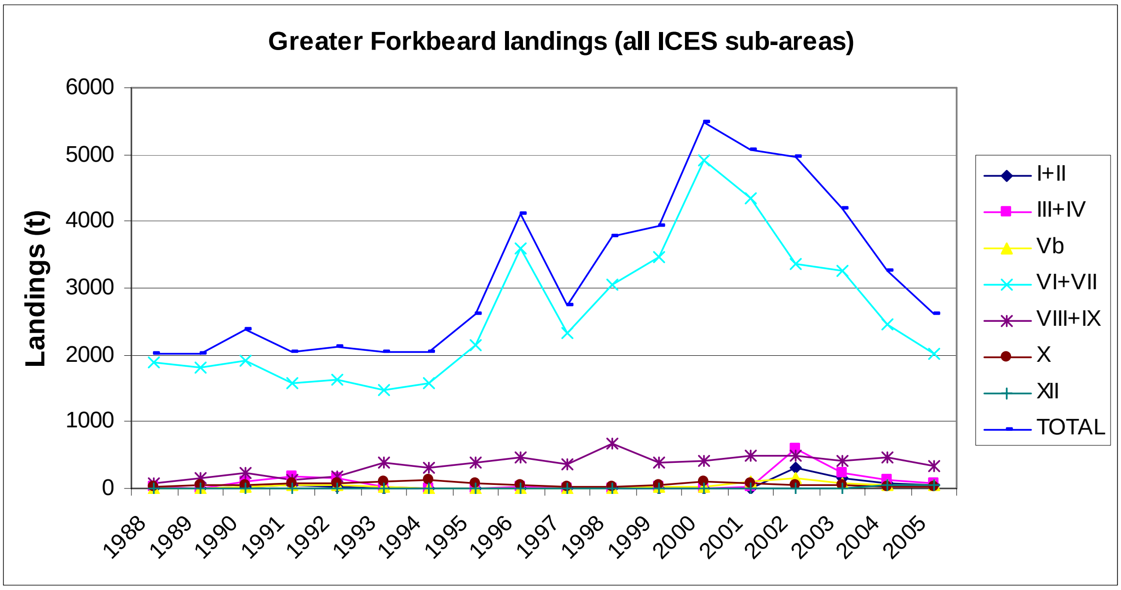


Figure 12.8.1. Greater forkbeard landing trends in all ICES Subareas since 1988.

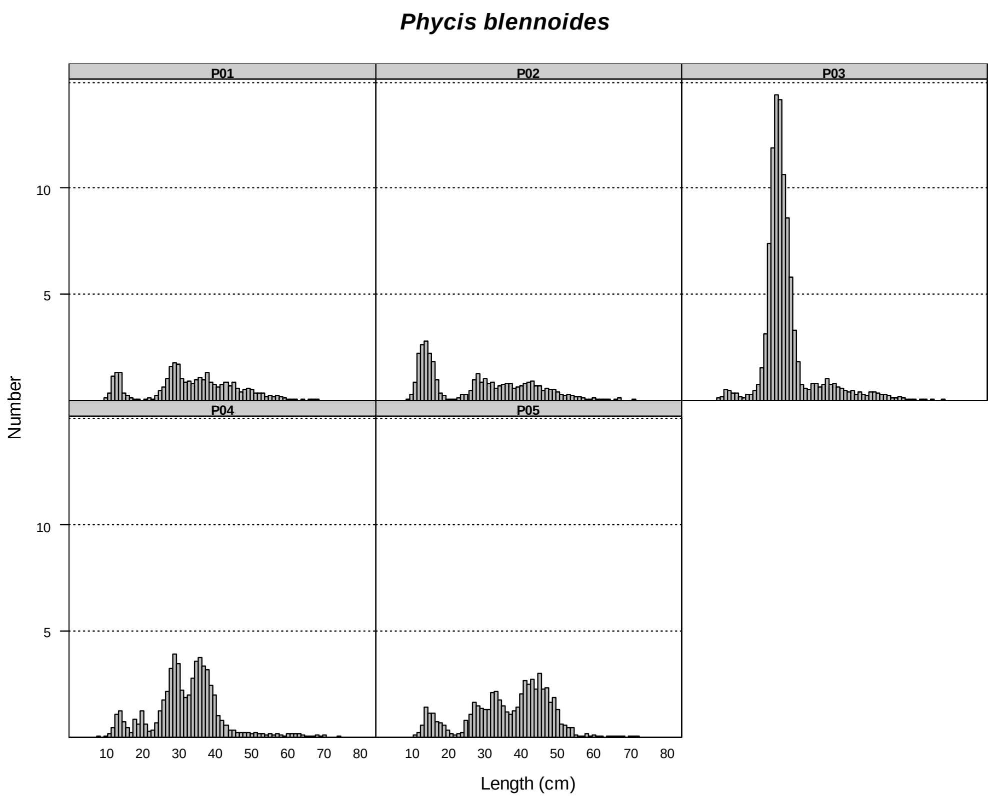


Figure 12.8.2. Spanish bottom trawl survey in Porcupine Bank. Comparison between Greater forkbeard length frecuency distributions from the 2001-2005 period.

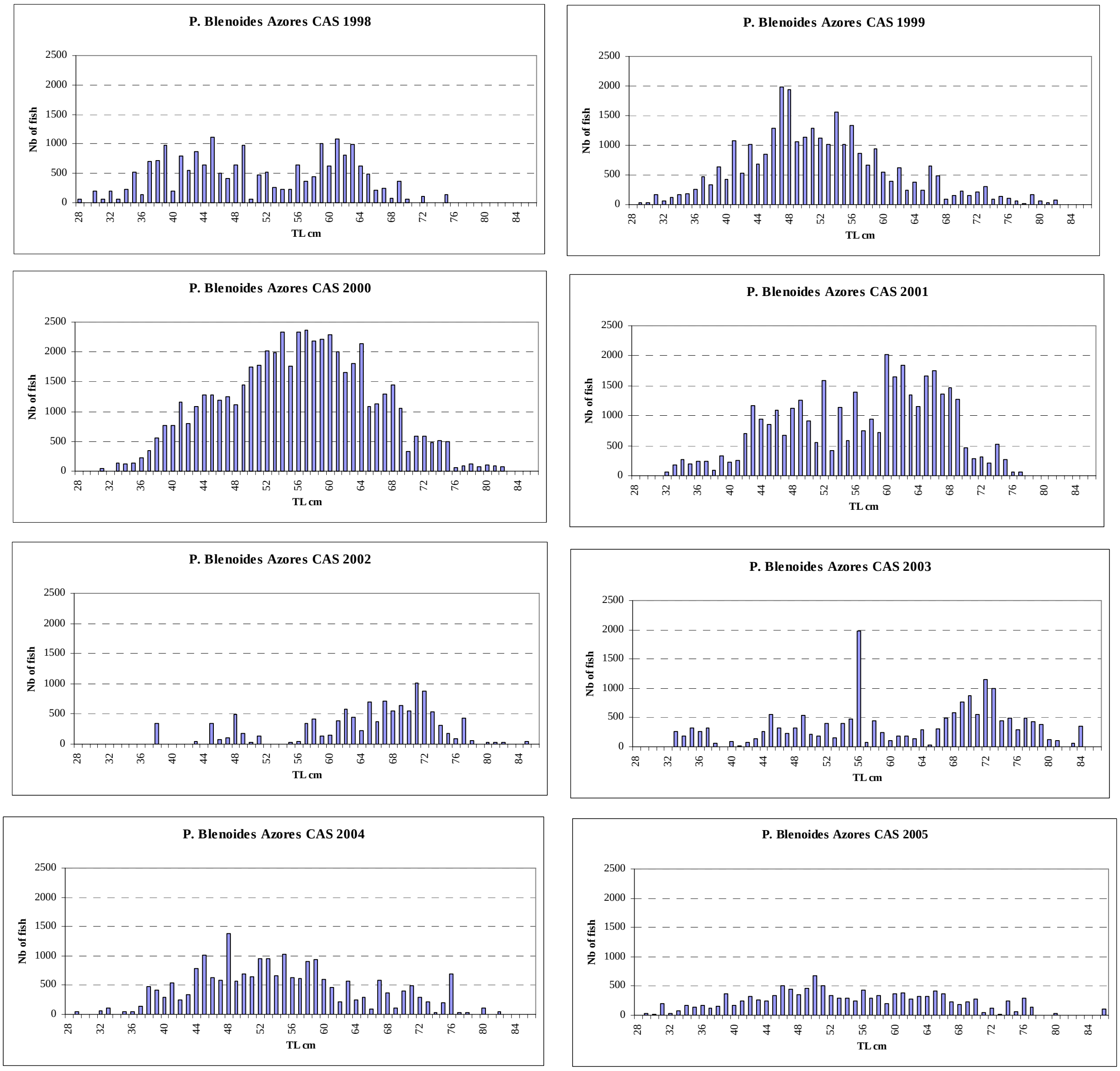


Figure 12.8.3. Catch at size distribution of *P. blennoides* landings of Portuguese fleet in subarea X (J. G. Pereira *pers. com.*).

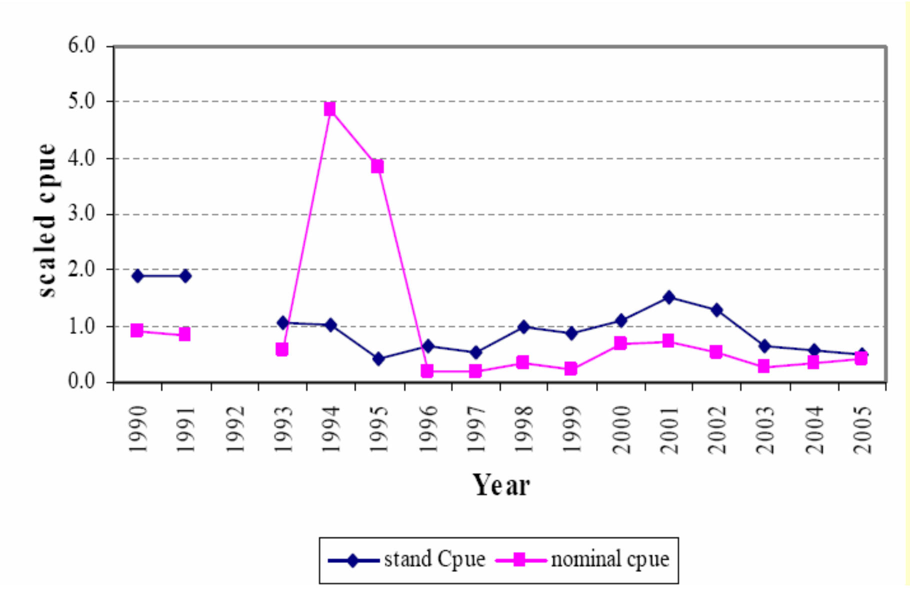


Figure 12.8.4. Comparison of greather forkbeard nominal and standardized CPUE in weight from Azores bottom longline fishery. For comparison purposes, series were scaled to their overall mean (J. G. Pereira *pers. com.*).

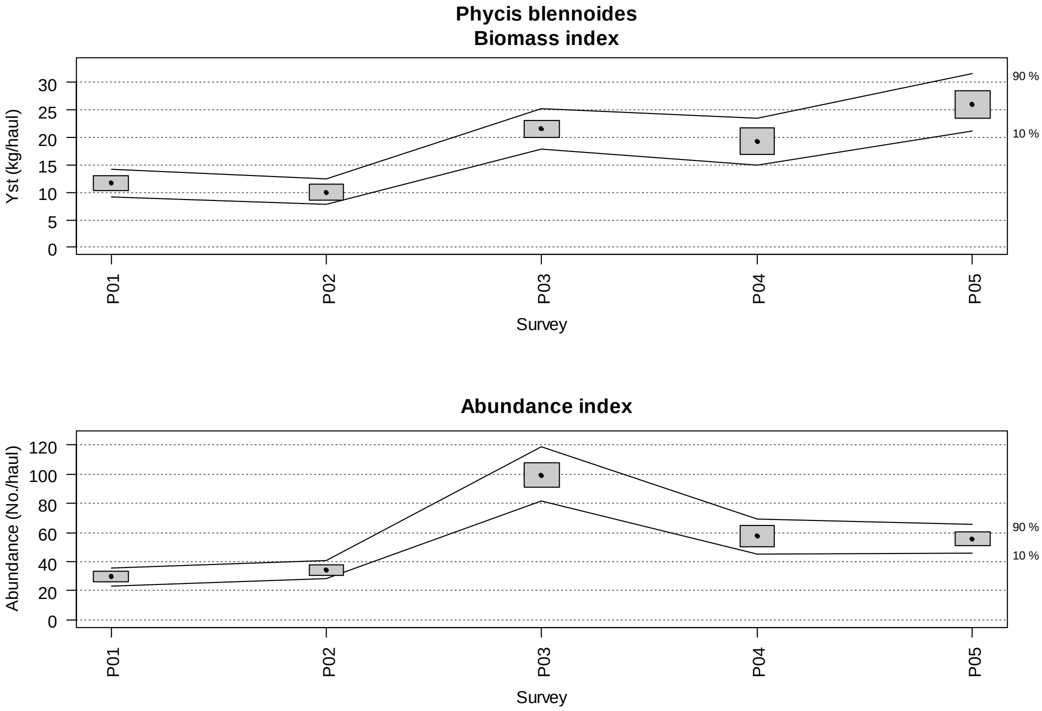


Figure 12.8.5. Changes in *Phycis blennoides.* biomass and abundance index during Porcupine Survey time series (2001-2005). Rectangles indicate. Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000) (F. Velasco, pers. com.)

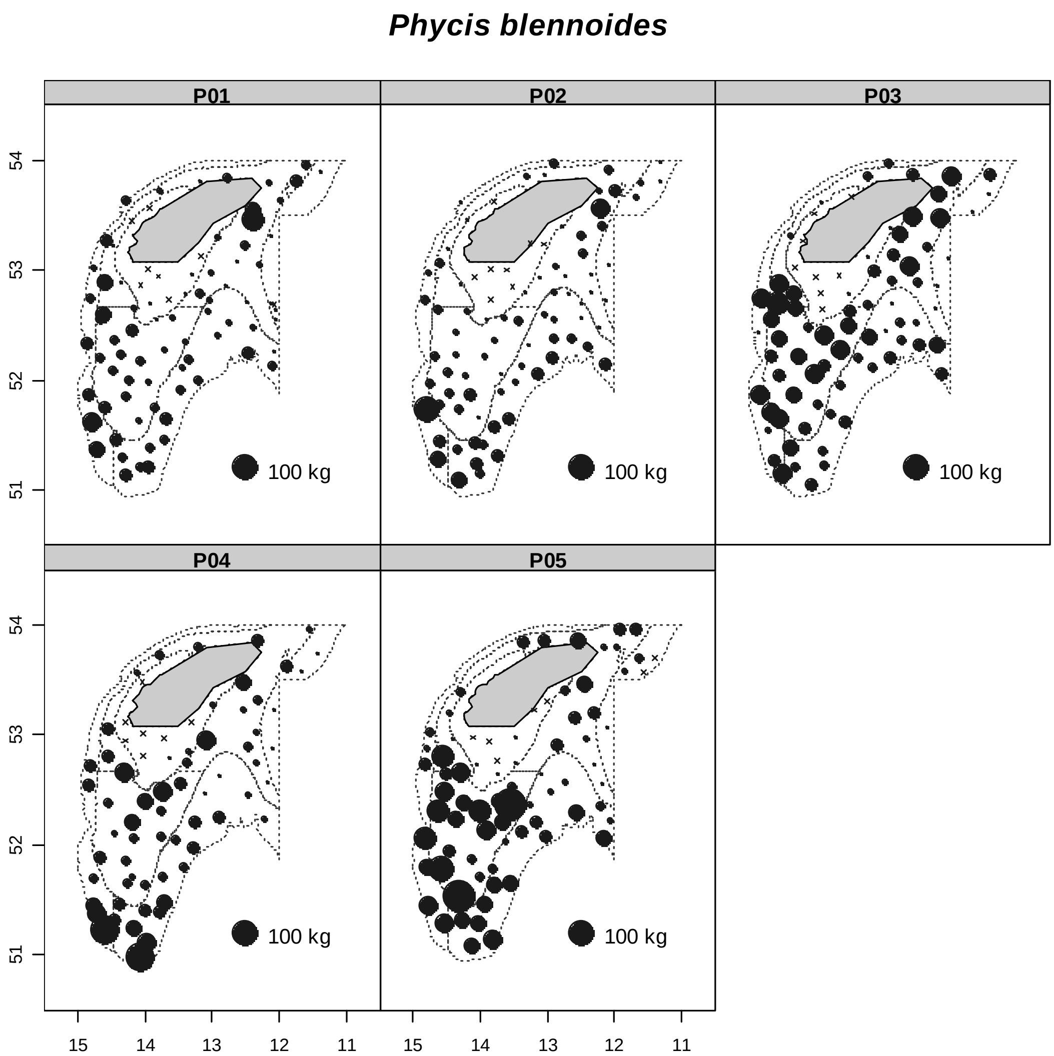


Figure 12.8.6. Geographic distribution of *Phycis blennoides* catches (kg/30 min haul) in Porcupine surveys between 2001 and 2005 (F. Velasco, pers. com.).

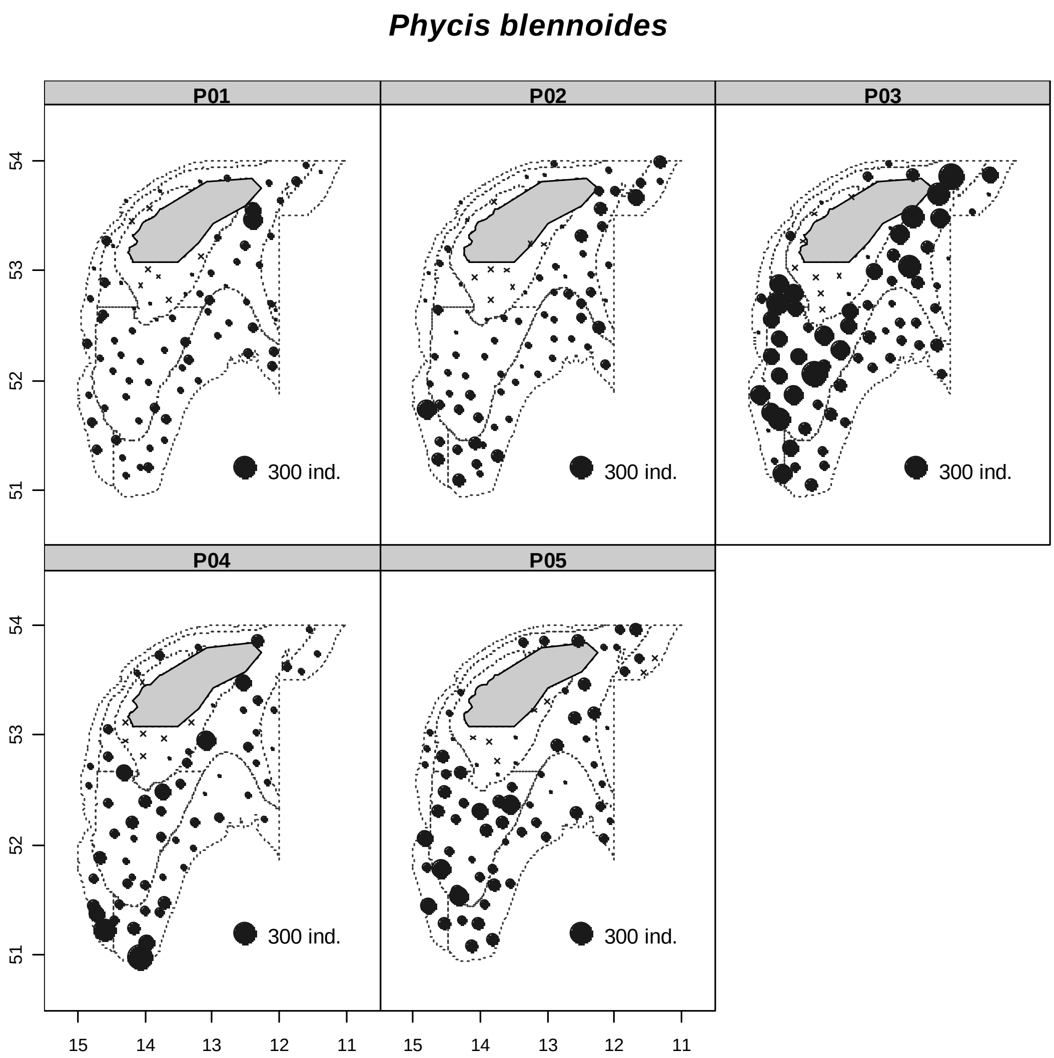


Figure 12.8.7. Geographic distribution of *Phycis blennoides* catches (n/30 min haul) in Porcupine surveys between 2001 and 2005 (F. Velasco, pers. com.).

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 X, where the landings of *B. decadactylus* averaged 20% of the catches of both species in the last 10 years.

Since 1988, more than 60% of landings came from subarea X. Portuguese, Spanish and French trawlers and long liners are the main fleets involved in this fishery. Former USSR trawlers were responsible for high catches in area X from 1994 to 1997.

Other areas with important catches are VI+VII, with an average contribution of 12% of the total catch from 1996 to 2005 and areas VIII+IX, which catches averaged 23% of the total from 1996 to 2005. 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.

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 12.9.1. 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 usually a by-catch of demersal fisheries targeting other species.

The reported landings have shown an increasing trend until 1996, year when the largest catch was recorded (816 t). In the following years a decrease was observed and the catches remained afterwards between 400 and 600 t annually, fluctuating without trend. The preliminary landing data for 2005 are of 417 t.

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 2005 catch (69 t) was at the same level of 2004 (62 t).

In Subareas VIII-IX, the reported landings were very small (1-2 t) and scattered until 1994, but they have increased continuously from 1995 onwards. The largest catch was observed in 1998, when it amounted to 269 t. In the period 1999-2002 the reported landings varied between 160 t and 237 t, mainly due to the Spanish landings. Most of these landings can be regarded as by-catches of the Spanish and Portuguese demersal fisheries in these Subareas. A drop in the catches was observed in 2003 (109 t) but they increased again in the following years, reaching 191 t in 2005.

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 *Beryx* spp. by former USSR trawlers were estimated to be around 1800 t during 1978−1979. Landings by Russian trawlers in the North Azores area were also estimated for some years in the 1990s. They oscillated between 100 and 864 t. From 1997 no landings were reported by Russia for the Subarea X. In 2000 one trawler worked a few days in the area catching 5 t. Some new information was referred during the meeting, but was not incorporated in the report due to lack of consistency with previously reported data.

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 1988-2005 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

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 *Beryx splendens* suggesting that significant genetic differentiation may occur between populations of *Beryx splendens* 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 sub area X.

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

Table 12.9.0 describes 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 subarea X (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 12.9.6 for alfonsino (Pereira, 2006, WD15e)

Mean annual length composition (1995-2005) from spring bottom longline surveys in Azores (Ices area X) for *B. decadactylus* are presented in figure 12.9.5 and in figure 12.9.8 for *B. splendens* (Pinho, WD15e).

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

New information on the sex ratio and stage of maturity was available for both *Beryx* species from the Azores fisheries in area X, presented in doc WD 15c (Pereira, 2006).

Beryx decadactylus:

Sex ratio: sex was determined for a total of 705 specimens of golden eye perch, from which 48.9% were males and 51.1% where females. The overall ratio of males to females (1:1.04) was not significantly different from the 1:1 ratio. However, the sex ratio by size classes shows an increasing proportion of females for sizes over 42 cm and for lengths greater than 50 cm no males were observed. This could indicate a differential growth or a natural mortality between sexes, since even for the smaller sizes we have not observed signs of hermaphroditism. The sex ratio of the observed golden eye perch, by size classes, is presented in figure 12.9.9.

Maturity: The monthly frequencies of occurrence of the various maturity stages of golden eye perch shows that individuals in spawning condition (stage IV) were not observed in the samples and only a few individuals were observed in ripe or post spawning conditions. The evolution of the gonadosomatic index ($GSI=Gonad_{weight}/Total_{weight} *100$), in a monthly basis, also confirms the previous observations, since the average GSI for both sexes stays at low levels during the all year (figure 12.9.10).

Beryx splendens:

Sex ratio: sex was determined for a total of 968 specimens of alfonsino, from which 42.4% were males and 57.6% where females (figure 12.9.11). The overall ratio of males to females (1:1.36) was significantly different from the 1:1 ratio. Also, the sex ratio by size classes shows an increasing proportion of females for sizes over 32 cm and, for lengths greater than

40 cm no males were observed. This could indicate a differential growth or a natural mortality between sexes, since even for the smaller sizes hermaphroditism was not observed.

Maturity: In the case of the females, individuals in spawning condition (stage IV) were observed in the samples from February to July and also in November and December, with a peak in February and March. In the case of the males, a similar situation was observed. The evidence of a reproductive period is also confirmed by the development of the gonadosomatic index ($GSI=Gonad_{weight}/Total_{weight} *100$). The GSI, presented in a monthly basis for both sexes in figure 12.9.12, shows an increase in the GSI from February to April, with a peak in March.

The gonadosomatic index by fork length classes and stage of maturity for the females of alfonsino, shows high values of GSI for larger specimens (Pereira, WD15c).

The mean length at first maturity was estimated fitting the logistic function to the fraction of mature females per 1 cm fork length size interval. Fish were considered sexually mature if they were in gonad stages III, IV or V. The logistic curve fitted to the proportion of sexually mature alfonsinos estimated the mean length at sexual maturity at 34.7 cm of fork length, as showed in figure 12.9.13.

No information about natural mortality of *Beryx* species was available during the WGDEEP meeting

12.9.3.6 Catch, effort and research vessel data

Beryx decadactylus

Catch and effort information on 1449 fishing trips from the deep water bottom longline fishery in Azores where available for the period 1990 to 2005.The generalized linear model (GLM) was used as the standardization method to adjust the CPUE trends in biomass (kg per 1000 hooks) and in number (number of fish per 1000 hooks) of golden eye perch from the Azores longline fishery. Factors year, month, area and target species were used to adjust the nominal catch per unit of effort in biomass and in number. The fitting of a general linear statistical model relating the CPUE (in biomass and in number) to the 4 predictive factors, explains 51.3% of the variability in CPUE. (Pereira 2006, WD15b).

The annual standardized CPUE in biomass and 95% confidence intervals are plotted in figure 12.9.14. Document WD15b provides information on estimated parameters, their standard error, relative CPUE by year and upper and lower 95% confidence intervals obtained. For comparison purposes, both biomass CPUE series, nominal and standardized, scaled to their overall mean are presented in figure 12.9.15.

Annual bottom longline survey abundance index in number “Relative Population Number” (RPN) available for the golden eye perch (*Beryx decadactylus*) from the Azorean deep-water species surveys, are presented in figure 12.9.16.

Beryx splendens

Catch and effort information on 1465 fishing trips from the deep water bottom longline fishery in Azores where available for the period 1990 to 2005.The generalized linear model (GLM) was used as the standardization method to adjust the CPUE trends in biomass (kg per 1000 hooks) and in number (number of fish per 1000 hooks) of golden eye perch from the Azores longline fishery. Factors year, boat category and target were used to adjust the nominal catch per unit of effort. The analysis was conducted for CPUE in biomass (kg of fish per 1000 hooks) and for CPUE in number (number of fish per 1000 hooks). The fitting of a general linear statistical model relating the CPUE (in biomass and in number) to the 3 predictive factors, explains 63.1% of the variability in CPUE (Pereira 2006, WD15a).

The annual standardized CPUE in biomass (kg per 1000 hooks) and 95% confidence intervals are plotted in figure 12.9.17. Document WD15a provides information on estimated parameters, their standard error, relative CPUE by year and upper and lower 95% confidence intervals obtained. For comparison purposes, both biomass CPUE series, nominal and standardized, scaled to their overall mean are presented in figure 12.9.18.

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, are presented in figure 12.9.19 (Pinho in WD 15).

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.

Beryx decadactylus

The size distribution of *B. decadactylus* landings shows a stability of the sizes caught along the period, which is also confirmed by the stability observed in the annual average weight (figure 12.9.4), which has fluctuated around 1.2 kg in the 8 years analyzed.

The estimated standardized CPUE in biomass, during the analysed exploitation period, presents an overall slow decreasing trend but with fluctuations around its mean. 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 (Pinho, WD 15).

Beryx splendens

Alfonsino size frequencies show some interannual variability with a general stability of the sizes caught along the analyzed period. The annual average weights (figure 12.9.7) also show some stability until 2002 followed by a small decrease in the two last years (Pereira 2006 in WD15e).

The standardized CPUE in biomass, during the analysed exploitation period, presents an overall slow decreasing trend but with fluctuations around its mean. 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.

12.9.5 Comments on the assessment

Considerable progress has been made concerning the statistics and the biology of both *Beryx* species. Recent work has been done on standardization of commercial cpue, abundances indices are available from longline surveys and the specific composition of the *Beryx* catches in area X is known. Considering this progress in the knowledge of the *Beryx*, a future assessment may be envisaged. This will require that both species be handled separately by the WGDEEP and also that an attempt should be done for the different fisheries in order to separate the overall catches of *Beryx* by species.

It is also recommended that the pattern observed in the residuals from the cpue standardisation from the Azores longline fishery be further analyzed.

12.9.6 Management considerations

The general absence of data for most fisheries, on species composition of the catches and biological parameters such as size and age compositions, weight at age, maturity and natural mortality, are important limiting factors for the assessment and thus limit the management advice. Survey data from Azorean waters shows slow declining catch rates in recent years for *B. splendens* but the opposite is seen for *B. decadactylus*, for which the abundance index presents an upward trend since 2003Some signs of decline in the abundance of both *Beryx* species are observed, based in the analyses of the standardized cpue from the Azores longline fishery..

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.

Table 12.9.1. WG estimates of landings for the Alfonsinos, (*Beryx* spp), by ICES Subareas/Divisions.

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**

*Preliminary

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**

*Preliminary

Table 12.9.1 (continued).

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*	14	0	55	0	**69**

*Preliminary

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	213	0	**280**
2005*	4	45	142	0	**191**

*Preliminary

Table 12.9.1 (continued).

ALFONSINOS (Beryx spp.) X

Year	Faroes	Norway	Portugal	Russia	E & W	TOTAL
1988			225			**225**
1989			260			**260**
1990			338			**338**
1991			371			**371**
1992			450			**450**
1993		195	533			**728**
1994		0	644	864		**1508**
1995	0	0	529	100		**629**
1996	0	0	550	0		**550**
1997	5	0	379	600		**984**
1998	0	0	229	0		**229**
1999	0	0	175	0		**175**
2000	0	0	203	5	15	**223**
2001	0	0	199	0	0	**199**
2002	0	0	243	0	0	**243**
2003	0	0	172	0	0	**172**
2004	0	0	139	0	0	**139**
2005*	0	0	157	0	0	**157**

*Preliminary

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**

*Preliminary

Table 12.9.1 (continued).

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*		

ALFONSINOS (Beryx spp.). All areas.

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	1508		**1515**
1995		1	3	82	629	2	**717**
1996			178	88	550		**816**
1997			25	135	984		**1144**
1998			81	269	229		**579**
1999			75	201	175		**451**
2000			133	167	223		**523**
2001			186	229	199		**614**
2002			94	237	243		**574**
2003			82	109	172		**363**
2004			62	280	139		**481**
2005*			69	191	157		**417**
*Preliminary							

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

Table 12.9.3. Estimated parameters, relative CPUE in biomass (kg per 1000 hooks), standard error, upper and lower 95% confidence limits for *B. decadactylus* from the Azores longline fishery (ICES X)

Year	Count	Mean	Stnd. Error	Lower Limit	Upper Limit
	1498	1.429207	1.154114	1.079169	1.892784
1990	110	2.130769	1.178497	1.544311	2.939942
1991	85	2.01663	1.190788	1.432166	2.839619
1992	13	2.377572	1.33532	1.348933	4.190625
1993	55	1.538605	1.206757	1.064521	2.223821
1994	26	1.288243	1.259644	0.819437	2.025258
1995	30	1.680926	1.245854	1.092538	2.586191
1996	36	1.270527	1.233824	0.841649	1.917948
1997	26	1.154105	1.25347	0.741215	1.79699
1998	67	1.579299	1.194385	1.114973	2.236992
1999	122	1.044628	1.175778	0.760547	1.434818
2000	184	1.455817	1.168112	1.073591	1.974124
2001	115	1.154022	1.178847	0.83591	1.593193
2002	131	1.616606	1.15914	1.210321	2.159276
2003	190	1.135207	1.167332	0.838254	1.537356
2004	139	1.177129	1.173769	0.859892	1.611401
2005	169	1.014088	1.169329	0.746314	1.377938

Table 12.9.4. Estimated parameters, relative CPUE in biomass (kg per 1000 hooks), standard error, upper and lower 95% confidence limits for Alfonsino (*B. splendens)* from the Azores longline fishery (ICES X).

	Count	Mean	Stnd. Error	Lower Limit	Upper Limit
Year	1464	2.692327	1.04053	2.490633	2.910369
1990	122	2.955713	1.093683	2.479922	3.522814
1991	78	2.659758	1.117483	2.139397	3.306698
1992	16	2.363302	1.269704	1.480013	3.773753
1993	64	3.396753	1.127828	2.683304	4.299892
1994	30	3.430308	1.191891	2.431713	4.839009
1995	23	3.139552	1.225156	2.108713	4.674349
1996	42	2.902928	1.164765	2.152838	3.914353
1997	32	2.669024	1.187641	1.905337	3.73882
1998	65	2.745354	1.129898	2.160944	3.487831
1999	143	2.472874	1.08647	2.101882	2.909351
2000	191	3.031477	1.078242	2.61535	3.513807
2001	106	2.986374	1.101268	2.471932	3.607879
2002	110	2.643678	1.098647	2.198508	3.178979
2003	141	1.864191	1.087221	1.58237	2.196201
2004	133	1.996044	1.089713	1.686705	2.362114
2005	168	2.39386	1.078367	2.064793	2.775359

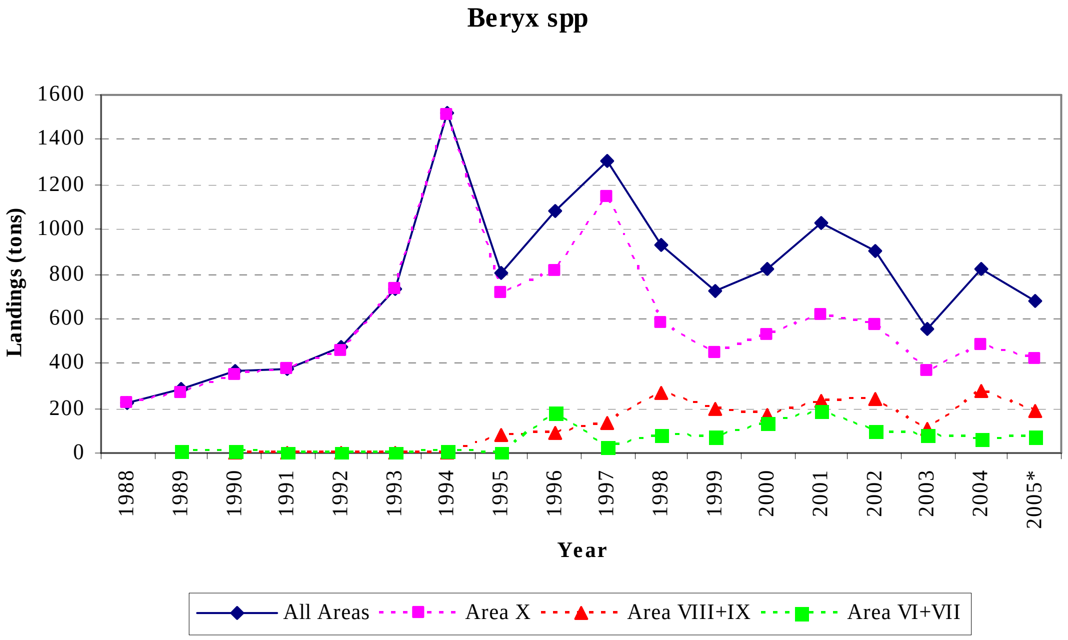


Figure 12.9.1. Reported landings for the Alfonsinos, (*Beryx* spp), by ICES Subareas/Divisions

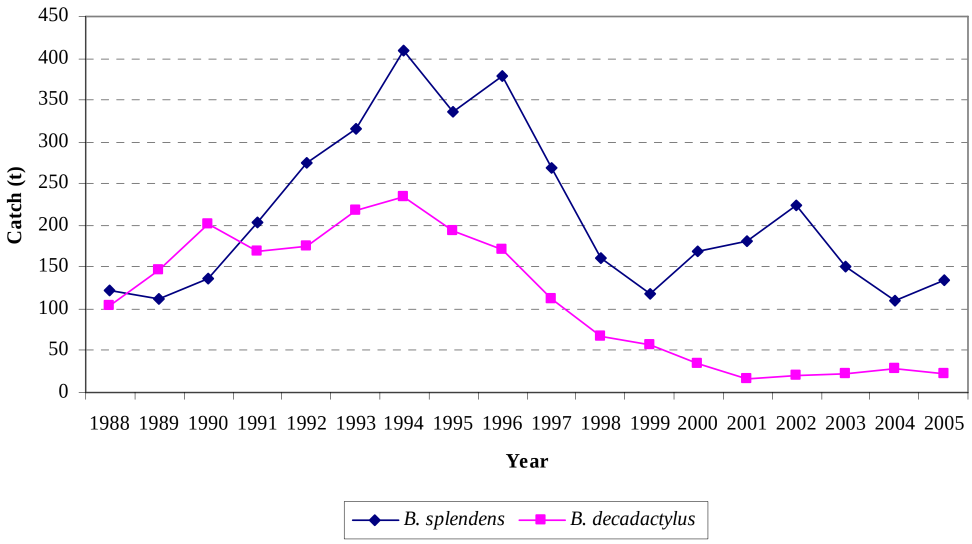


Figure 12.9.2. Landings of *Beryx splendens* and *B. decadactylus in Azores (*Ices area X).

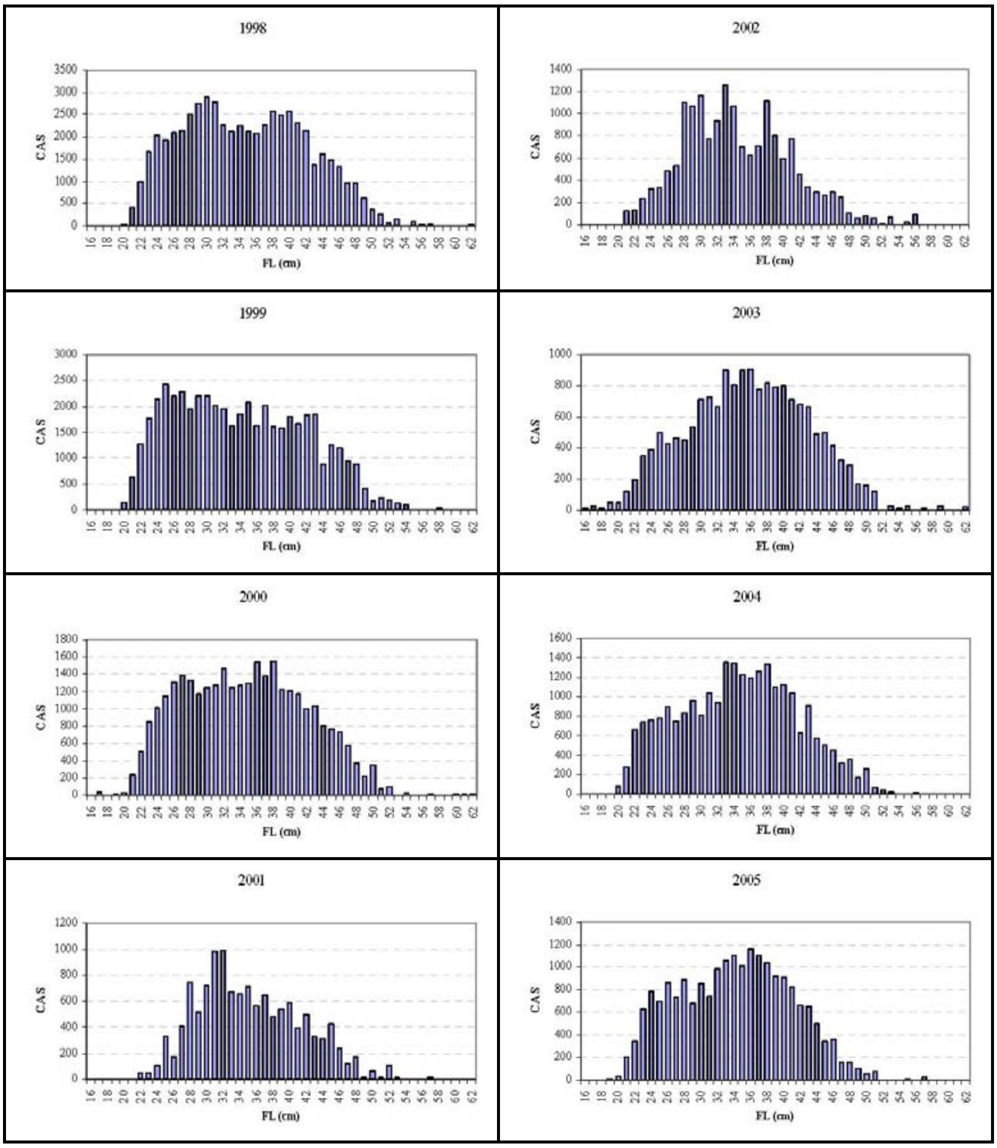


Figure 12.9.3. Size frequencies of the catches of the Golden eye perch (*Beryx decadactylus*) from the Azores longline fishery, from 1998 to 2005 (ICES X).

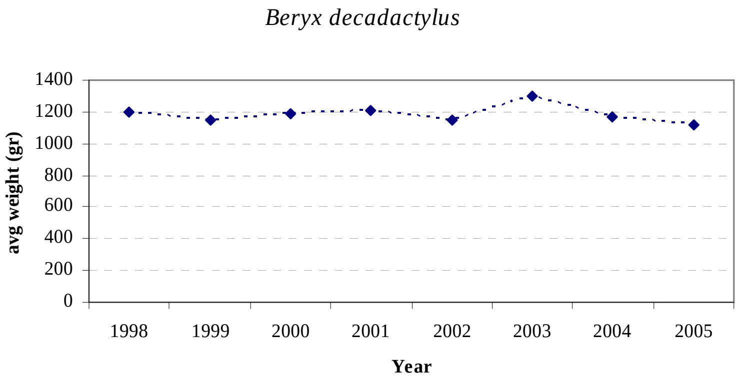


Figure 12.9.4. Annual average weights of the Golden eye perch (*Beryx decadactylus*) from the Azores longline fishery (ICES X).

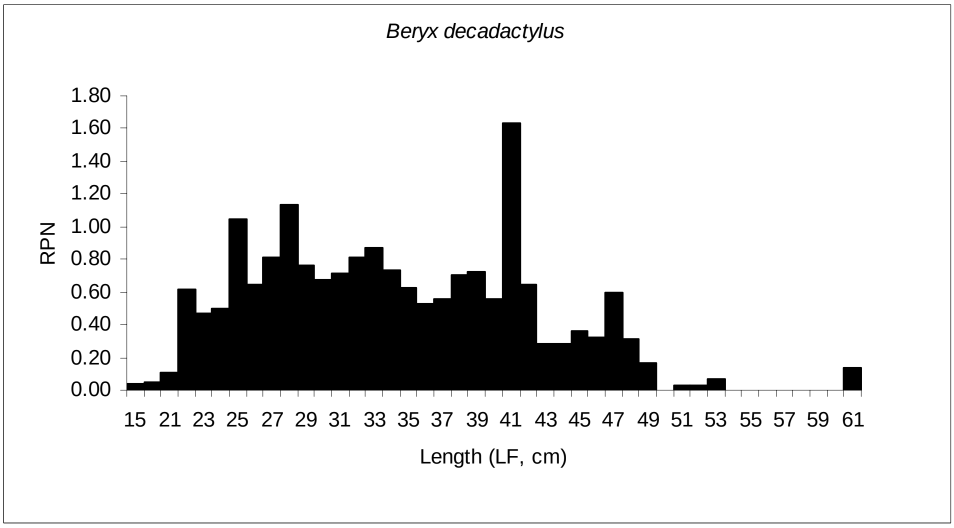


Figure 12.9.5. Mean annual length composition (1995-2005) from spring bottom longline surveys in Azores (Ices area X) for *Beryx decadactylus*.

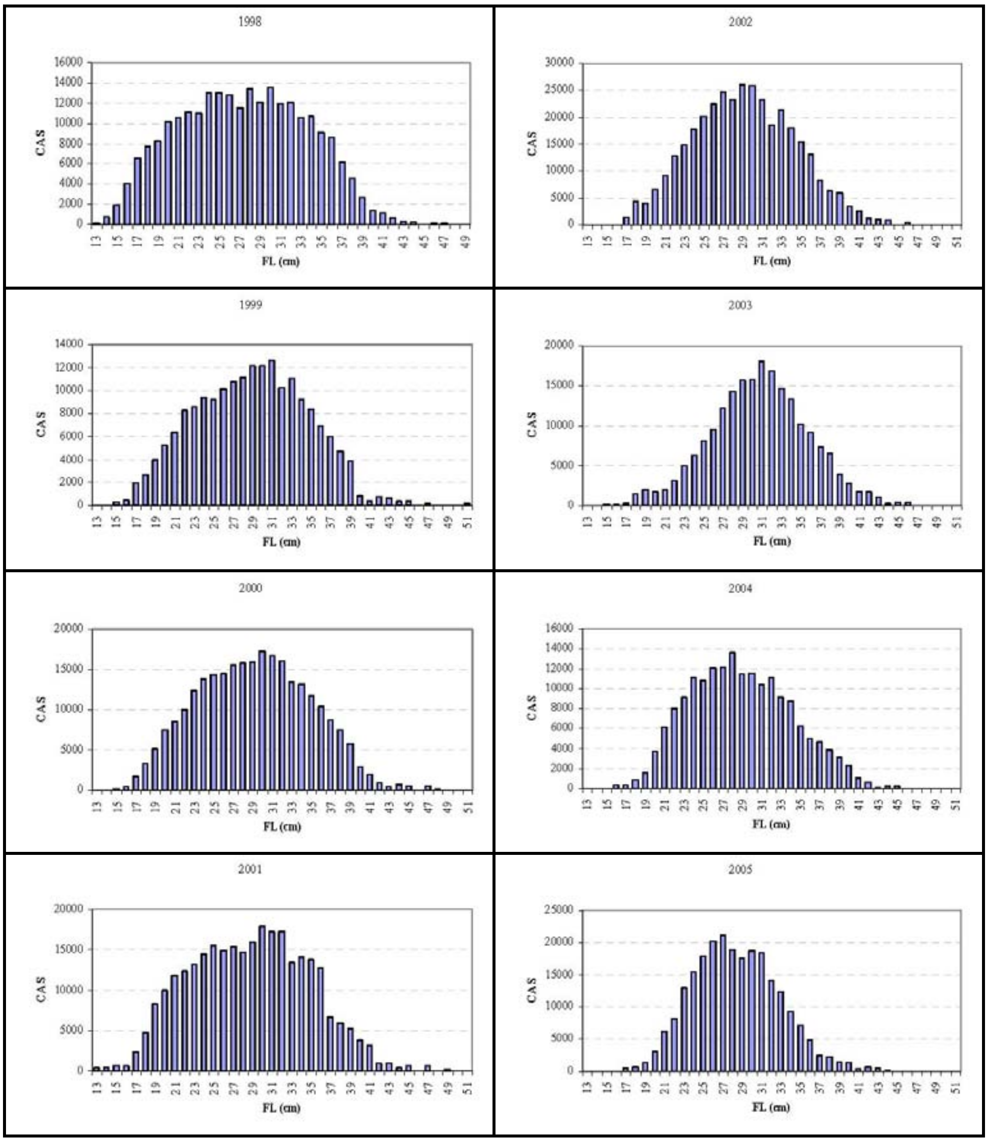


Figure 12.9.6. Size frequencies of the catches of alfonsino (*Beryx splendens*) from the Azores longline fishery, from 1998 to 2005 (ICES X).

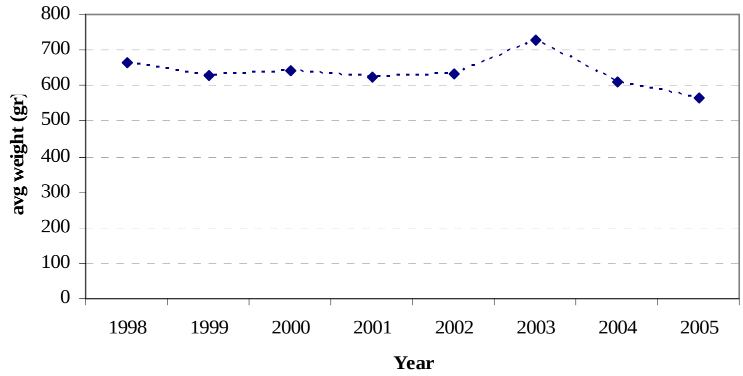


Figure 12.9.7. Annual average weights of the alfonsino (*Beryx splendens*) from the Azores longline fishery (ICES X).

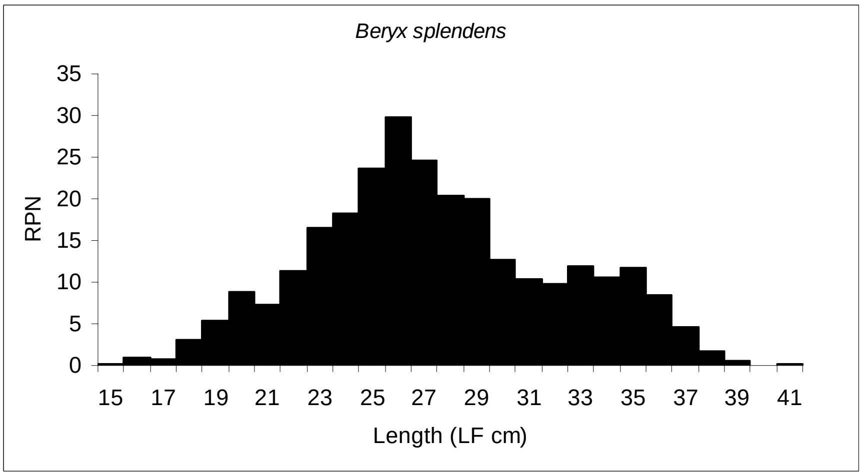


Figure 12.9.8. Mean annual length composition (1995-2005) from spring bottom longline surveys in Azores (Ices area X) for *Beryx splendens*.

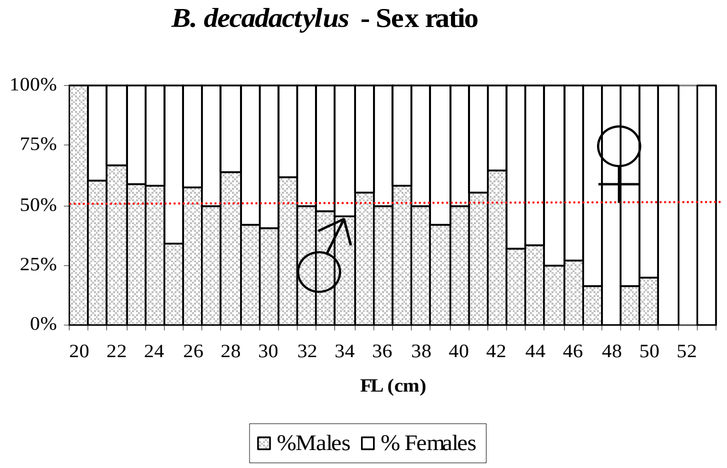


Figure 12.9.9. Sex ratio of the Golden eye perch (*Beryx decadactylus*) from the Azores longline fishery (ICES X).

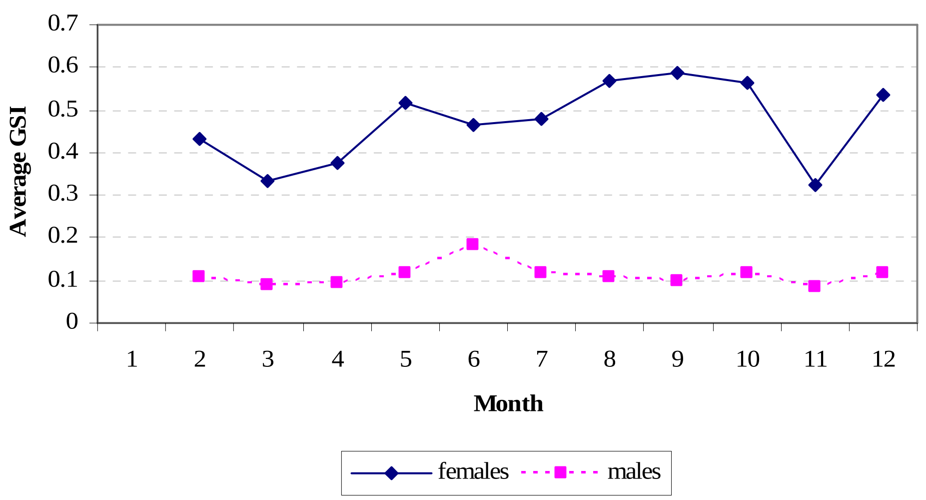


Figure 12.9.10. Monthly evolution of the average gonadosomatic index (GSI) for Golden eye perch (*Beryx decadactylus*) in the Azores (ICES X).

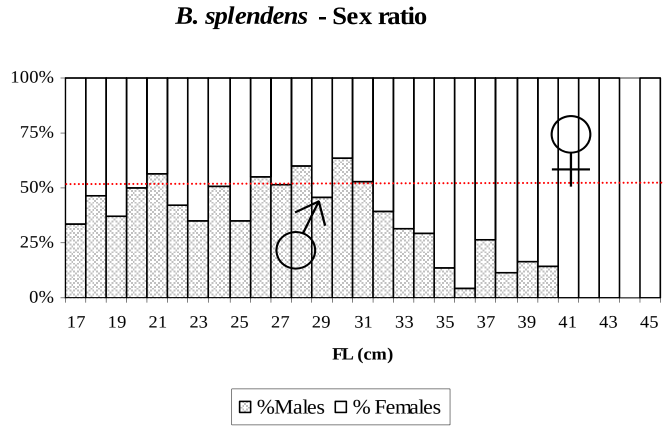


Figure 12.9.11. Sex ratio of alfonsino (*Beryx splendens*) from the Azores longline fishery (ICES X).

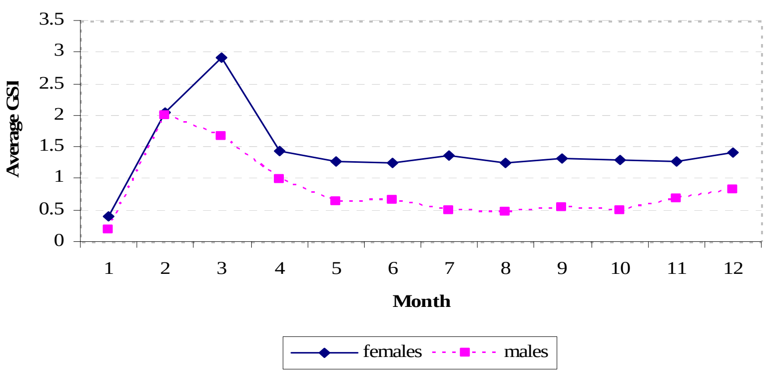


Figure 12.9.12. Monthly evolution of the average gonadosomatic index (GSI) for the Alfonsino *(Beryx splendens*) from the Azores (ICES X).

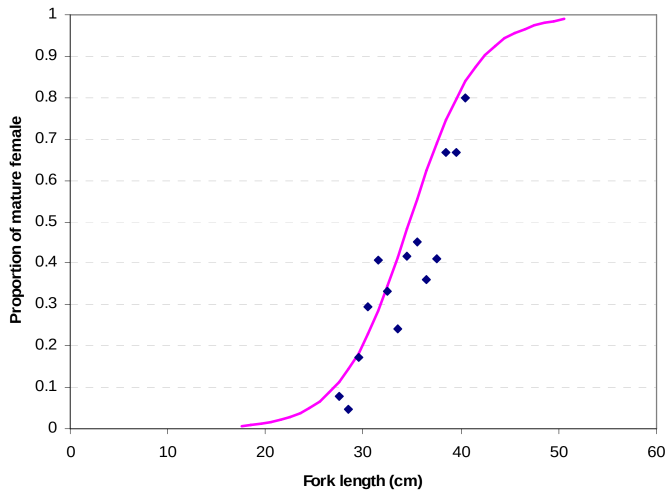


Figure 12.9.13. Size at sexual maturity (FL_{50}) for Alfonsino *(Beryx splendens*) from the Azores (ICES X).

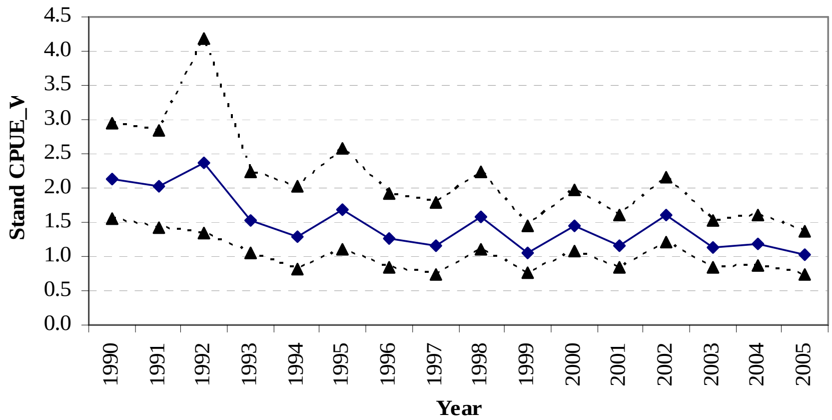


Figure 12.9.14. Annual standardized CPUE in biomass (kg per 1000 hooks) and upper and lower 95% confidence intervals for *B. decadactylus* from the Azores longline fishery (ICES X)

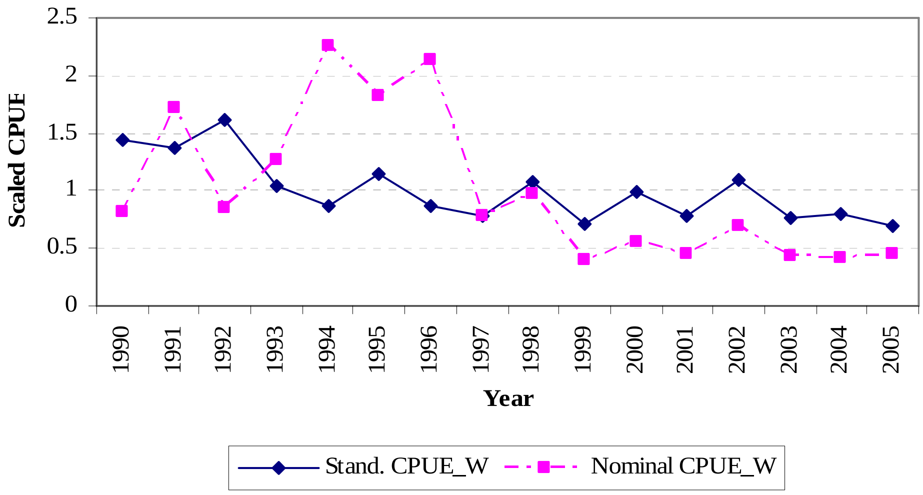


Figure 12.9.15. Comparison of golden eye perch (*B. decadactylus)* nominal and standardized CPUE in weight from Azores bottom longline fishery. For comparison purposes, series were scaled to their overall mean (ICES X).

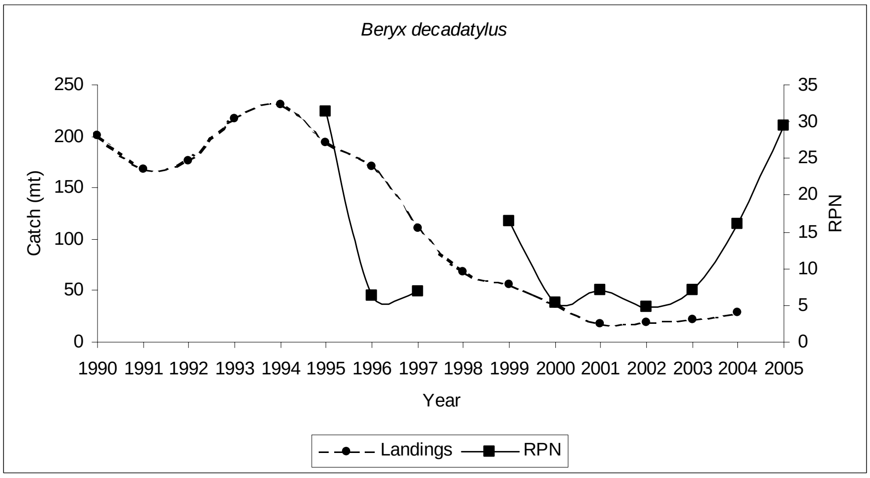


Figure 12.9.16. Annual bottom longline survey abundance index in number "Relative Population Number" (RPN) available for the golden eye perch (*B. decadactylus*) from the Azorean deep-water species surveys (ICES X). Annual landing are also presented in the graph for trend illustration.

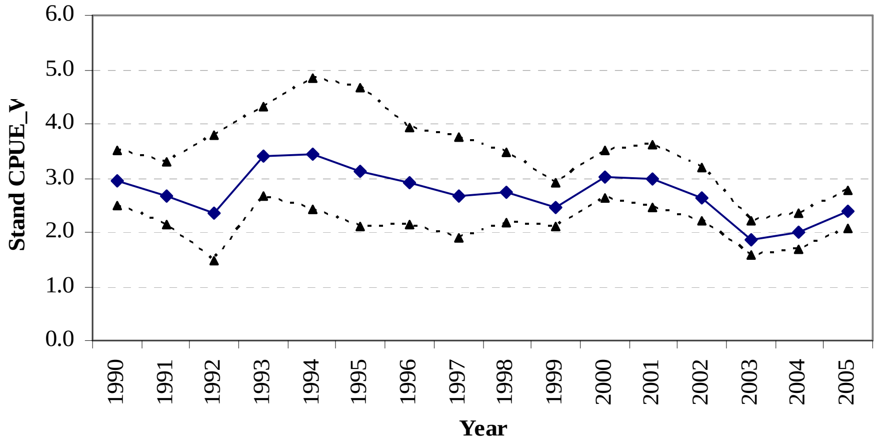


Figure 12.9.17. Annual standardized CPUE in biomass (kg per 1000 hooks) and upper and lower 95% confidence intervals for the Alfonsino (*B. splendens)* from the Azores longline fishery (ICES X).

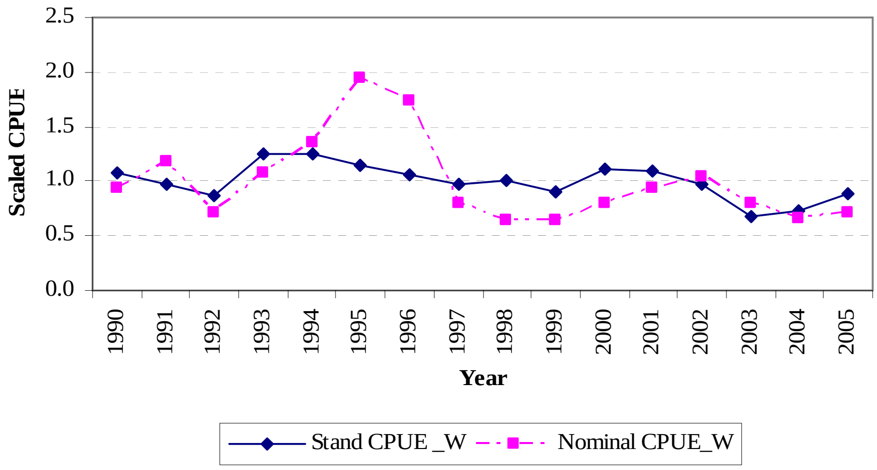


Figure 12.9.18. Comparison of alfonsino (*B. splendens)* nominal and standardized CPUE in weight from Azores bottom longline fishery (ICES X). For comparison purposes, series were scaled to their overall mean.

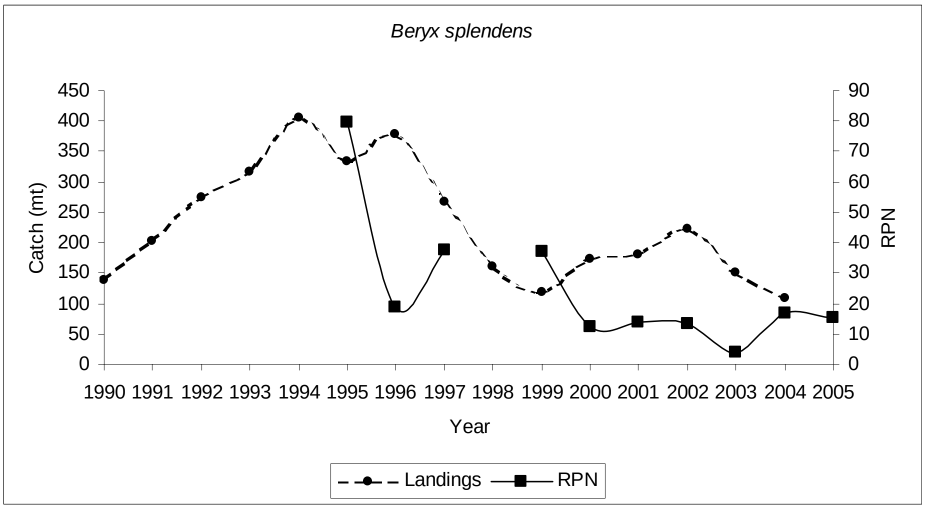


Figure 12.9.19. Annual bottom longline survey abundance index in number "Relative Population Number" (RPN) available for the Alfonsino (*Beryx splendens*) from the Azorean deep-water species surveys (ICES X). Annual landing are also presented in the graph for trend illustration.

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*) and deep-water cardinal fish (*Epigonus telescopus*).

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.

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 "*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 realocated to roughhead grenadier in response to more restrictive quotas on other species. It is also possible that part of the high landings of roughhead may result from misreporting of other species eg. roundnose grenadier.

Reported landings of Mora have decreased since 2002 both in the trawl fisheries in sub-areas VI, VII and XII and in the longline fisheries in sub-areas VIII, IX and X. 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 in 2005 continuing a general increasing trend since the mid 1990s. This may be a result of increasing market acceptance of this species which was formerly discarded by most fleets. The greatest increase took place in subarea III where it is a bycatch of the fishery for roundnose grenadier; this reflects the overall increase in catches of the target species.

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. The majority of reported landings are of *A. bairdii* but landings of 1632 kg of *A. rostratus* were reported by Scottish longliners in division VIIk.

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 have declined continuously 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.

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

A summary of the new data made available to the Working group in working documents provided to the WGDEEP 2006 is given in table 12.10.1

12.10.3.1 Landings and discards

Landings for all of these species are presented in table 12.10.0.

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, Spain and the Azores and survey data from Spain. This adds to data included in previous reports.

Length compositions of roughhead grenadier taken in Russian trawl and longline surveys in East Greenland, Hatton Bank and the Norwegian Sea in 2005 are presented in Figures 12.10.1 to 12.10.4. Length compositions of Mora from the Azorean longline survey covering the entire survey period from 1995 to 2005 are presented in figure 12.10.5.

Length compositions of Baird's smoothhead taken in Russian trawl and longline surveys in Hatton Bank and Bill Bailey Bank in 2005 are presented in Figures 12.10.6 to 12.10.8. Length compositions of Baird's smoothhead and roundnose grenadier in the Spanish Hatton Bank survey, ECOVUL/ARPA

2005/10 are shown in figures 12.10.9 and 12.10.10. Further length compositions of this species from Spanish commercial catches and discards from the Hatton Bank fishery between 2002 and 2005 are presented in figures 12.10.11a and 12.10.11b. During this time period there was a reduction in modal length in landings.

Length compositions of wreckfish in the Azorean longline surveys covering the entire survey period from 1995 to 2005 are presented in figure 12.10.12. Length compositions for bluemouth were submitted to the working group from Russian trawl fisheries at Rockall in 2005, Azorean longline surveys from 1995 to 2005 and Spanish surveys on the Porcupine Bank between 2002 and 2005. These are presented in figures 12.10.14 to 12.10.16. Length compositions of Silver Scabbardfish in the Azorean longline surveys covering the entire survey period from 1995 to 2005 are presented in figure 12.10.21.

12.10.3.3 Age compositions

No new data on age compositions of any of these species were presented to WGDEEP in 2006.

12.10.3.4 Weight at age

No new data on weight at age for any of these species were presented to WGDEEP in 2006.

12.10.3.5 Maturity and natural mortality

Vinnichenko & Bokhanov 2006 (WD7) presented data on percentage maturity of roughhead grenadier in catches at East Greenland, Hatton Bank and the Norwegian Sea; Baird’s smoothhead at on Hatton and Bill Bailey Bank; and Bluemouth on Rockall Banks in 2005.

12.10.3.6 Catch, effort and research vessel data

New Catch and effort data was provided to the Working Group in the form of working documents from Russia, Spain and the Azores and survey data from Spain. This adds to data included in previous reports

Tables 12.10.2 to 12.10.4 show CPUEs for the main commercial fish species (excluding elasmobranches) in the Spanish Hatton Bank survey, ECOVUL/ARPA 2005/10 and the Spanish Bottom trawl Cooperative survey. The data are broken down by depth strata. These findings show that maximum catch rates for smoothheads and rabbitfish do not occur in the same depth range as the optimal catch rates of roundnose grenadier. This may have implications for targeting of these species with vessel changing fishing depth to target smoothheads or rabbitfish when quota restrictions prevent fishing for roundnose grenadier.

Variation in abundance indices of bluemouth in the Spanish Porcupine Bank Survey from 2001to 2005 is shown in figure 12.10.18. CPUE has remained more or less stable for through this period.

CPUE in the Azorean longline fishery for bluemouth increased from 1990 to 1999 then decreased from 2000 to the present; this was considered to be partly a result of changing targeting in the fishery. To account for this, data from 1990 to 2005 were used to develop a standardized catch per unit of effort (CPUE) biomass index of abundance (Pereira, 2006 WD15f). The methodology for this analysis is described in section 3.1. Both of these CPUE series, nominal and standardized, scaled to their overall mean are presented in figure 12.10.19. Nominal and Standardised CPUE have both shown decreasing trends since 1999.

The Azorean spring longline survey provides an abundance index (“Relative Population Number”) for bluemouth in subarea X (figure 12.10.20). This index has fluctuated without any obvious trend since 1999. Similar abundance indices were produced for wreckfish in Azorean longline surveys. These are presented in figure 12.10.13 Relative Population Number (RPN) for wreckfish has fluctuated without any obvious trend since 1999.

12.10.4 Data analyses

The data available to the working group on the species considered here were not considered sufficient to attempt any analytical assessments.

For those species for which CPUE series are available, these may provide a crude index of stock abundance. CPUE for bluemouth from the Spanish trawl survey on the Porcupine Bank have been stable over the short period of this survey. Nominal and standardised CPUEs for bluemouth in from Azorean commercial fisheries have declined continuously since 1999 but this is not reflected in the Azorean longline survey CPUE which has fluctuated without trend.

12.10.5 Comments on the assessment

For most of the species considered in this chapter, data are not sufficient to give advice for management. It is likely that historic and recent data exists in many countries and effort should be made to make this available to the working group.

12.10.6 Management considerations

Many of the species included here are caught as bycatch in fisheries targeted towards other species or as minor components of mixed species fisheries. Effort in the mixed species trawl and longline fisheries in sub-areas VI, VII and XIIb has declined in recent years as a result of effort limitation on EC vessels and restrictive quotas for the main target species. This could be expected result in reallocation of effort towards targeting species in the other species group. The Working Group is concerned over high levels of under reporting of catches of smoothhead and rabbitfish due high levels of discarding.

No stock exploitation boundary can be suggested for any of these species due to lack of assessment. Furthermore, the knowledge of the biology of these species is insufficient, and it is unclear how vulnerable they are to exploitation. Fisheries on such species should be permitted only when they are accompanied by programmes to collect data.

Table 12.10.0. Other species. WG estimates of landings.

ROUGHHEAD GRENADIER (Macrourus berglax) I and II					
Year	Germany	Norway	Russia	France	**TOTAL**
1988					
1989					
1990	9	580			**589**
1991		829			**829**
1992		424			**424**
1993		136			**136**
1994					
1995				1	**1**
1996				3	**3**
1997		17		4	**21**
1998		55			**55**
1999				+	
2000		35	13	+	**48**
2001		74	20	+	**94**
2002		28	1	+	**29**
2003		47	30		**77**
2004		78	1		**79**
2005		67	13	+	**80**

ROUGHHEAD GRENADIER (Macrourus berglax) III and IV					
Year	France	Ireland	Norway	Scotland	**TOTAL**
1991					
1992			7		**7**
1993					
1994					
1995					
1996	4				**4**
1997	5				**5**
1998	1				**1**
1999	+				
2000	+	1	3	+	**4**
2001	+	1	9		**10**
2002	+		3	+	**3**
2003	+		2		**2**
2004	+		+	1	**1**
2005	1		38		**39**

Table 12.10.0 (continued).

ROUGHHEAD GRENADIER (Macrourus berglax) Va						
Year	Iceland	**TOTAL**				
1995						
1996	15	**15**				
1997	4	**4**				
1998	1	**1**				
1999						
2000	2	**2**				
2001	1	**1**				
2002	4	**4**				
2003	33	**33**				
2004	3	**3**				
2005	5	**5**				
Table 19.1.1 contd.						
ROUGHHEAD GRENADIER (Macrourus berglax) Vb						
Year	France	Norway	Scotland	**TOTAL**		
1997	6			**6**		
1998	9			**9**		
1999	58			**58**		
2000	1			**1**		
2001	2	2		**4**		
2002	3		+	**3**		
2003	12			**12**		
2004	8		1	**9**		
2005	6			**6**		
ROUGHHEAD GRENADIER (Macrourus berglax) VI and VII						
Year	UK (EW)	France	Norway	Scotland	Spain	**TOTAL**
1988						
1989						
1990						
1991						
1992						
1993	18					**18**
1994	5					**5**
1995	2	2				**4**
1996		13				**13**
1997		12				**12**
1998		10				**10**
1999		34				**34**
2000	+	2		8		**10**
2001		1	27	16		**44**
2002		11	2	6		**19**
2003		9	2		1	**12**
2004		5		5	3	**13**
2005		6			2569	**2575**

Table 12.10.0 (continued).

ROUGHHEAD GRENADIER (Macrourus berglax) X		
Country	France	**TOTAL**
1998		
1999	3	**3**
2000		
2001		
2002		

ROUGHHEAD GRENADIER (Macrourus berglax) XII					
Country	Norway	France	Spain	Russia	**TOTAL**
1999		+			
2000	7	+			**7**
2001	10	+			**10**
2002	7	+			**7**
2003	2	+			**2**
2004	27	1			**28**
2005		+	2434	5	**2439**

Table 19.1.1 contd.

ROUGHHEAD GRENADIER (Macrourus berglax) XIV				
Country	Greenland	Norway	Russia	**TOTAL**
1992				
1993	18	34		**52**
1994	5			**5**
1995	2			**2**
1996				
1997				
1998		6		**6**
1999		14		**14**
2000				
2001		26		**26**
2002		49	4	**53**
2003		33		**33**
2004		46	9	**55**
2005		30	10	**40**

ROUGHHEAD GRENADIER (Macrourus berglax). All areas									
Year	I and II	III and IV	Va	Vb	VI and VII	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	5	1	10		7		**75**
2001	94	10	3	4	44		10	26	**191**
2002	29	3	11	3	19		7	53	**125**
2003	77	2		12	12		2	33	**138**
2004	79	1		9	13		28	55	**185**
2005	80	39		6	2575		2439	40	**5179**

Table 12.10.0 (continued).

MORIDAE II						
Year	Norway	**TOTAL**				
2000	8	**8**				
2001	1	**1**				
2002	1	**1**				
2003						
2004						
2005						
MORIDAE Vb						
Year	**Norway**	**France**	**TOTAL**			
1988						
1989						
1990						
1991	5		**5**			
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999		1	**1**			
2000	3	+				
2001	100		**100**			
2002	19		**19**			
2003	2		**2**			
2004						
2005	1		**1**			
MORIDAE VI and VII						
Year	UK (E+W)	France	Ireland	UK (Scot) (	Norway	**TOTAL**
1988						
1989						
1990						
1991					1	**1**
1992					25	**25**
1993		10				
1994		10				
1995						
1996						
1997						
1998		41				
1999		12			8	**20**
2000	3	59	39		58	**146**
2001		72	32		90	**190**
2002		50	45		64	**158**
2003		51	83		193	**327**
2004		35	36			**71**
2005		21	24			**45**
(1) Included with Phycis blennoides						

Table 12.10.0 (continued).

MORIDAE VIII and IX							
Year	France	Spain	**TOTAL**				
1995		83	**83**				
1996		52	**52**				
1997		88	**88**				
1998							
1999							
2000	5	21	**26**				
2001	2	18	**20**				
2002	1	7	**8**				
2003	2	10	**12**				
2004	2	9	**11**				
2005	6	9	**15**				
MORIDAE X							
Year	Portugal*	**TOTAL**					
1988	18	**18**					
1989	17	**17**					
1990	23	**23**					
1991	36	**36**					
1992	31	**31**					
1993	33	**33**					
1994	42	**42**					
1995							
1996							
1997							
1998							
1999							
2000							
2001	1	**1**					
2002	100	**100**					
2003	125	**125**					
2004	87	**87**					
2005	69	**69**					
* source of data 1988 to 1994 unknown, may be unreliable							
MORIDAE XII							
Year	France	Spain	Norway	TOTAL			
2000	+	1		**1**			
2001	+		87	**87**			
2002			13	**13**			
2003			15	**15**			
2004			4	**4**			
2005							
MORIDAE XIVb							
Year	Norway	**TOTAL**					
2003	7	**7**					
2004							
2005							
MORIDAE (all areas)							
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		146	26		1		**173**
2001	100	190	20	1	87		**398**
2002	19	158	8	100	13		**298**
2003	2	327	12	125	15	6	**487**
2004		71	11	87	4		**173**
2005	1	45	15	69			**130**
* source of data 1988 to 1994 unknown, may be unreliable							

Table 12.10.0 (continued).

RABBIT FISH (Chimaera monstrosa and Hydrolagus spp) I & II							
Year	France	Norway	Denmark	**TOTAL**			
1997							
1998							
1999	1			**1**			
2000	6			**6**			
2001	5		+	**5**			
2002	2	13		**15**			
2003	1	56		**57**			
2004		21		**21**			
2005	2	62		**64**			
RABBIT FISH (Chimaera monstrosa and Hydrolagus spp) III/IV							
Year	Denmark	France	Scotland	Norway	**TOTAL**		
1991							
1992	122				**122**		
1993	8				**8**		
1994	167				**167**		
1995							
1996	14				**14**		
1997	38				**38**		
1998	56				**56**		
1999	45		+		**45**		
2000	17	15	1		**33**		
2001	10	10			**20**		
2002	21	3			**24**		
2003	15	3		7	**25**		
2004	19	4		17	**40**		
2005	158	1		10	**169**		
RABBIT FISH (Chimaera monstrosa) Va							
Year	Iceland	**TOTAL**					
1988							
1989							
1990							
1991	499	**499**					
1992	106	**106**					
1993	3	**3**					
1994	60	**60**					
1995	106	**106**					
1996	21	**21**					
1997	15	**15**					
1998	29	**29**					
1999	2	**2**					
2000	5	**5**					
RABBIT FISH (*Chimaera monstrosa*) Vb							
Year	Faroes	France	Scotand	Norway	Iceland	Russia	**TOTAL**
1988							
1989							
1990							
1991							
1992							
1993							
1994							
1995	1						**1**
1996	+						
1997	+						
1998							
1999		3	+				**3**
2000		54					**54**
2001		94		1	1		**96**
2002		47	+	17			**64**
2003		53	1	7			**61**
2004		57	+	3		36	**96**
2005		52	+	3		2	**57**

Table 12.10.0 (continued).

RABBIT FISH (Chimaera monstrosa) VI and VII

Year	UK(EW)	France	Ireland	Scotland	Spain	Norway	**TOTAL**
1988							
1989							
1990							
1991							
1992							
1993							
1994			2				**2**
1995							
1996							
1997							
1998			2				
1999		235		1			**236**
2000	3	347	5	1	2		**355**
2001	1	622	14	39	6	47	**722**
2002		543	16	7		7	**573**
2003		392	2	33		47	**474**
2004		409	1	4	4	15	**433**
2005		282			204	7	**493**

RABBIT FISH (Chimaera monstrosa) VIII

Year	France	**TOTAL**
1997		
1998		
1999	2	**2**
2000	2	**2**
2001	7	**7**
2002	6	**6**
2003	2	**2**
2004	6	**6**
2005	5	**5**

RABBIT FISH (Chimaera monstrosa) XII

Year	Spain	France	Ireland	Norway	**TOTAL**
1995					
1996					
1997	32				**32**
1998	42				**42**
1999	114	1			**115**
2000	46	2			**48**
2001	61	1	1	16	**79**
2002	89	+		9	**98**
2003	59	12		10	**81**
2004	48	12		68	**128**
2005	244	5			**249**

RABBIT FISH (Chimaera monstrosa) XIV

Year	Spain	Norway	**Total**
2001			
2002	1		**1**
2003	1	3	**4**
2004		5	**5**
2005			

RABBIT FISH (Chimaera monstrosa). All areas.

Year	I/II	III/IV	Va	Vb	VI/VII	VIII	XII	XIV	**TOTAL**
1988									
1989									
1990									
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				42		**127**
1999	1	45	2	3	236	2	115		**404**
2000	6	33	5	54	355	2	48		**503**
2001	5	20		96	722	7	79		**929**
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**

Table 12.10.0 (continued).

SMOOTHHEAD (Alepocephalus spp.) Va											
Year	Iceland	**TOTAL**									
1988											
1989											
1990											
1991											
1992	10	**10**									
1993	3	**3**									
1994	1	**1**									
1995	1	**1**									
1996											
1997	+										
1998											
SMOOTHHEAD (Alepocephalus spp.) Vb											
Year	Russia	**TOTAL**									
2004	6	**6**									
2005	1	1									
SMOOTHHEAD (Alepocephalus spp.) VI and VII											
Year	Spain	Scotland	Russia	Ireland	Estonia	Germany	UK E&W	Lithuania	Poland	France	**TOTAL**
1991										31	**31**
1992										17	**17**
1993											
1994											
1995											
1996											
1997											
1998											
1999											
2000	978										**978**
2001	4689				154	2		460			**5305**
2002	N/A	1			259						**260**
2003	0		6	2	43			229	113		**393**
2004	1203		15		22			525			**1765**
2005	5223		13					229			**5465**

Table 12.10.0 (continued).

SMOOTHHEAD (Alepocephalus spp.) XII						
Year	Spain	Luthuania	Russia	Faroes	Poland	**TOTAL**
1988						
1989						
1990						
1991						
1992						
1993				2		**2**
1994						
1995						
1996	230					**230**
1997	3692					**3692**
1999	4643					**4643**
1999	6549					**6549**
2000	4146					**4146**
2001	3132	460				**3592**
2002	12538					**12538**
2003	6864	13			6	**6883**
2004	4344	21	3			**4368**
2005	6857	13	2			**6872**

SMOOTHHEAD (Alepocephalus spp.) XIV			
Year	Germany	Spain	**TOTAL**
1988			
1989			
1990			
1991			
1992			
1993			
1994			
1995			
1996			
1997			
1999			
1999			
2000	12		**12**
2001			
2002		661	**661**
2003		632	**632**
2004		245	**245**
2005			

SMOOTHHEAD (*Alepocephalus* spp.). All areas.						
Year	Va	Vb	VI and VII	XII	XIV	**TOTAL**
1988						
1989						
1990						
1991			31			**31**
1992	10		17			**27**
1993	3			2		**5**
1994	1					**1**
1995	1					**1**
1996				230		**230**
1997				3692		**3692**
1999				4643		**4643**
1999				6549		**6549**
2000			978	4146	12	**5136**
2001			5305	3592		**8897**
2002			260	12538	661	**13459**
2003			393	6883	632	**7908**
2004		6	1765	4368	245	**6384**
2005		1	5465	6872		**12338**

Table 12.10.0 (continued).

WRECKFISH (*Polyprion americanus*) VI and VII					
Year	France	Ireland	Spain	E & W	TOTAL
1988	7				**7**
1989					
1990	2				**2**
1991	10				**10**
1992	15				**15**
1993	0				
1994					
1995					
1996	4		79		**83**
1997					
1998			12		**12**
1999	9		5		**14**
2000	13		1		**14**
2001	15	1	+	1	**17**
2002	9		+	+	**9**
2003	1		1		**2**
2004	2				**2**
2005	+				
WRECKFISH (Polyprion americanus) VIII and IX					
Year	France	Portugal	Spain	UK (EW)	**TOTAL**
1988	1	188	9		**198**
1989	1	283			**284**
1990	2	161			**163**
1991	3	191			**194**
1992	2	268			**270**
1993	12	338			**350**
1994	1	406	3		**410**
1995	1	372	19	2	**394**
1996	3	214	69	8	**294**
1997	8	170	44		**222**
1998	11	164	63		**238**
1999		137	7		**144**
2000	14	72	37		**123**
2001	6	77	84		**167**
2002	6	88	62		**156**
2003	1	209	33		**243**
2004	6	110	25		**141**
2005	+	174	22		**196**

Table 12.10.0 (continued).

WRECKFISH (Polyprion americanus) X				
Year	France	Portugal	Norway	**TOTAL**
1988		191		**191**
1989		235		**235**
1990		224		**224**
1991		170		**170**
1992	7	234		**237**
1993	3	308	3	**311**
1994	1	428		**428**
1995		240		**240**
1996		240		**240**
1997		177		**177**
1998		139		**139**
1999		133		**133**
2000		268		**268**
2001		229		**229**
2002		283		**283**
2003		270		**270**
2004		189		**189**
2005		279		**279**
WRECKFISH (Polyprion americanus) All areas				
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	237	**521**
1993		350	311	**649**
1994		410	428	**837**
1995		394	240	**633**
1996	83	294	240	**617**
1997		222	177	**391**
1998	12	238	139	**378**
1999	14	144	133	**298**
2000	14	123	268	**403**
2001	17	167	229	**413**
2002	9	156	283	**448**
2003	2	243	270	**513**
2004	2	141	189	**317**
2005		196	279	**475**

Table 12.10.0 (continued).

BLUEMOUTH (Helicolenus dactylopterus) III/IV						
Year	UK (EW)	UK (SCO)	France	**TOTAL**		
1989						
1990			4	**4**		
1991			5	**5**		
1992			3	**3**		
1993			1	**1**		
1994			2	**2**		
1995			2	**2**		
1996			2	**2**		
1997			1	**1**		
1998			+			
1999	5	+	3	**8**		
2000		+	+			
2001			+			
2002			+			
2003			+			
2004			2	**2**		
2005			+			
BLUEMOUTH (Helicolenus dactylopterus) Vb						
Year	UK (EW)	UK (SCO)	France	Russia	**TOTAL**	
1989			+			
1990			+			
1991			+			
1992			+			
1993			+			
1994			+			
1995			+			
1996			+			
1997			+			
1998			+			
1999	58	+	6		**64**	
2000	16		+		**16**	
2001						
2002			+			
2003			+			
2004			2	1	**3**	
2005			+			
BLUEMOUTH (Helicolenus dactylopterus) VI						
Year	France	Spain	UK (EW)	UK (SCO)	Ireland	**TOTAL**
1989	79					**79**
1990	69					**69**
1991	99					**99**
1992	112					**112**
1993	87					**87**
1994	62					**62**
1995	62					**62**
1996	77					**77**
1997	78					**78**
1998	53					**53**
1999	45	91		58		**194**
2000	36	64	28	85		**213**
2001	32	9	33	103		**177**
2002	22		14	45		**81**
2003	24	106	13	41	+	**184**
2004	44	85	13			**142**
2005	61	42				**103**
BLUEMOUTH (Helicolenus dactylopterus) VII						
Year	France	UK (EW)	UK (SCO)	Spain	Ireland	**TOTAL**
1989	48					**48**
1990	31					**31**
1991	29					**29**
1992	47					**47**
1993	65					**65**
1994	55					**55**
1995	9					**9**
1996	10					**10**
1997	10					**10**
1998	92					**92**
1999	29	112	19	+		**160**

Table 12.10.0 (continued).

BLUEMOUTH (Helicolenus dactylopterus) VIII and IX							
Year	France	Portugal	Spain	**TOTAL**			
1989	2			**2**			
1990	5			**5**			
1991	12			**12**			
1992	11			**11**			
1993	8			**8**			
1994	4			**4**			
1995	+						
1996	+						
1997	1			**1**			
1998	3			**3**			
1999	5	15	9	**29**			
2000	14	12	7	**33**			
2001	5	22	7	**34**			
2002	1	17		**18**			
2003	1	16	107	**124**			
2004	3	17	115	**135**			
2005	17	50	139	**206**			
BLUEMOUTH (Helicolenus dactylopterus) X							
Year	Portugal	**TOTAL**					
1989	481	**481**					
1990	480	**480**					
1991	483	**483**					
1992	575	**575**					
1993	650	**650**					
1994	708	**708**					
1995	589	**589**					
1996	483	**483**					
1997	410	**410**					
1998	381	**381**					
1999	340	**340**					
2000	452	**452**					
2001	301	**301**					
2002	280	**280**					
2003	338	**338**					
2004	282	**282**					
2005	190	**190**					
BLUEMOUTH (Helicolenus dactylopterus). All areas							
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**

Table 12.10.0 (continued).

SILVER SCABBARDFISH (Lepidopus caudatus) VI and VII					
Year	France	Germany	UK (SCO)	UK (EW)	**TOTAL**
1993		2			**2**
1994					
1995					
1996					
1997					
1998					
1999	18				**18**
2000		3	12	1	**15**
2001	1		5		
2002	1			+	**1**
2003					
2004	+				
2005					
SILVER SCABBARDFISH (Lepidopus caudatus) VIII and IX					
Year	France	Portugal	Spain	Russia/USS	**TOTAL**
1988		2666			**2666**
1989		1385			**1385**
1990		547		37	**584**
1991		808			**808**
1992		1264		110	**1374**
1993		2397			**2397**
1994		1054			**1054**
1995		5672			**5672**
1996		1237			**1237**
1997		1725			**1725**
1998		966			**966**
1999	2	3067			**3069**
2000	1	15			**16**
2001	15	37	654		**706**
2002	23	72	1737		**1832**
2003	N/A	22	1659		**1681**
2004		68	786		**854**
2005		19	507		**526**

Table 12.10.0 (continued).

SILVER SCABBARDFISH (Lepidopus caudatus) X					
Year	Latvia	Portugal	**TOTAL**		
1988		70	**70**		
1989		91	**91**		
1990		120	**120**		
1991		166	**166**		
1992	1905	255	**2160**		
1993	1458	264	**1722**		
1994		373	**373**		
1995	8	781	**789**		
1996		815	**815**		
1997		1115	**1115**		
1998		1186	**1186**		
1999		86	**86**		
2000		28	**28**		
2001		14	**14**		
2002		10	**10**		
2003		25	**25**		
2004		29	**29**		
2005		31	**31**		
SILVER SCABBARDFISH (Lepidopus caudatus) XII					
Country	Russia/USS	**TOTAL**			
1988					
1989	102	**102**			
1990	20	**20**			
1991					
1992					
1993	19	**19**			
1994					
SILVER SCABBARDFISH (Lepidopus caudatus). ALL AREAS					
	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		526	31		**557**

Table 12.10.0 (continued).

DEEP_WATER CARDINAL FISH (Epigonus telescopus) Vb							
Year	France	**TOTAL**					
1994	4	**4**					
1995	3	**3**					
1996	8	**8**					
1997	8	**8**					
1998							
1999	8	**8**					
2000	2	**2**					
2001	7	**7**					
2002	+						
2003	2	**2**					
2004	1	**1**					
2005	+						
DEEP_WATER CARDINAL FISH (Epigonus telescopus) VI							
Year	France	Ireland	UK (SCO)	E & W	Spain	Germany	**TOTAL**
1993	15						**15**
1994	35						**35**
1995	20						**20**
1996	13						**13**
1997	27						**27**
1998	86						**86**
1999	52						**52**
2000	56	1	+	1		50	**108**
2001	61	10	1	21		10	**103**
2002	39	3		+	48		**90**
2003	30	15					**45**
2004	17	11					**28**
2005	40	9					**49**
DEEP_WATER CARDINAL FISH (Epigonus telescopus) VII							
Year	France	Faroes	Ireland	Spain	**TOTAL**		
1993	15				**15**		
1994	182				**182**		
1995	71				**71**		
1996	32				**32**		
1997	22				**22**		
1998	29				**29**		
1999	202	4			**206**		
2000	177		2		**179**		
2001	75		207		**282**		
2002	22		845	17	**884**		
2003	54		971	5	**1030**		
2004	41		800		**841**		
2005	14		618	3	**635**		

Table 12.10.0 (continued).

DEEP_WATER CARDINAL FISH (Epigonus telescopus) VIII and IX							
Year	France	Portugal	Spain	**TOTAL**			
1999		3		**3**			
2000	2	3		**5**			
2001	+	4		**4**			
2002		3	5	**8**			
2003		3	2	**5**			
2004	1	4	5	**10**			
2005	3	3	3	**9**			
DEEP_WATER CARDINAL FISH (Epigonus telescopus) X							
Year	France	Portugal	Ireland	**TOTAL**			
1999							
2000	3			**3**			
2001							
2002		14		**14**			
2003		15		**15**			
2004		6	15	**21**			
2005		4	+	**4**			
DEEP_WATER CARDINAL FISH (Epigonus telescopus) XII							
Year	Ireland	Faroes	**TOTAL**				
2001							
2002							
2003	1	+	**1**				
DEEP_WATER CARDINAL FISH (Epigonus telescopus). All areas.							
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		49	635	9	4		**697**

Table 12.10.0 (continued).

BLUE ANTIMORA (Antimora rostrata) Area			
Year	Iceland	**TOTAL**	
1994			
1995			
1996	2	**2**	

Table 12.10.1. Summary of available data on landings, CPUEs, survey indices and biology of "other species" arising from working documents provided to WGDEEP 2004.

Species	ICES Sub-areas and Divisions											
	I + II	III+IV	Va	Vb	VI	VII	VI + VII	VIII + IX	X	XII	VIb+XII	XIV
Roughhead grenadier (*Macrourus berglax*)	1, 3R, 4R	1	1				1		1	1	1, 3R, 4R	1, 3R, 4R
Common mora (*Mora moro*)				1	1	1		1	1, 3Pa	1		1
Rabbitfish (*Chimaera monstrosa*)	1, 3R, 4R	1	1	1, 3R, 4R	3R, 4R		1	1		1		1, 3R, 4R
Baird's smoothhead (*Alepocephalus bairdii*)			1	1, 3R, 4R			1			1	1, 3R, 4R, 3Sa, 5Sa	1, 3R, 4R
Risso's smoothhead (*Alepocephalus rostratus*)						1						3R, 4R
Wreckfish (*Poyprion americanus*)							1	1	1, 5a, 3Pa			
Bluemouth (*Helicolenus dactylopterus)*		1		1	1, 3R, 4R	1, 3Sb, 5Sb		1	1, 3Pa, 5Pa, 2Pb,			
Silver scabbardfish (*Lepidopus caudatus*)							1	1	1, 5Pa, 3Pa	1		
Deep-water cardinal fish (*Epigonus telescopus*)				1	1	1		1	1	1		

Notes: 1 – Landing data, 2 – CPUE data, 3 – Length data, 4 – Biological data; 5 – Survey indices; Pa – Portuguese WD by Pinho, 2006 (WD15Azo); Pb – Portuguese WD by Pereira, 2006 (WD15f); R – Russian WD by Vinnichenko & Bokhanov (WD7), 2006; Sa – Spanish WD by Durán Muñoz (WD18), 2006; Sb – Spanish Porcupine Bank survey data.

Table 12.10.2.- Catch rates of commercial fish species (excluding elasmobranches) in Spanish Hatton Bank survey ECOVUL/ARPA 2005/10. CPUE (Kg/hr) in the hauls carried out inside the trawl fishing area (>1000m.). Preliminary.

	Depth strata			
Species	1000-1200 m	1200-1400 m	> 1400 m	**TOTAL**
Coryphaenoides rupestris	69.7	227.3	620.9	215.1
Alepocephalus bairdii	94.4	122.6	127.8	110.4
Molva dipterygia	22.1	10.7	6.4	15.3
Aphanopus carbo	18.2	3.6	0.3	9.9
Hydrolagus mirabilis	3.9	< 0.1	-	1.8
Reinhardtius hippoglossoides	-	3.3	-	1.3

Table 12.10.3.- Catch rates of commercial fish species (excluding elasmobranches) in Spanish Hatton Bank survey ECOVUL/ARPA 2005/10. CPUE (Kg/hr) in the hauls carried out outside the trawl fishing area (<1000m.). Preliminary..

	Depth strata
Species	<1000m.
Chimera monstrosa	115.4
Lophius piscatorius	62.8
Alepocephalus bairdii	30.9
Coryphaenoides rupestris	17.2
Aphanopus carbo	8.4
Molva dipterygia	5.6

Table 12.10.4.- Catch rates of commercial fish species (excluding elasmobranches) in Spanish Bottom trawl Cooperative survey. CPUE (Kg/hr) in Div. VIb1, by depth strata. Preliminary.

Depth range (m)	Roundnose grenadier	Smoothhead	Chimaera	Blue ling
<1000	37.0	15.1	151.1	16.4
1001-1200	181.2	149.4	60.9	31.2
1201-1400	481.0	154.2	1.5	21.0
>1400	1004.8	138.1	0.5	3.1
TOTAL	680.9	132.1	23.8	12.4

Table 12.10.5.- Catch rates of commercial fish species (excluding elasmobranches) in Spanish Bottom trawl Cooperative survey. CPUE (Kg/hr) in Div. XIIb+XIIa1, by depth strata. Preliminary.

Depth range (m)	Roundnose grenadier	Smoothhead	Blue ling	Black scabbardfish
<1000	56.6	83.8	31.1	18.2
1001-1200	141.0	133.2	47.5	56.4
1201-1400	459.1	84.5	21.5	7.3
>1400	723.3	29.5	11.0	3.3
TOTAL	431.5	82.5	24.7	16.0

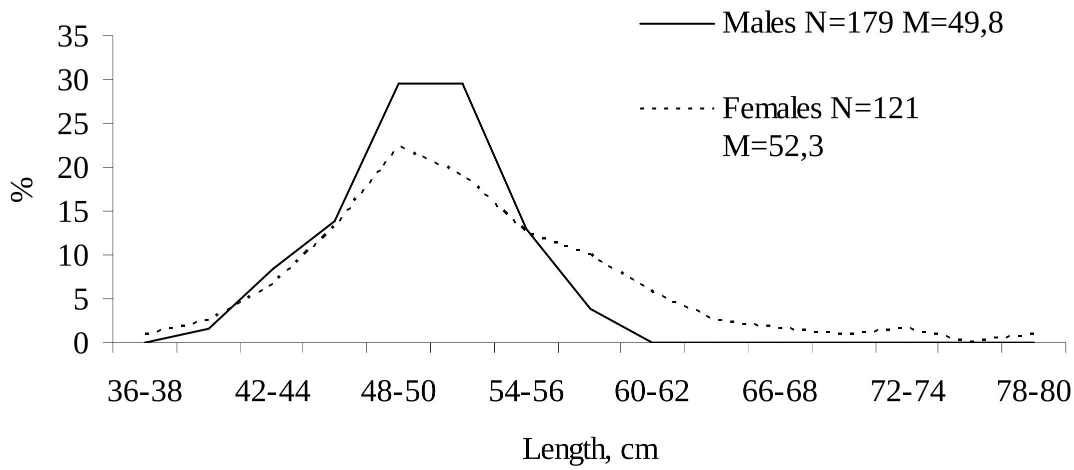


Figure. 12.10.1. Length composition of roughhead grenadier in Russian trawl survey catches near the East Greenland, September 2005.

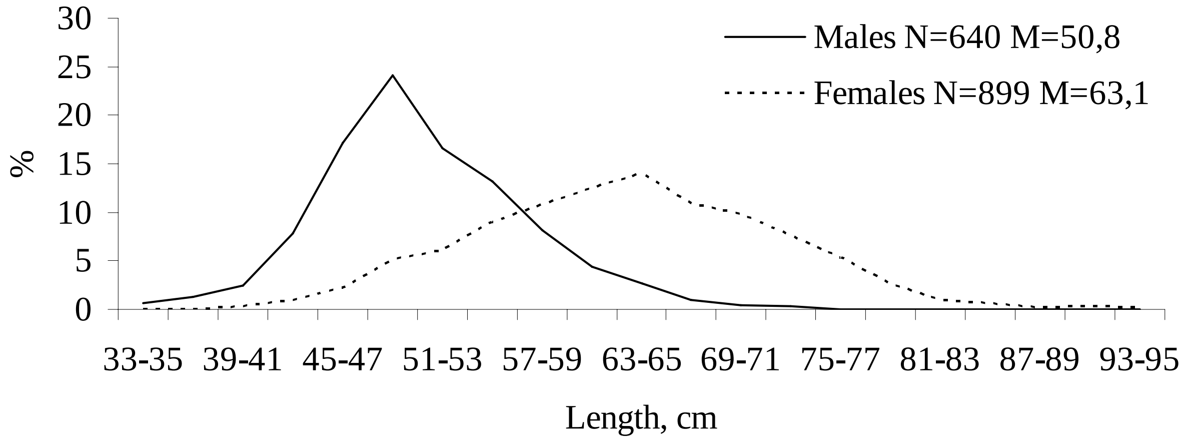


Figure. 12.10.2. Length composition of roughhead grenadier in Russian longline survey catches near the East Greenland in July and September 2005

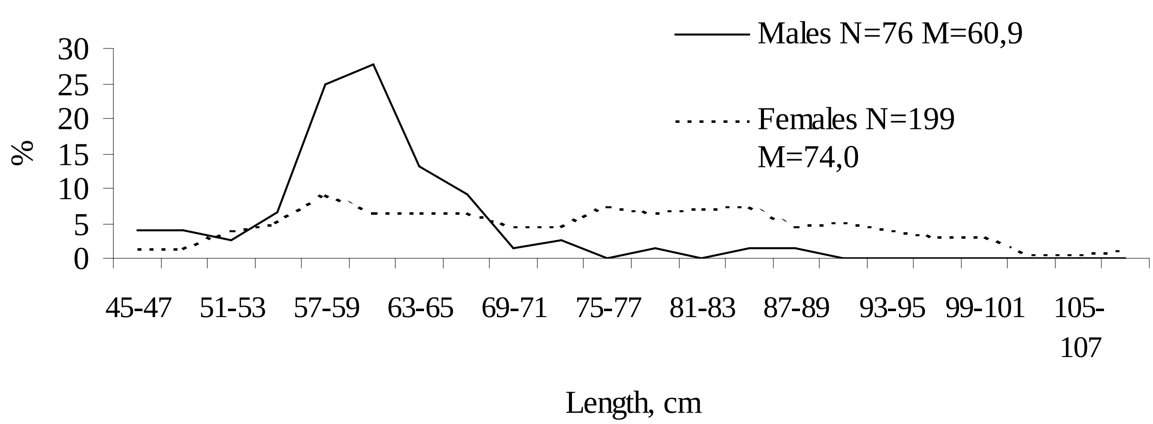


Figure 12.10.3. Length composition of roughhead grenadier in Russian longline survey catches on Hatton Bank in July and August 2005

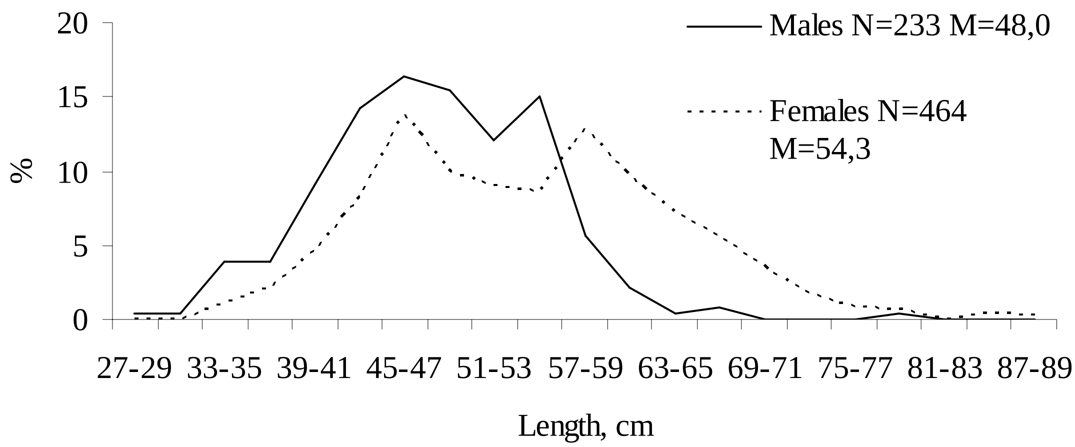


Figure 12.10.4. Length composition of roughhead grenadier in Russian trawl survey catches in Norwegian Sea in August-November 2005.

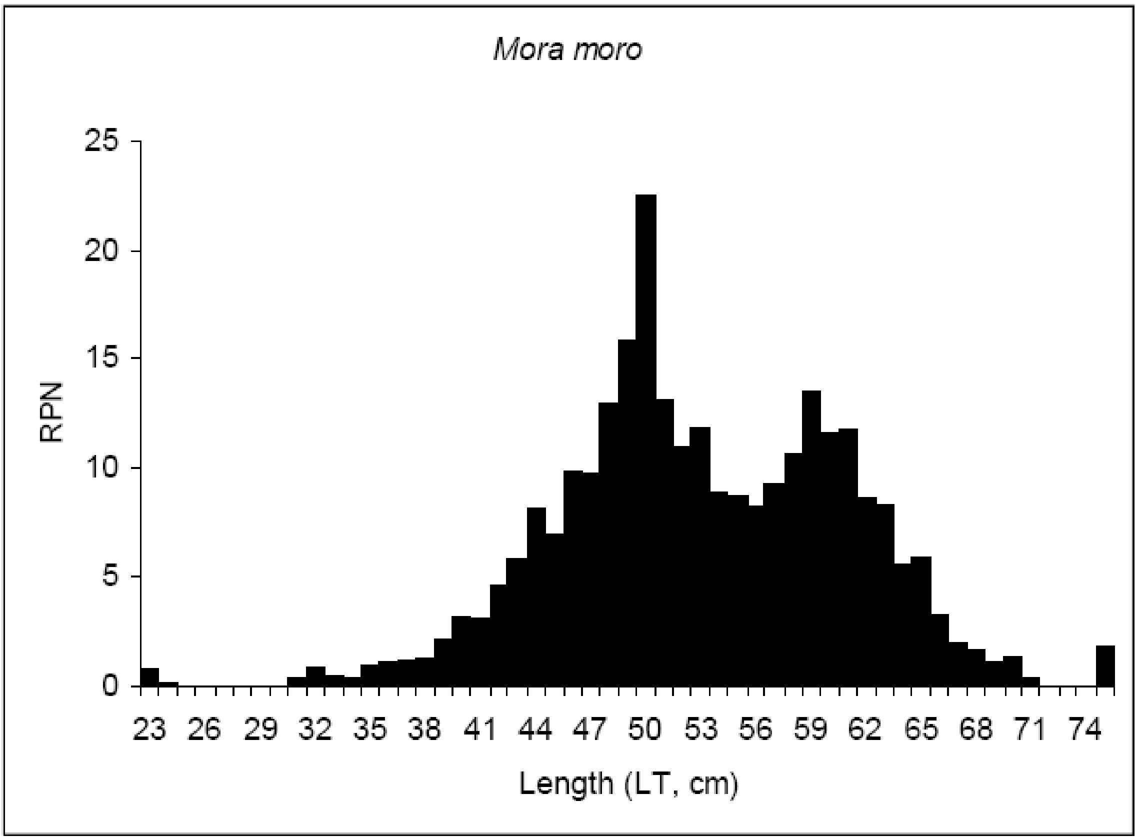


Figure 12.10.5. Length composition of Mora from the Azorean longline survey. Combined data, 1995 to 2005.

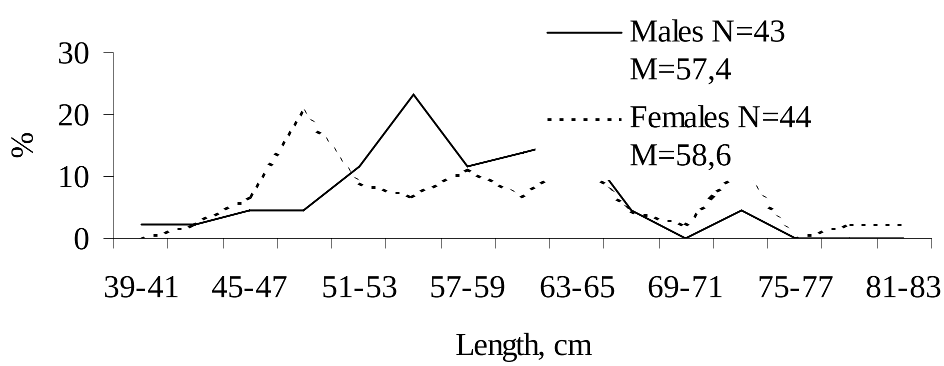


Figure 12.10.6. Length composition of Baird's smooth-head in Russian trawl surveys on the Hatton Bank in April-May 2005

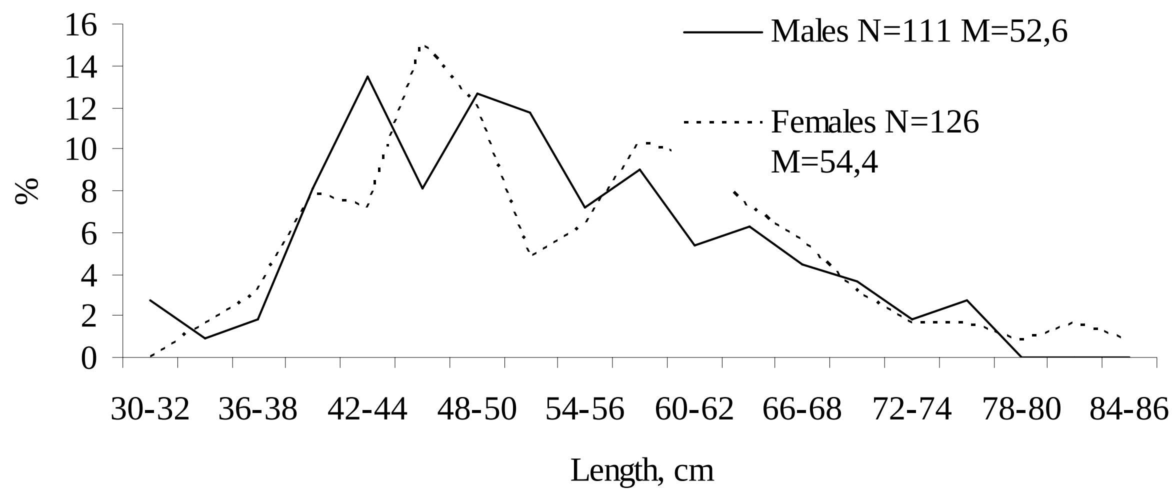


Figure. 12.10.7. Length composition of Baird's smooth-head in Russian trawl surveys on Hatton Bank in August-September 2005

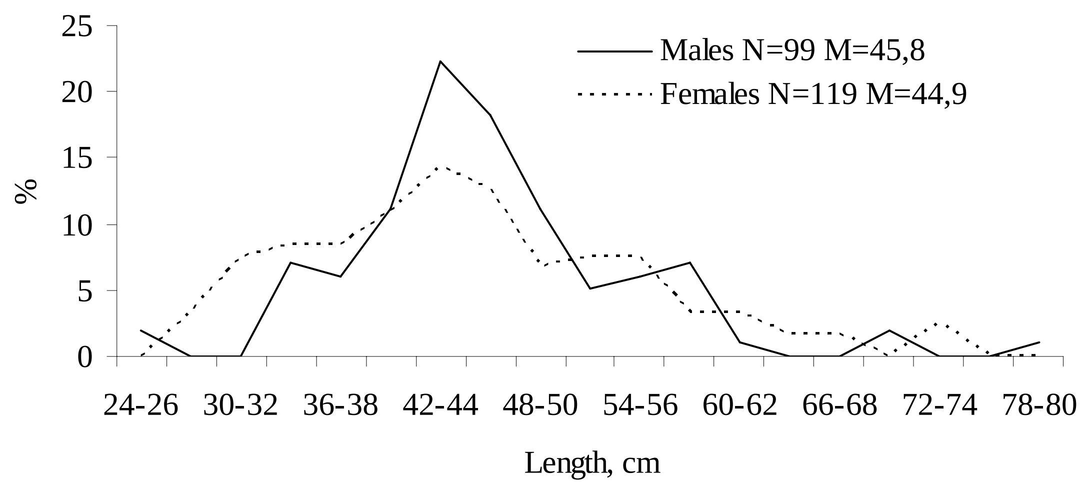


Figure. 12.10.8. Length composition of Baird's smooth-head in Russian trawl surveys on Bill Baileys Bank in September 2005

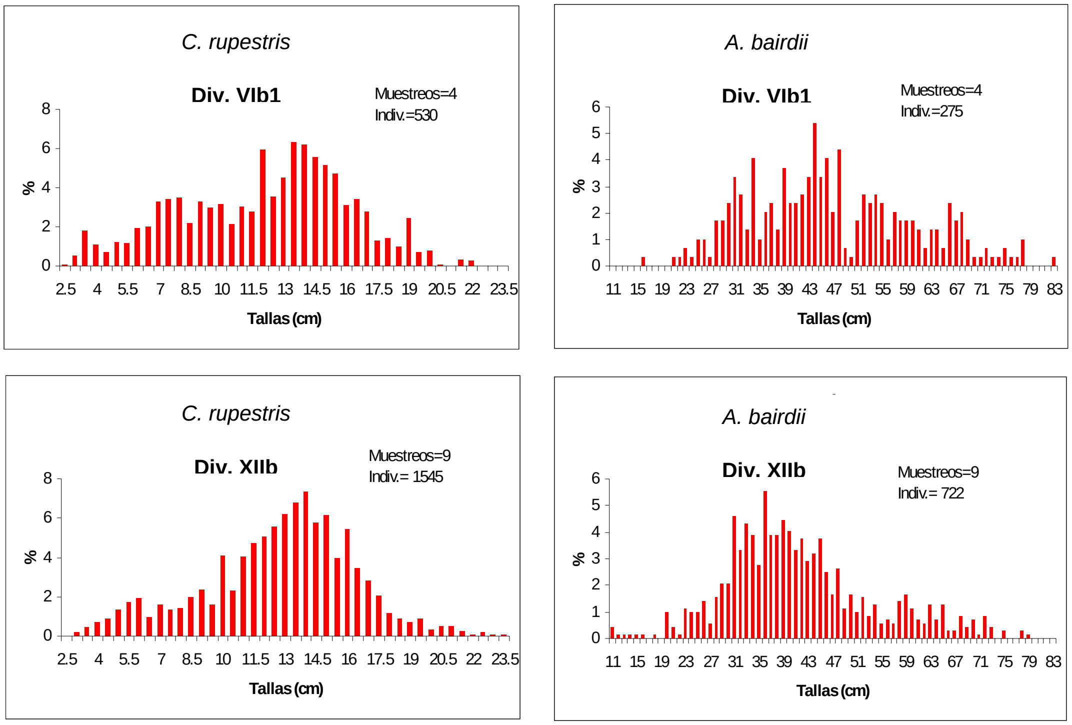
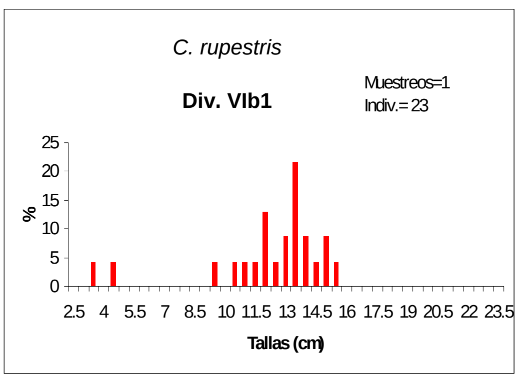


Figure 12.10.9.- Length composition of *C. rupestris* and *A. bairdii* in Spanish Hatton Bank survey ECOVUL/ARPA 2005/10: Length distributions in the hauls carried out inside the trawl fishing area (>1000m.).



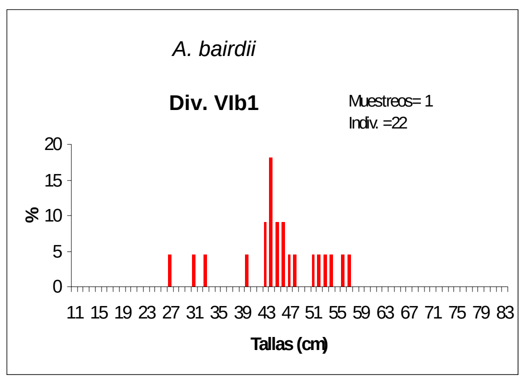


Figure 12.10.10.- Length composition of *C. rupestris* and *A. bairdii* in Spanish Hatton Bank survey ECOVUL/ARPA 2005/10: Length distributions in the hauls carried out outside the trawl fishing area (<1000m.). Preliminary.

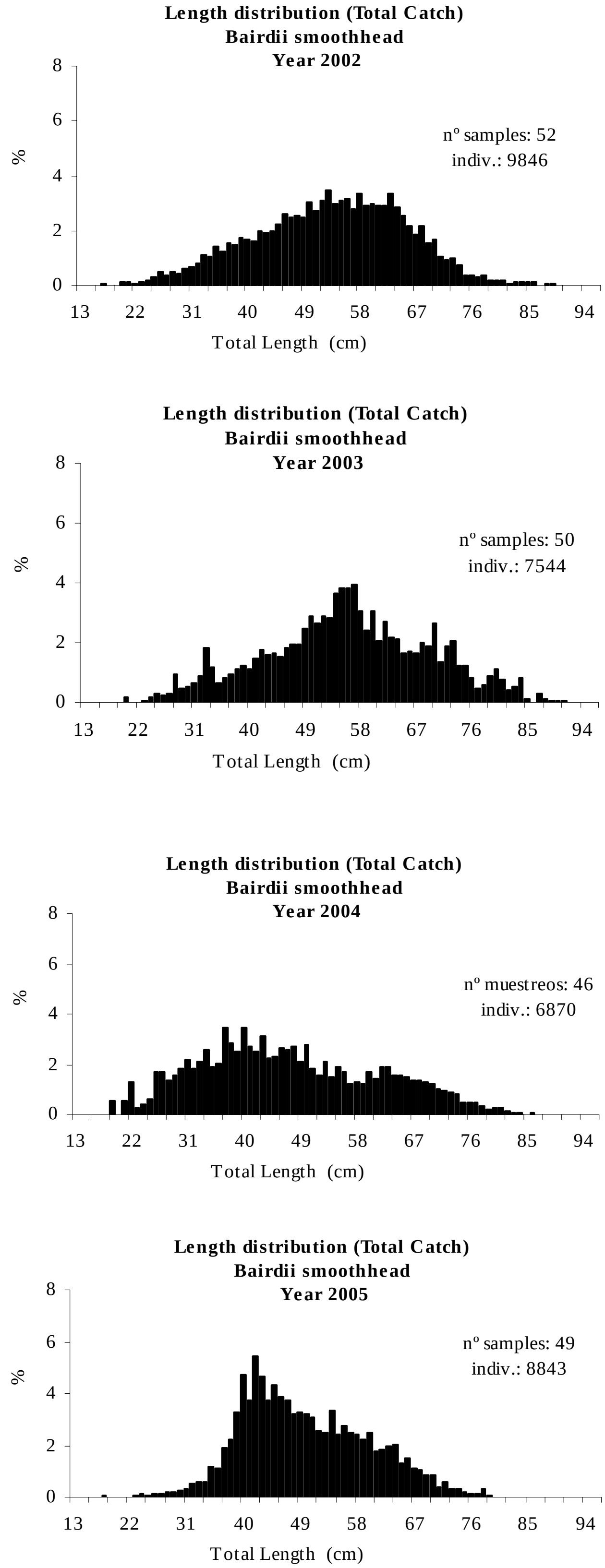
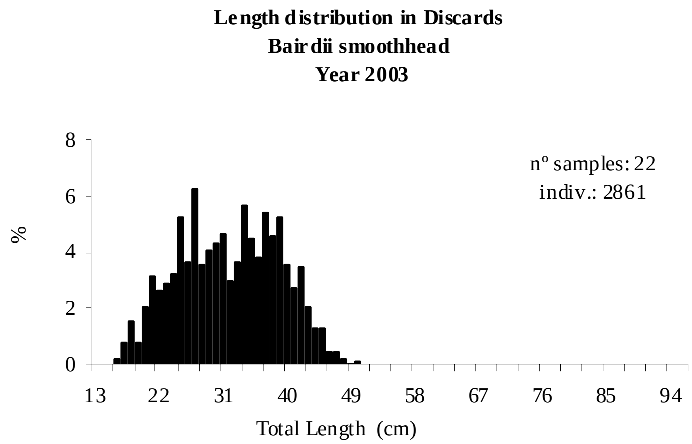
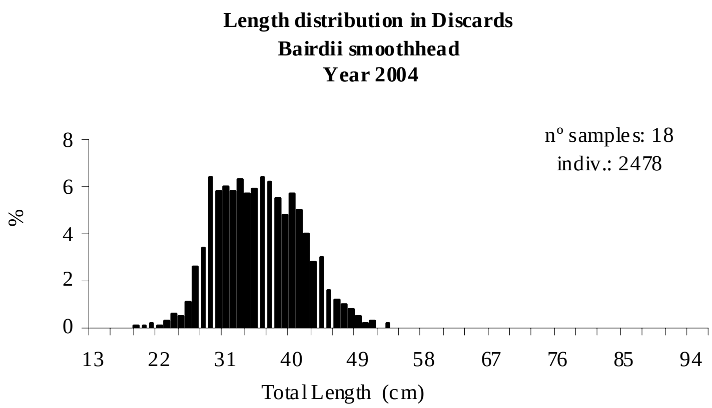


Figure 12.10.11a. Length distribution of Baird's smoothhead in catches of Spanish commercial trawlers on the Hatton Bank, 2002-2005.





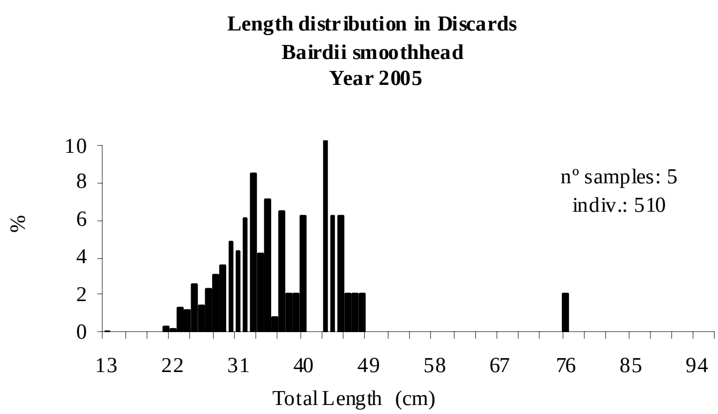


Figure 12.10.11b. Length distribution of Baird's smoothhead in discards of Spanish commercial trawlers on the Hatton Bank, 2002-2005.

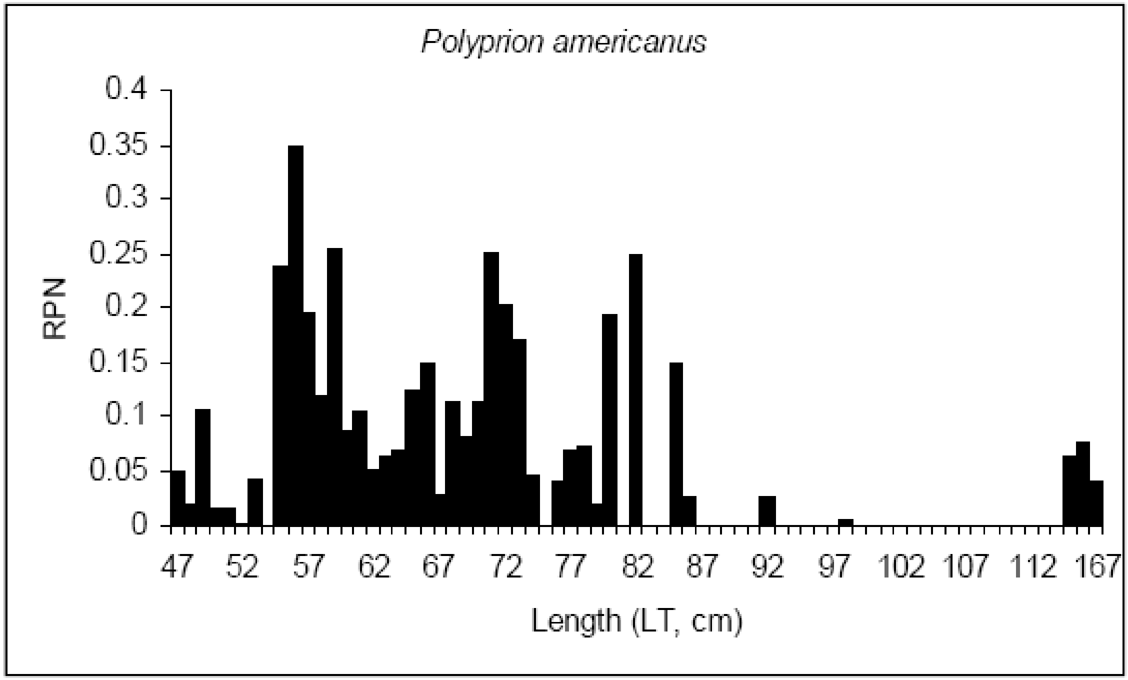


Figure 12.10.12. Length composition of wreckfish in the Azorean longline survey. Combined data, 1995 to 2005.

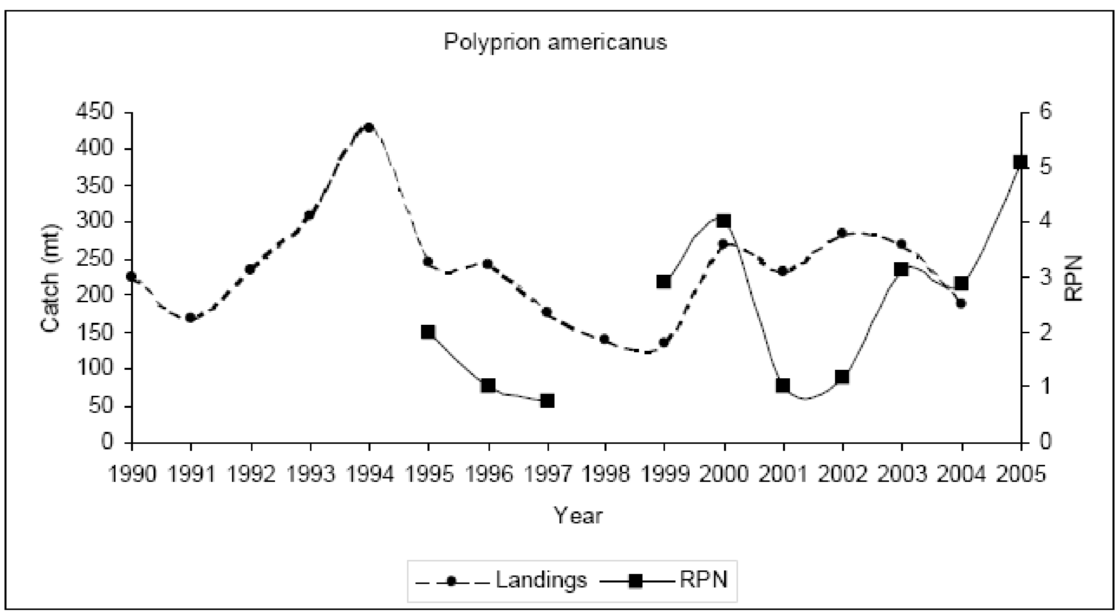


Figure 12.10.13. Annual bottom longline survey abundance index in number "Relative Population Number" (RPN) for wreckfish in Azorean longline surveys. Landings are also presented in the graphs for trend illustration.

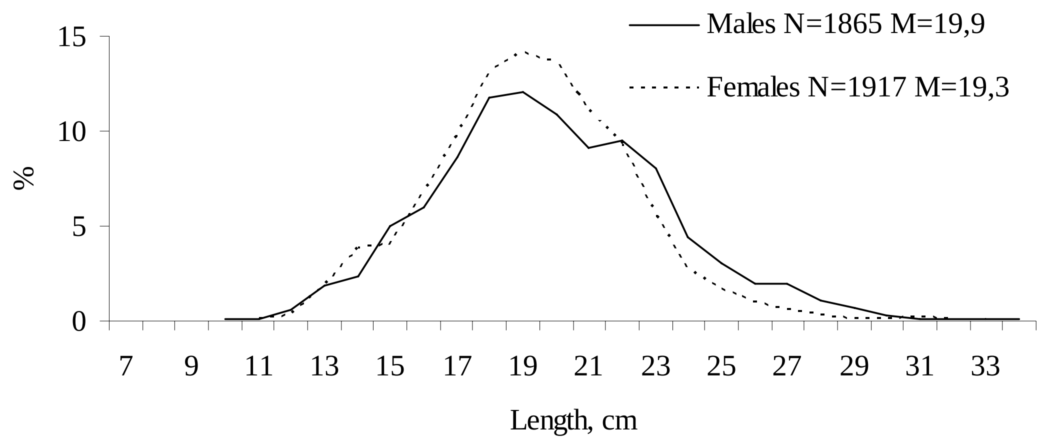


Figure 12.10.14. Length composition of bluemouth in Russian trawl surveys on the Rockall Bank in April-September 2005

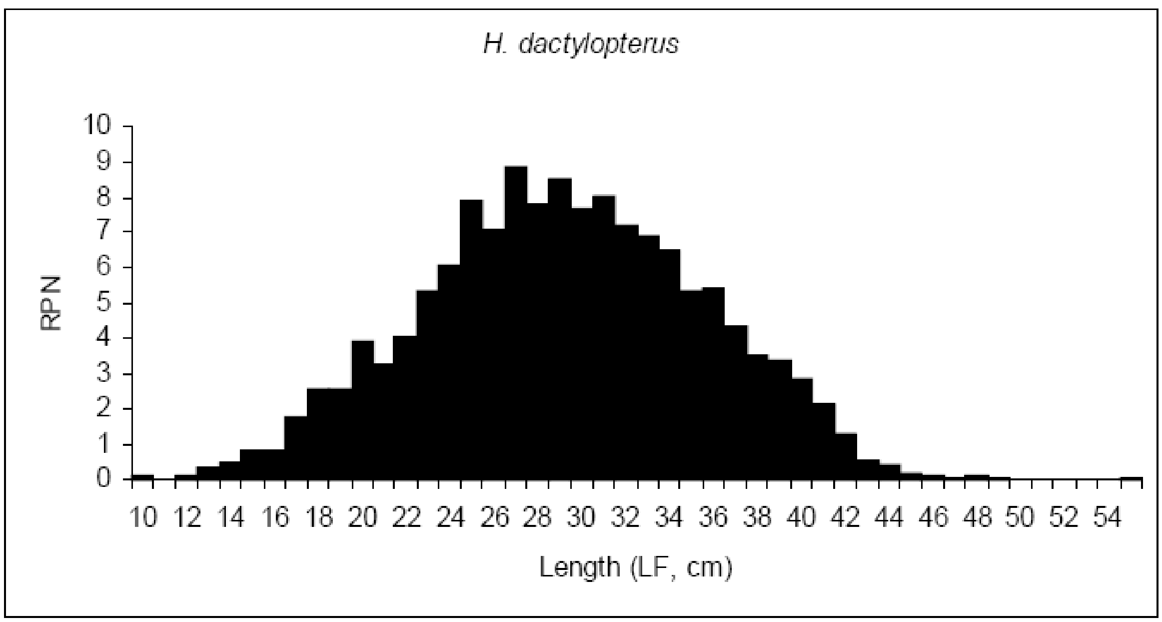


Figure 12.10.15. Length composition of bluemouth from the Azorean longline survey. Combined data, 1995 to 2005.

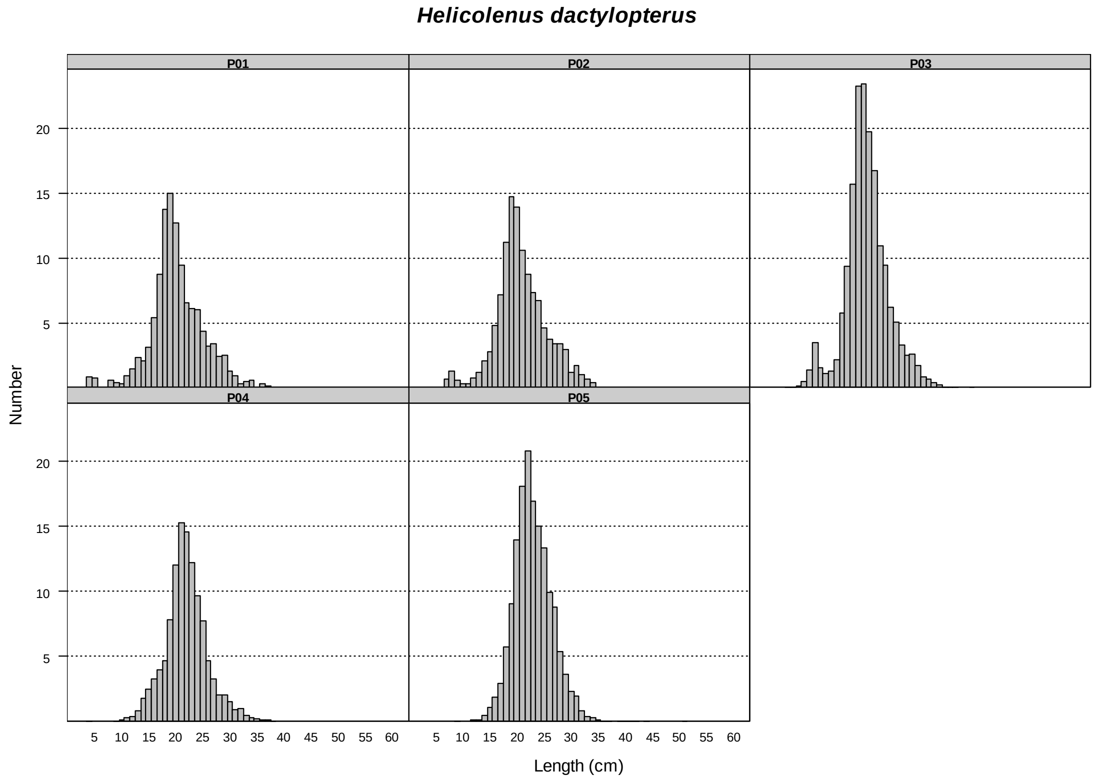


Figure 12.10.16. Mean stratified length distributions of Helicolenus dactylopterus in Spanish Porcupine Bank surveys (2001-2005) (F. Velasco, pers.com.).

13 STOCKS AND FISHERIES OUTSIDE ICES ECO-REGIONS: THE "CUSK" (*BROSME BROSME*) FISHERY IN CANADIAN WATERS

Cusk (*Brosme brosme*) are caught by a number of gear types in Atlantic Canada however there is no directed fishery. Although considered a deep water species, it is caught mostly in waters of less than 500m in depth due to the distribution of commercial fishing effort. The majority of landings are reported from the cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) longline fishery (Table 13.1). Catches by otter trawlers are low due to the behaviour of cusk and their preference for rocky or hard bottom. Cusk 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 cusk and it has been suggested that other species, such as cod, were landed as cusk when quotas were exceeded. Cusk were also landed in combination with white hake and pollock as 'shack'. The proportion of shack landings that were cusk cannot be determined.

Currently cusk caught in the invertebrate pot and trap fisheries cannot be legally landed currently. These discards are not recorded. Cusk caught in the lobster fishery could be landed in unlimited quantities prior to 1999. Unfortunately reporting at that time was limited and thus there are no historical estimates of cusk landed from the lobster fishery although anecdotal reports suggest catches may have been substantial.

Management measures

Cusk can only be legally landed in the groundfish fisheries. A by-catch cap of 1000t for fixed gear in Northwest Atlantic Fisheries Organization (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 caught in invertebrate fisheries cannot be landed.

Fishery trends

Cusk landings in the Atlantic Canada have declined and have been at an historical low since 1994. The CPUE of cusk in the 4X groundfish longline fishery declined in the early 1990s. The current catch rates are at around 40% of the historical level. The decline appears to have stopped. The proportion of 5-minute square units in 4X in which cusk landings were reported and the proportion of trips that report cusk 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 cusk since 1991 or in the proportion of 4X longline trips with cusk since 1977, and that cusk 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 cusk are no longer a significant proportion of the catch in certain locations where they were once abundant.

Table 13.1. Reported landing (tonnes) of cusk by gear type in NAFO areas 4VWX5Z

	Longline	Bottom Trawl	Gillnet	Miscelaneous	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	1036	28	13	4	1080
2004	842	27	7	2	878
2005	856	23	6	2	887

14 IMPACT OF AREA CLOSURES

The following refers to the pt. h) of the TOR, and considers how the WG can at the latest by the 2007 meeting become able to evaluate effects of area closures introduced in 2005. A requirement is that data and methods are available so that the Group can consider *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.*

The Group assumed that the area closures referred to in the TOR were the ones introduced by NEAFC in 2005 (for three years). The request from NEAFC to ICES in 2006 reads:

The NEAFC Commission requests ICES to continue to provide all available new information

a. on distribution of vulnerable habitats in the NEAFC Convention Area and fisheries activities in and in the vicinity of such habitats;

b. assisting NEAFC in evaluating the closures of the Faraday, Hekate, Antialtair, Altair seamounts and the area on the Southern Reykjanes Ridge not later than November 2007.

However, according to the TOR the Group was also expected to evaluate the appropriateness of the continuation of the closures, or alternative, area closures in 2007.

NEAFC considered primarily vulnerable habitats in international waters, but the Group is also aware of closed areas within EEZs that are relevant to the deepwater species, e.g. coldwater coral reefs off Norway, the areas closed to orange roughy trawling in Subarea VI, and closed juvenile areas for tusk in Iceland.

14.1 Current evaluation

14.1.1 Current basis of evaluation

WGDEEP has only received data at a spatial scale of ICES Subareas and Divisions. In the absence of spatially resolved data on fishing activity and catch, it is impossible to evaluate the effects of the areas closures in the NEAFC regulatory area. No historical information was presented to the group that would allow an analysis of changes resulting from area closures.

No members reported any monitoring activity that would seem useful for an evaluation. The MAR-ECO project (www.mar-eco.no) visited some of the locations selected for closure, but this was in 2004 before the areas were closed. The sampling effort was also too limited in each site to be useful as reference and for monitoring.

It was noted that NEAFC had provided VMS data to ICES WGDEC, but these data were not available to WGDEEP. The data were also not accompanied by information on what type of vessels visited the areas and what gears were used. WGDEEP is of the opinion that in order to evaluate fisheries-related activity and effects the expertise of both groups is necessary.

14.1.2 Appropriateness of areas, a first evaluation

The Group is not in a position to evaluate the appropriateness of the closed areas in the mid-Atlantic. In the absence of relevant information, the choice of locations may be reasonable considering geographical distribution and depth range.

Neither of the locations are entirely pristine. Based on historical and current information the state of habitats and resources in the closed areas in the mid-Atlantic is uncertain and unknown. However, current exploitation on the mid-Atlantic Ridge is perceived to be lower than in the late 1970s and the 1980s when there considerable activity of e.g. eastern European fleets was documented. Exploratory fishing appears more or less to have ceased, and the reported activity is currently only a very low number of Russian vessels fishing occasionally and a Faroese vessel fishing seasonally for orange roughy. It is underlined, however, that this only reflects the activity reported to WGDEEP. It is suspected, but not documented, that there is higher activity.

The situation is clearer on the European slope, but the effects of the fishing activity on the seabed habitats is still under investigation. At least the knowledge on fishing activity and catches is better. In view of the fact that there is rather good documentation for considerable exploitation in European slope waters, including the Hatton Bank and Rockall, it is the opinion of the Group that protection of vulnerable habitats and communities in these waters would seem to be very urgent. This would be perceived as more urgent than protecting locations on the mid-Atlantic Ridge.

In order to allow a satisfactory selection of appropriate areas, it would be necessary to collect international data on incidental catches of vulnerable invertebrates in all bottom fisheries, included trawl, longlining, gilnets and pots, both within the EEZ and international waters. In the same sense, research surveys with a multidisciplinary approach and focused on vulnerable ecosystems (eg. Spanish Survey in Hatton) are needed.

14.2 Prerequisites for future evaluation

14.2.1 Data needs

It is imperative that relevant national and international data are made available for evaluation by the Group. This concerns data need to assess character and level of fishing activity, level of damage to habitats, and monitoring data; appropriately scaled in relation to the size of the closed areas.

14.2.2 Data access

Access to historical records and current records of fishing activity, catch and geographical patterns must be ensured by national governments and e.g. NEAFC. Without such access, it will not be possible to respond adequately to requests.

14.2.3 Collaboration and division of labour between ICES groups.

There is contact between the chairs of WGDEEP and WGDEC, but sharing of information and expertise should be improved. It is assumed that WGDEEP will continue to be expected to answer requests related mainly to fisheries and fishery resources.

14.2.4 Analysis methods

Analysis of VMS data may require new methodology and the Group will consider options. Members would also consider existing opportunities and/or development of direct monitoring efforts, e.g. by research vessels, in the closed areas.

15 NEAFC REQUEST CONCERNING THE SPATIAL AND TEMPORAL EXTENT OF DEEP-WATER FISHERIES IN THE NE ATLANTIC

The NEAFC Commission requested ICES to provide "*information on the spatial and temporal extent of all current deep-water fisheries in the NE Atlantic. ICES is also asked to 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. This information is required to enable NEAFC to develop fishery-based management initiatives*".

ICES WGDEEP is using definitions of deep-water fisheries, but these are not based on consistent criteria. The WG was of the opinion that fisheries definitions should not be restricted to the deep-sea fraction, but should be approached on a broader scale. The ICES Study Group on Fishery-based Forecasts (SGDFF) has met in 2003 and 2004, and it has provided some general guidelines on methods to segment fleets and fisheries. In the context of its Data Collection Regulation (DCR) programme, the EC has recently promoted a number of workshops intended to standardise definitions of fleets and fisheries, including deep-sea fisheries, at EU or Regional levels. The methods and criteria used to make that segmentation shall be finalised by the end of 2006. The WG was of the opinion that deep-water fisheries definitions for EU countries should be consistent with the classification made up in relation to the DCR. For other countries, fisheries definitions should be worked out inter-sessionally, e.g. following the general guidelines provided by the ICES SGDFF.

Table 15.1 summarises the qualitative information on the fisheries harvesting deep-sea species in the different areas. The 2005 landing statistics are available by fleet and by new ICES areas in the overview sections (Chapter 3).

Tables 15.2a-15.2d show a provisional overview of technical interactions between deep-sea fisheries, as reflected by landings split into main gears, areas and species.

Table 15.1. Deep-sea fisheries (TR: trawlers; LL: long-liners) in relation to their level of targeting (TAR: target species; BYC: by-catch), as used by WGDEEP06.

	I+II	III+IV	VA	VB	VI+VII	VIII+IX	X	XII	XIV
TR (TAR)					RNG BSF SKH BLI ORY			RNG	
TR (BYC)		RNG			RNG BSF SKH BLI ORY				SKH
LL (TAR)						BSF SBR	ALF SBR		
LL (BYC)	LIN USK BLI		LIN USK BLI	LIN USK BLI					
PT (BYC)				LIN USK BLI					

Table 15.2a. Provisional overview of technical interactions between deep-sea fleets and fisheries: landings by main gear, area and species. Bottom trawls.

year	2005

Sum of Kg		species												
main gear	ICES area	ALF	ARG	ARU	BLI	BSF	FOR	LIN	ORY	RNG	SBR	USK	ZZZ	SKH
bottom trawl	I			7214	1000			13657				2902		
	IIa			8062492	20210		341	335858		1150		71846	3223	
	IIb			641	35			21044				3088	205	
	IIIa		454200	65	50419			54742		12959243		3985	445454	
	IVa			2661	21840	12	346	2186236		1634		263274	188	
	IVb				123			254394				2020	40	
	IVc						13	38475			8			
	IX	0		0	7651		39450	0	0	0	2024	0	81136	
	Va				55643			1737		83		8192		
	Vb			59000	97275	10871		90559		18015		12009	4817	
	Vb2				299000	55000	2000		9000	649000			39000	68000
	VI	63		0	135077		49895	56542	0	489	0	15946	42023	
	VIa			61192	2322002	2382573	395073	1093091	32905	1852573		107657	402224	523000
	VIb	210		4000	840163	77362	336374	241124	5720	227176	23630	90459	40413	18000
	VII	2503		0	16960		699347	171407	20	0	330	471	138146	
	VIIa				30	0	234	421440						
	VIIb				11087	4335	134931	612131	230	6380	2870	11113	27950	
	VIIc	5528		1527	59791	52416	492237	663872	19215	35444	3650	2348	354984	
	VIId				16		27	64303			4			
	VIIe				194		5333	1044971			1400			
	VIIf				45		5277	545428			5			
	VIIg			73	16	0	10950	606649					2614	
	VIIh				18436		15260	1703755						
	VIII	18732		32100	13626		96768	11705	0	43	15760	0	34032	
	VIIIa							10578			3883			
	VIIIb						14	5012			5015			
	VIIId							12						
	VIIj	10798		14355	87561	70668	925271	1806173	4483		2252	409	8375	
	VIIk	7608		800	146717	34675	1147632	670979	70058	13610	1320	1771	274180	
	X					65			350	1598000			250	
	XII	0		0	660338	189	60164	0	0	4804310	0	5000	9661071	
	XIIb				5000	8000	0		29000	291000			5000	11000
	XIV	0		0	0		0	0	0	13000	0	0	5000	
	XIVa				3297									
	XIVb				13012			332		7760		36	5686	
	Vb1a				1000	0	0		0	3000			0	1000
	Vb1b				351000	18000	2000		1000	76000			16000	32000
	VIb2				0	0	0		0	0			0	0
	VIIc2				0	1000	0		0	0			0	0
	VIIj1				1000	8000	4000		3000	0			3000	0

Table 15.2b. Provisional overview of technical interactions between deep-sea fleets and fisheries: landings by main gear, area and species. Lines.

year	2005

Sum of Kg		species									
main gear	ICES area	ALF	ARU	BLI	BSF	FOR	LIN	RNG	SBR	USK	ZZZ
artisanal (lines)	IX				0	0			0		0
lines	I			1061		2555	92199	502		546920	4979
	IIa		60	2701		48776	3155588	6658		5451418	112731
	IIb					1820	79201	412		161382	2367
	IIIa			274			11850			20016	
	IVa			10106		82019	3291535	106		1438308	49589
	IVb						8685			3879	
	IX	0	0	0		46	0		333889	0	456163
	Other grounds										103414
	Va			19615		466	179890			303395	
	Vb			353							
	Vb1			14813		40463	1553416	610		1397913	
	Vb2			13636		2650	647322			359843	4010
	VI	0	0	63		1216	4382		0	0	0
	VIa			34685	16	128076	1991430	155		705916	5837
	VIb			1432		24946	976663			639368	611
	VII	50112	15	6742		180012	299255		3226	8	39485
	VIIa						13467				
	VIIb			49	27	6898	44185			2507	
	VIIc			2051	41	3566	55909			648	
	VIIe					38	127717		50		
	VIIf						1605				
	VIIg					4290	97283		34		
	VIIh			77	38	1272	556753			111	
	VIII	20693	3	2865		118300	47120		44318	0	14926
	VIIIa			37	196	663	226418		254		
	VIIIb						824				
	VIIj			12705	6936	63138	356693				
	VIIk					21854	92210				
	X				0	0			0		0
	XII	0	0	5000		0	0		0	0	0
	XIV	0	0	4000		0	0		0	8000	5000
	XIVa									4901	
	XIVb			788						35875	24622

Table 15.2c. Provisional overview of technical interactions between deep-sea fleets and fisheries: 2005 landings by main gear, area and species. Nets.

year	2005

Sum of Kg		species									
main gear	ICES area	ALF	ARU	BLI	FOR	LIN	ORY	RNG	SBR	USK	ZZZ
gill nets	I			11		13				11885	
	IIa		265605	127200	11446	21879		2365		755232	6595
	IIb					1870					
	IIIa			171						6205	
	IVa	812		56848	9798	259764		156		83530	567
	IVb					56731				231	
	IVc					2315			5		
	IX	0		0	177	0	0	0	0	0	214
	Na			1426	5400						
	Other grounds										307974
	Vb			34912	2378	18211				691	
	VI	0		0	0	0	0	0	0	0	0
	VIa	8371		55527	112781	1171699	1313	7	928	13440	11317
	VIb			151365	112766	593326				11580	142
	VII	2091		1475	10218	13360	0	0	625	180	3344
	VIIa			8	15	98952				72	
	VIIb	180		15784	31889	424341	2223			9810	2933
	VIIc			69712	65475	302579	11779		3353	2898	4181
	VIId					2197					
	VIIe				586	3833906			46		
	VIIf				1847	2467624			1		
	VIIg				7538	1987225				793	
	VIIh				52086	3822224			24	196	41
	VIII	34562		7333	8066	16155	2	5	5568	0	2819
	VIIIa				2801	13255			8200		7756
	VIIIc			22	209						
	VIIId				34				9		
	VIIIe					14					
	VIIj	8173		52976	481769	1724132	2105		5722	31236	38937
	VIIk	7932		48996	272519	750284	7577		21457	4599	
	XII	0		3245	8995	42668	0	0	0	0	0
	XIV	0		0	0	0	0	0	0	0	0
net&line	VIIa					33489					
	VIIb					504					
	VIIc					942					
	VIId					95					
	VIIe				835	590827			27		
	VIIf				722	417117			1		
	VIIg				1112	511467					
	VIIh				97	299474					
	VIIj				39	192658					
	VIIk					307					

Table 15.2d. Provisional overview of technical interactions between deep-sea fleets and fisheries: 2005 landings by main gear, area and species. Pelagic trawls, seines and other gearss.

year	2005

Sum of Kg		species								
main gear	ICES area	ALF	ARU	BLI	FOR	LIN	RNG	SBR	USK	ZZZ
other gear	IX	6138	4130	0		31		28801		
	VI	0	0	0		0		0		
	VII	0	0	0		0		0		
	VIII	62130	12	23417		65546		24224		
	XII	0	0	0		0		0		
	XIV	0	0	0		0		0		
pel trawls	IIa		8313588	407		852	67		151	
	IVa					130568			9220	88
	IVb					80723			11965	750
	IVc					16		30		
	Vb								65	
	VIa		64380	258	282	58327			242	
	VIb					905				
	VIIa					228766			56	
	VIIb			129	89	984			60	
	VIIc			549	3292	19763			12131	
	VIId							104		
	VIIe							119		
	VIIf					78				
	VIIg					1544				
	VIIh					7114				
	VIIIa					699				
	VIIj		14000	11	325	1503				
	VIIk			11	274	275			58	
seines	I		50			152			366	
	IIa		240004	46		26620	767		6383	767
	IVa					23919			696	
	IVb					112				
	VIa					508				
	VIIa					524				
	VIIf					360				
	VIIg					19520				
	VIIj					2901				

16 EC REQUEST CONCERNING THE IDENTIFICATION OF KEY AREAS/SPECIES TO BE RECORDED ON A DEDICATED INTERNATIONALLY COORDINATED SURVEY

During the EU Regional Coordination Meeting for the North-East Atlantic, it was recommended that *"ICES WGDEEP should be asked to propose key areas/species to be recorded on a dedicated internationally coordinated survey"*.

The Working Group was of the opinion 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 of a higher priority than any other. Therefore this request was addressed with regards the full set of stocks investigated by WGDEEP, and not only those exploited by the EU fleets. Given the size of the geographic area where these stocks are found, a single dedicated survey would not be feasible. Therefore the Working Group has 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 dedicated bank and continental slope areas where fisheries have been active, or are suspected to take place. The key stocks to be investigated in the different areas are categorised as either "fully/heavily exploited" or in "unknown state".

Considering the fully or heavily exploited stocks, the WG recommended that surveys be conducted regularly. The frequency of these surveys would depend on the requirements for stock assessment analyses and management requirements.

- **Sub-Areas I and II.** For these sub-areas, 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 700m. There may also be scope to extend the coverage of the on-going Greenland halibut and redfish surveys.
- **Division IIIa.** In order to evaluate of the stocks of greater silver smelt and roundnose grenadier in this area, the Working Group recommends extending the coverage of the on-going shrimp survey to include the complete range of distribution of these stocks.
- **Division Va and b.** The existing groundfish surveys in these areas (Faeroe Islands and Iceland) could be extended below 500m to cover the full distribution of ling, blue ling and tusk. A dedicated acoustic survey could also be carried out to evaluate the stock of greater silver smelt.
- **Sub-Areas VI-IX.** The Working Group suggests that a dedicated internationally-co-ordinated survey of the continental slope in this large area should be undertaken. This survey should consist of depth transects at selected reference sites, which should include, not exhaustively, the Hebridean slope, Rockall, Hatton Bank, Porcupine Bank, Bay of Biscay and the area between canyons of Nazare and Sesimbra, Meriadzec Terrace. The key species to be surveyed would include roundnose grenadier, orange roughy, blue ling, black scabbardfish and deep-sea sharks. The survey could build on the experience from the Scottish survey, which has been conducted on the Hebridean slope since 1998. 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.
- **Sub-Area X.** A long-line survey is currently conducted in the Azores EEZ, and it would prove useful to extend the depth range of this survey, in particular in relation to such species as alfonsinos, Mora mora, sharks.
- **Sub-Area XIV.** There could be scope extending the on-going Greenland halibut survey to obtain fishery-independent abundance estimates of deep-water sharks.

Trawls may not be the most suitable gear to sample sharks. Long-lines may be a more appropriate gear to sample these species.

Considering stocks of unknown status, these are essentially those of the Mid-Atlantic Ridge. For this area, the WG recommends that a survey be conducted regularly, but not necessary annually, as long as their exploitation remains at current levels. If exploitation were to increase, then the survey should be upgraded to an annual basis. It is suggested that the survey design should build on the outcomes of the MAR-ECO project (http://www.mar-eco.no/) and sites should include the NEAFC closed areas. The terrain of this region would necessitate the use of a variety of techniques including acoustics, visual survey methods in combination with trawling. This survey should link to any extended survey within the Azores EEZ.

17 Recommendations

17.1 Data availability

- The Working Group remains concerned that the landings statistics as presented may not reflect the true scale of the recent fishing activity. This year, several countries have not reported any data at all in relation to deep-sea fishing. In addition, no official statistics were delivered to ICES in relation to some key species including roundnose grenadier, orange roughy and black scabbardfish. For these species, the Working Group had to rely on the data brought in by national experts. The Working group recommends that member states should be encouraged to collect statistical rectangle specific catch, landings, effort data and biological data from exploratory and commercial fishing activities in national and international waters and report it to ICES early in the year. Any documented information that member states may have on fishing activity from non-member states should also be reported to ICES.
- Due to the lack of fishery-independent data, commercial CPUE are in general terms the main tuning series available to calibrate the assessment of deep-water species. The WG is aware of the many difficulties in interpreting these data, and it could generally make only little use of them, for assessment purposes. Nevertheless, the Working Group notes that substantial efforts have been made this year to standardise and refine the CPUE series for a number of stocks. In some cases (e.g. blue ling in V, VI & VII and red seabream in X) assessments have been attempted using standardised CPUEs, with encouraging results. In other cases, CPUE series were thought to be useful but could not be used because of short time series (e.g. ling and tusk in Sub-Areas I&II). The Working Group recommends that member states maintain and refine long-term data series on catch and effort and where possible collate historical data. It is recommended that at future meetings of the Working Group the results of such analyses including diagnostics be provided to allow for an evaluation of the reliability.
- Provision of research survey data, particularly time-series data from surveys designed for assessment purposes, is strongly encouraged, as is analyses of existing survey information. It is noted that additional financial resources are required.
- For several species there is concern that catch rates can only be maintained by sequential depletion of relatively isolated concentrations/sub-units of a stock. The smallest unit for which data are reported at present is the ICES Subareas and Divisions, and this spatial resolution may not be appropriate for monitoring this type of fishing activity. The depth range within an area may be very wide, and the sizes of the areas are very different. It is therefore recommended that systems are developed and implemented for recording effort and catches at a finer temporal and geographical scale. Countries should provide access to VMS data.
- Efforts should be made to compile historical species-specific landings data for the *Pagellus* fisheries in Sub-areas VI, VII and VIII.

17.2 Assessment methods

For all of the stocks being investigated, landings ande LPUE time series of more than 15 years. However age-reading is still problematic for most of the stocks. In that co, the CSA method, which is a compromise between age-structured and production models, is rather promising. It has been used this year for the assessment of blue ling in Vb, VI & VII, with some success. This method could be used more widely by WGDEEP in the near future.

17.3 Mixed fisheries advice

Since WGDEEP04, The Working Group has initiated efforts to define deep-water fisheries and fleets, and to collect fleet-disaggregated data. However, the WG could not agree on common definitions of deep-sea fleets and fisheries, so those remained country-specific. The EU has developed a matricial framework for mixed-fisheries advice and management. The basic concept would be a table, with row being fleets and columns fishing activities. Each documented cell (*i*, *j*) would then include catch-at-age and effort information of fleet *i* operating fishery *j*. This framework, which will be consolidated in 2007, could be considered by WGDEEP in the near future as a support for providing mixed-fisheries advice.

17.4 Ecosystem based advice

During WGDEEP06, the collaboration between WGDEEP and WGDEC has taken place via participation of key members to both groups. In order to make further progress towards ecosystem-based advice, WGDEEP06 makes the following suggestions:

- Data needs. It is imperative that relevant national and international data are made available for evaluation by the Group. This concerns data need to assess character and level of fishing activity, level of damage to habitats, and monitoring data; appropriately scaled in relation to the size of the closed areas.
- Data access. Access to historical records and current records of fishing activity, catch and geographical patterns must be ensured by national governments and e.g. NEAFC. Without such access, it will not be possible to respond adequately to requests.
- Collaboration and division of labour between ICES groups. There is contact between the chairs of WGDEEP and WGDEC, but sharing of information and expertise should be improved. It is assumed that WGDEEP will continue to be expected to answer requests related mainly to fisheries and fishery resources.
- Analysis of VMS data may require new methodology and the Group will consider options. Members would also consider existing opportunities and/or development of direct monitoring efforts, e.g. by research vessels, in the closed areas.

17.5 General organisation of WGDEEP

This year, WGDEEP has made a move towards providing advice on a stock and regional basis. This has generated an increased workload for the members of the WG, some of them being responsible of 3 or 4 stocks. When such stocks are subject to routine assessments, this situation will be a problem. ICES sould reconsider how stocks are distributed within assessment WGs. One possibility could be that some of the stocks WGDEEP is dealing with be reallocated to other regional assessment WGs. Another possibility would be to split WGDEEP into two assessment groups, each of them dealing with specific eco-regions. These groups would then convene in alternance every other year.

WGDEEP discussed the possibility of assessing deep-sea sharks, which are currently dealt with by WGEF. The WG was in favour of this transfer, the rationale being that deep-water sharks are caught together with roundnose grenadier and black scabbardfish in a mixed-fishery. However, the WG notes that, due to their existing workload, the current members of WGDEEP will not have the possibility to assess deep-sea sharks, and that the current WGEF expert dealing with these species should participate to WGDEEP.

17.6 Research needs

- Black scabbardfish is widely distributed in the NE Atlantic. Although the knowledge on the biology of this species has increased in recent years, information on its spatial and seasonal distribution is still very limited and uncertain. Modelling the actual state of species exploitation is severely impaired by the lack of relevant data. Nevertheless, as a consequence of the uncontrolled increase in fishing pressure on this species, the need for improved scientific advice is increasing. Therefore, it is strongly recommended to pursue scientific investigations of this species related to fisheries management, particularly through a detailed analysis of historical and recent data in a spatial context.

- The status and identity of alfonsino stocks is poorly understood, and the knowledge of its population biology is unsatisfactory.
- Improving the assessment of red seabream stocks would require getting more insights into the mechanisms of growth, sexual maturity and hermaphrodism.
- Age determination of blue ling and black scabbardfish remains difficult and unvalidated, and efforts are recommended to develop and calibrate age reading techniques.

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18.2 Working Documents

WD1: Ofstad, L.H (2006). Data on Greater Silver Smelt (Argentina Silus) in Faroese Waters.

WD2: Ofstad, L.H (2006). Data on Faroese Deep-Sea fisheries

WD3: Helle, K. (2006). Estimating the relation between effort and the commercial catch of ling, blue ling and tusk

WD4: Helle, K., and Pennington, M. (2006). Tracking the changes in the length composition of ling, blue ling and tusk in commercial catches

WD5: Harris, L. (2006). Cusk (*Brosme brosme*) in Canadian Waters

WD6: Sigurdsson, T. (2006). Information on Deep Sea species in Icelandic waters

WD7: Vinnichenko, V.I., and Bokhanov, S., P. (2006). Biology and distribution of deep-sea fishes in the North-East Atlantic

WD8: Vinnichenko, V.I., and Bokhanov, S., P. (2006). Russian deep-sea fisheries in the North-East Atlantic in 2005

WD9: Vinnichenko, V.I., and Khlivnoi, V.N. (2006). On closure of areas with cold-water corals on the Hatton and Rockall banks

WD10a: Bergstad, O.A. (2006). Exploitation and advice options for roundnose grenadier in the Skagerrak (IIIa)

WD10b: Munch-Petersen, S. (2006). Data from the Danish fishery for roundnose grenadier.

WD11: Biseau, A. (2006). Deep Species CPUE : a mixture of abundance and strategy. Example of the French fishery.

WD12a: Girard, M. (2006). Some CPUE calculated from effective fishing time and taking into account some annual fishing strategy variations; Results for roundnose grenadier (*Coryphaenoides rupestris*), black scabbard (*Aphanopus carbo*) and blue ling (*Molva dipterygia*).

WD12b: Girard, M. (2006). Using VMS record as an effort distribution indicator.

WD13a: Mac Aulay, G., Doonan, I. (2006). An acoustic survey of orange roughy in the north east Atlantic.

WD13b: Nils-Roar Hareide, N.R., Johnston, G. & Hanniffy, O. (2006). Orange Roughy Acoustic Survey Cruise Report (B) – Fishing Operations

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WD13d: Boyer, D., Hampton, I., and Soule, M. (2006). The Assessment of Orange Roughy (Hoplostethus atlanticus) Stocks in the Deep Waters off the West Coast of Ireland using Acoustic Survey Techniques, Annex to the main report.

WD13e: Shepard, S., and Rogan, E. (2006). The Assessment of Orange Roughy (Hoplostethus atlanticus) Stocks in the Deep Waters off the West Coast of Ireland using Acoustic Survey Techniques. Main report.

WD14 : Egan, A., Hareide, N.R., Doonan, I., and Clarke, M. (2006) A summary of the Irish fishery for deepwater species in 2005

WD15a: Pereira, J.G. (2006). Standardized cpue for the Alfonsino *Beryx splendens* from ICES area X

WD15b: Pereira, J.G. (2006). Standardized cpue for the Golden Eye Perch *Beryx decadactyluss* from ICES area X

WD15c: Pereira, J.G. (2006). Statistics and biological data on the Alfonsinos, *Beryx decadactylus and Beryx splendens* from the Azores

WD15d: Pereira, J.G. (2006). Standardized cpue for the Bluemouth rockfish (*Helicolenus dactylopterus)* from the Azores

WD15e: Pereira, J.G., and Pinho, M. (2006). Statistical data on selected deep sea species from the Azores fishery

WD15f: Pereira, J.G. (2006). Standardized cpue for Greater Forkbeard from ICES area X

WD15g: Pereira, J.G. (2006). Standardized catch rates in number and weight for the Blackspot seabream (*Pagellus bogaraveo*) from the Azores longline fishery

WD15h: Pinho, M., Krug, H., and Pereira, J.G. (2006). Data evaluation for the assessment of Blackspot seabream (*Pagellus bogaraveo*) from ICES area X (Azores).

WD15i: Pinho, M. (2006). Survey data of deep-water species from the Azores

WD16a. Fernandes, A.C., and Ferreira, A (2006). First Approach on Portuguese black scarbbardfish longline fleet discards

WD16b: Machado, P.B., Ventura, L., and Figueiredo, I. (2006). Preliminary analysis of VMS data from the Portuguese longline fleet targeting black scabbardfish

WD16c: Figueiredo, I., and Machado, P.B. (2006). Standardization of commercial black scabbardfish in the longline Portuguese fishery

WD16d: Figueiredo, I., and Machado, P.B. (2006). Mainland Portugal data contribution ttto the 2006 WGDEEP report

WD17: Gonzalez, C., Patrocinio, T., and Duran Muñoz (2006). Food of Species Roundnose grenadier (*Coryphaenoides rupestris*) in Hatton Bank

WD18: Duran Muñoz (2006). Spanish investigations on the Hatton bank and adjacent waters during 2005

WD19: Mesnil, B. (2003). The Catch-Survey Analysis (CSA) method of fish stock assessment: an evaluation using simulated data. Fish. Res., 63, 193-212.

WD20: Gil, J., Canoura, J., and Sobrino, I. 2006The fishery of the Strait of Gibraltar (ICES IXa south): Update of the information available required for the assessment of the red seabream (*Pagellus bogaraveo*).

Annex 1: List of participants

NAME	ADDRESS	PHONE/FAX	EMAIL
Bergstad, Odd Aksel	Institute of Marine Research, Floedevigen, N-4817 His, Norway	Tel: +4737059019, Fax: +4737059010	oddaksel@imr.no
Ian Doonan	The Marine Institute Galway Technology Park Parkmore, Galway, Ireland	Tel.: 353 91 730490 Fax.: +35391730470	Ian.doonan@marine.ie
Juan Gil	Inst. Español de Oceanografía (IEO)Unidad de Cádizc/ República Saharaui s/n Institutos de Investigación.11510 Puerto Real, Cádiz, Spain	Tel.: +34 956 016290 Fax.: +34 956 016415	juan.gil@cd.ieo.es
Pablo Durán Muñoz	Inst. Español de Oceanografía (IEO)Centro Oceanográfico de VigoApdo 1552E-36280 VigoSpain	Tel.: +34 986 492111	pablo.duran@vi.ieo.es
Guzman Diez	AZTI tecnalia, Txatxarramendi Ugartea z/g 4835 Sukarrieta, Bizkaia Spain	Tel.:+34 946029400 Fax.: +34 946870006	gdiez@suk.azti.es
Tom Blasdale	JNCC, Dunnett House, 7 Thistle Place, Aberedeen, AB10 1UC, UK	Fax.: +44 1224 621488	Tom.blasdale@jncc,gov.uk
Paul Marchal (Chair)	IFREMER, 150, Quai Gambetta F-62200 Boulogne-sur-Mer France	Tel.: +33 321995616 Fax.: +33 321995601	Paul.marchal@ifremer.fr
Pascal Lorance	IFREMER, BP70, 29280 Plouzane, France	Tel.: +33298224649 Fax.: +33 238224653	Pascal.lorance@ifremer.fr
Thorsteinn Sigurdsson	Marine Research Institute P.O.Box 1390 Skúlagata 4 IS-121 Reykjavik, Iceland	Tel: +354 575 2116 Fax.: +3545752001	Steini@hafro.is
Kristin Helle	Institute of Marine Research, P.O.Box 1870 Nordens, N-5817 Bergen	Tel.: +47 55238601 Fax.; +47 55238531	Kristin.helle@imr.no
Mário Rui Pinho	Departemento de Oceanografia e Pescas, Universidade dos Acores, Azores, Faial-Horta, Portugal	Tel.: +351 292200400 Fax.: +351 292 200411	maiuka@notes.horta.uac.pt
Ivone Figueiredo	IPIMAR, Avenida de Brasilia, P-1449-006 Lisbon, Portugal	Tel.: +351 21 302 7131 Fax.. +3512133319067	ivonfig@ipimar.pt
Philip Large	CEFAS Lowestoft Laboratory Lowestoft Suffolk NR33 0HT, UK	Tel.: +44 1502 562244 Fax.: +44 1502 513865	p.a.large@cefas.co.uk
Sten Munch-Petersen	Danish Institute for Fishery Research Charlottenlund Slot DK-2920 Charlottenlund Denmark	Tel.: +45 33 96 33 90 Fax.: +45 33 96 33 33	smp@dfu.min.dk
Lise Helen Ofstad	Faroese Fisheries Laboratory Nóatún 1, P.O. Box 3051 FO-110 Tórshavn Faroe Islands		liseo@frs.fo
Vladimir Vinnichenko	PINRO 6, Knipovitch Street 183763 Murmansk Russia	Tel: +7 8152 472192 Fax: +7 8152 473331	vinn@pinro.ru
Alexei Orlov	Russian Federal Res. Inst. of Fisheries & Oceanography (VNIRO) 17, Verkhne Krasnoselskaya Moscow 107140 Russia		orlov@vniro.ru
Joao Gil Pereira	Departamento de Oceanografia e Pescas Universidade dos Açores 9901-862 HORTA Portugal	Tel: +351 292200431 Fax: +351 292200411	pereira@notes.horta.uac.pt

Annex 2: Technical minutes

Working group	WGDEEP
Year	2006
Review group chair	Martin Pastoors
Review group participants	Knut Korsbrekke, Kevin Stokes, Alberto Serrano
WG chair	Paul Marchal
Date of review	22-24 May 2006

General introduction

The WG is complimented for providing a well structured report. The WG has clearly put a lot of effort in interpreting the available, even if that is not very much in some cases. The general assessment process in the WG to try and work from indicators of stock development is very useful. The layout of the report in terms of Ecoregions has facilitated the review process.

The major issues that came up during the review process were:

- The basis for the stock structure. The arguments for stock structure are mostly very abstract and refer back to a WG report that itself is referring to undocumented papers or material. In this way, stock identity becomes mystified. We should have positive statements about why stocks should be considered as separate stocks. Referring to "practical purposes" is not sufficient.
- The analysis of the available CPUE data and the use of indicators in general.

Although there are some examples where CPUE data were analysed in the framework of a GLM model, the general approach seems to have been to use nominal effort and overall landings. The review group considered that these type of CPUE analysis are not up-to-date. Unless care is taken to analyse the available CPUE data, there is a risk that the fleet dynamcis become entangled with the stock dynamics.

When short time series of CPUE or surveys are presented and long time series of landings are available, it would be useful to develop graphical displays that can link these two together.

WGECO and WGFE suggesed other possible indicators like maximum length, mean weight and general size based indicators (e.g percentage of large fish).

- The definition of reference points based on U_{max} has not been carried forward by the WG. If a Umax approach is used, there should have been an estimate of Umax and an indication of which index would be used. There is a problem in interpreting Umax when when the exploitation history is much longer than for which relative abundance data is available. The Review group considered that a Ulim could be defined as an alternative to Umax. Ulim would be based on the lowest observed index over the time series from which the index has apparently been able to "recover".

If reference points are defined, it would be useful to develop plots which have the reference points added to the index trends.

- Access to data is drawn out as a main point. VMS data is clearly important for these type of species, but mostly when they can be coupled to catch data. Access to data should be arranged with NEAFC, perhaps by simply visiting the NEAFC headquarters. There is an open question on whether we can extend the VMS data backwards?
- There are no wider ecosystem considerations in terms of impacts of fisheries on ecosystem functioning. Is there anything known about fishing down the foodweb? E.g is there anything know on changes on hatton bank where we have information before fishing started?
- Most of the time series in the WG report appear to be truncated in 1988. If information is available before 1988, it would be very useful to include those in the report.
- The "final assessment" should be better highlighted. It is often not clear which of the indices to look at for the accepted trends in the stock
- If trends in effort are available, they should be presented in the report.

Comments by stock:

Blue ling in Division Va and Subarea XIV [bli-icel]

- There are different ways of calculating the CPUE of trawlers. Argumentation is not always clear on when to use CPUE from directed or non-directed fisheries.
- Autumn survey is too short but goes deep enough: promising for the future.
- CPUE is not a basis for estimating Umax

Greater Silver Smelt in Division Va [arg-icel]

- Good candidate for acoustic survey. Highly aggregated. Attempts have been done in Norway.
- Cod gear in survey does not sample the semi-pelagic phase.
- How come that so many samples are from the longline fishery and almost none from the trawl fishery (e.g 5 fish in 1996).
- Effort on semi-pelagic fishery not a useful metric

Ling in Subarea I and II [lin-arct]

- CPUE from directed fishery of longliners from private logbooks. Effort in number of hooks. Series is broken 1975-1993 and 2000-2004. CPUE in earlier period based on private logbooks; not always the same vessels. In recent period always the same vessels. It is difficult to interpret the consistency between the two sets.
- CPUE plots should be done with a time axis rather than a category axis. Otherwise timetrends cannot be interpreted.
- Exploitation existed prior to 1975. What was the exploitation history.
- No definition of Umax on the basis of the CPUE series.
- If the reference fleet is collecting length information, will this be made available to the WG?

Tusk in Subareas I and II [tus-arct]

- Mixed fishery with Ling
- Landings have fluctuated a lot, and decreased over the time series.
- CPUE is decreasing in recent years except 2005. Very noisy CPUE signal prior to 2001. More rigorous CPUE analysis needed (also for ling)
- No definition of Umax on this basis.

Ling (Division Vb)

- Attempted age structured model; separable model very noisy. Catch curve analysis: inconsistent.
- CPUE information uses only one treshold (60%) and so heavily directed fishery. Is this a useful indicator?
- CPUE earlier period very noisy, no basis for Umax.
- Foreign vessels operate by TAC. Faroe vessels by effort.
- Effort information should be made available, especially when that is the basis for the main management method.

Blue ling in Division Vb and Subarea VI and VII

- French CPUE and length distributions: CSA methodology. Strong residuals pattern. No convergence in retrospective plot. Useful to develop methods that work on length only.
  - o parameter "s" will be sensitive to recruitment if is it has more than 1 yearclass.
  - o how does CSA deal with multiple CPUE series?
  - o This is a promising approach but more work is needed.
- Catch available since 1963 but not in the WG report. Please supply the information.
- Umax taken as first three years, some decline in overall catches compared to 1980s. Similar situation as for ling.
- No consistency of CPUE series across areas? Was this the basis for stock definition?

Orange roughy in Subarea VI

- Given the problems with interpreting CPUE: could we learn from the New Zealand methodology for using orange roughy data?
- Argumentation: all experience show depletion; fishery is moving away, signals in CPUE indicate boom in early 1990 and quick tailing of like for other roughy stocks.

Orange roughy in Subarea VII

- Acoustic survey with Irish trawler. Estimated relative abundance and absolute abundance but latter with 60% CV. Would indicate 600 tonnes in MCY. Are the assumptions from that analysis applicable in this area?
- Trawl survey more appropriate that acoustic survey.

Roundnose grenadier in Division Vb and Subarea VI and VII

- Long lived species.
- Same CPUE series as for Blue ling (reference areas)
- Most of the fishing effort in area VI
- Depth distribution: indicator of stock decrease. Peak abundance shifted from 800 to 1400 m. Confirmed by age structured analysis. More analysis of survey data.
- Survey series started some years ago; needs to be continued.

Black Scabbardfish in Division Vb and Subarea VI and VII

- age reading contested. Even contested how long-lived it is. Perhaps not as long-lived: not more than 30 years. stock identity contested: french juveniles, portugese adults. Treated as a combined stock. Vb, VI, VII and XII. CPUE inconsistent by area. Some areas show strong increase, other show decrease. Complex mixture of stock and fleet dynamics. State of stock unknown.
- Observer trips should be used to obtain more biological measurements.

North Sea

Roundnose grenadier in Division IIIa

- Does CPUE reflect abundance? More targetting on this stock? Are special devices used? RG is worried about application of this CPUE series. More analysis required to CPUE. Fit statistical method to CPUE data. GLM approach.
- Table 8.2.2 inconsistent with tables 8.2.0 and 8.2.1. Has to do with separation between logbooks and saleslips. Grenadier is part of the industrial fishery. Is the increase in landings correlated with the collapse of Norway Pout?

Bay of Biscay and Iberian Seas

Black scabbardfish in VIII and IX

- CPUE series from longliners the basis for advice. Stable exploitation area. No changes in gear. Effort has been relatively stable. Self regulating?
- Plot 9.2.2 not very useful.
- Effort information should be included.
- Uptake of the TAC is well below the TAC for many years. Apparently the TAC is not constraining.

Red seabream in Division VI, VII & VIII

- Hermaphrodite: youngest are males, older are females
- Landings have dropped dramatically. Pelagic trawl fishery developing 1980s

Red Seabream in IX

- Age information available. Non-validated ages. Extrapolation over unsampled years.
- Growth seems to be increasing with age. Could this be due the sex change?
- This stock is very susceptible to exploitation. See area VI, VII and VII.
- Many more fish taken in recent years (1998-2001), graph 9.4.3. 2002-2005 graphs missing.
- Ageing from age 9 suspicious. Try otolith reading without knowledge of size of the fish. Age-length-sex key?
- Separable VPA useful approach. Many assumptions to make. No hard conclusions, but no major problems with residuals. Still: plusgroup very high influence on results of separable. Apparently there is a building-up of animals in the plusgroup.
- Is there an increase in exploitation of smaller individuals? Could be reason for worry.

Widely distributed and migratory stocks

Ling

- CPUE pattern can be interpreted. But still needs more analysis.
- Stock structure uncertain but CPUE is consistent between areas.
- Provide the available effort information.
- plot CPUE with time series on x axis instead of category axis

Blue ling

- XIIb would be better placed in Celtic Sea area (Hutton bank): will the WG make that "decision"
- Blue ling not included in genetic studies.
- Include plots of landings.
- Include CPUE information on this stock.

Tusk

- Vb is included for this stock but not for ling. It is unclear why
- If the survey data does not cover the depth range: better remove it?
- There are inconsistencies between areas in CPUE signal.

Greater Silver Smelt

Tuesday, 23 May Review

- Pelagic trawl fishery. Effort data not a good metrics of exploitation.
- Acoustic survey required. Can it be integrated with the blue whiting survey?
- Management could be by taking a fixed proportion of the measured stock from an acoustic survey (like the Bay of Fundy herring)

Orange roughy

- No restrictions in international waters except for NEAFC closed areas.
- Landings data are suspicious
- Catch rate is available but not supplied.

Roundnose grenadier on MAR

- Strong increase in landings in X by Russia (probably in NEAFC area). Do we get all the landings?
- Contrary to the slow development of the fishery.

Black scabbardfish

- Landings data, mostly from area XII. The change observed in grenadier was not apparent here.
- Landings data is suspicious.

Greater forkbeard

- No stock structure: needs to be developed.
- Main landings from Celtic Seas
- Need for deepwater survey in VI and VII.
- Alternative: cheaper to ask fishermen to fish some places or Observer program on board program.

Alfonsinos

- Longevity of 11-13 years. Strongly schooling.
- Azores long line survey. Longline is inappropriate for these small fish?

Roundnose grenadier on Mid Atlantic ridge

- Substantial biological information from Russian exploration but only on paper.

- Umax could be 1970 as a virgin stock. But huge technological creep. Research needed. Low catches associated with increases. CPUE difficult to interpret: therefore no proposal for Umax. Still a story can be told.

Red seabream in Xa (Azores)

- Survey data: Azorean longline survey. Indicates increase over 1995-2005.
- Standardized CPUE using GLM analysis. Somewhat increasing.
- General trends in stock similar to tuning data
- Include: effort in the plots. Inputs should have been provided.
- No basis for definition of reference points. Comment on F in relation to M. Hermaphrodite. Should not exploit selectively the smaller or larger individuals. Could use lowest observed biomass as a Blim.

Other stocks: mainly smoothhead and roughhead grenadier

- Roughhead has increased tremendously. Could be misreporting.
- Smoothhead has increased from 6000 to 12000 tonnes.
- No TAC for these species.
- Concern: misreporting or new fishery?